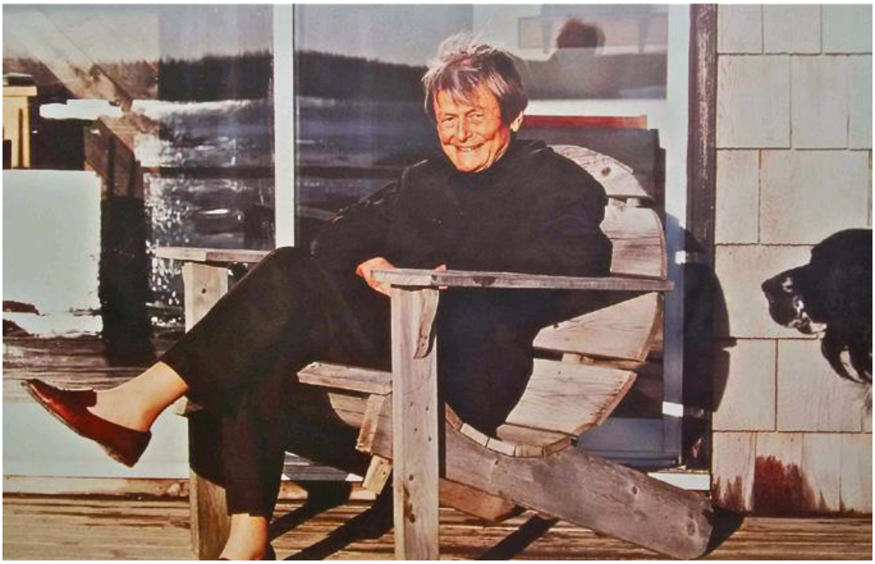
The Future of Ocean Governance and Capacity Development



Elisabeth Mann Borgese, 1918–2002

First Lady of the Oceans

remembering Elisabeth Mann Borgese

Committed as she was to all the right things,
she gave dazzling speeches
with a brilliant turn of a phrase, but
I remember her best standing on her head
and smiling upside down.

It was the oceans she loved, those salty seas
where life began and over time emerged onto land.
She believed a new set of laws would do as life
had done: emerge from the seas onto land. She gave
her own life to this grand possibility.

She lived at the water's edge and took her dogs
for long walks on the sandy shores.
In her quiet moments she taught her dogs,
proper English setters, to play piano, to type
and even to write Columbian school poetry.

I learned from her the art of vision, of looking
into the depths and finding a future worth fighting for.
She was only fifty when I saw her standing
on her head, well past youth and on her way
to venerability.

She grew older with grace, never slowing
her tempo or showing the accumulating years.
They called her the queen of the seas,
the first lady of the oceans. It was the mountains

that took her away, the snow covered mountains.

DAVID KRIEGER, February 2011

The Future of Ocean Governance and Capacity Development

Essays in Honor of Elisabeth Mann Borgese (1918–2002)

Edited by the International Ocean Institute - Canada

Dirk Werle – Paul R. Boudreau – Mary R. Brooks –
Michael J.A. Butler – Anthony Charles – Scott Coffen-Smout –
David Griffiths – Ian McAllister – Moira L. McConnell –
Ian Porter – Susan J. Rolston – Peter G. Wells

BRILL
NIJHOFF

LEIDEN | BOSTON

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Foreword

Born in 1918 as World War I was receding, Elisabeth Mann Borgese learned to make her own way in a man's world as an independent, self-taught author, professor, and oceans activist. Elisabeth possessed an unwavering commitment to improving ocean governance so that all countries could benefit from exploiting and conserving the wealth of the world's marine resources. Her practical and conceptual work contained the seeds of many ocean governance developments addressed in this volume, whether training marine management experts or conceiving institutions for strengthening international ocean cooperation. The concept of treating ocean resources as common heritage, for example, was new and untested when she first expanded upon it in the 1960s and 1970s, as preparations for what would become the UN Convention on the Law of the Sea took shape. Almost half a century later the concept still challenges the slow-moving institutions of international law, which eventually acknowledged that seabed and subsoil resources beyond national jurisdiction are common heritage, but wrestles still with expanding that protection to living marine resources. Elisabeth's commitment to international solutions to persistent problems were the product of a life lived across continents and countries, and across eight decades. She witnessed the naïve belief of her parents' generation in the power of international institutions and its slow transformation into a more practical understanding that national and international interests are better pursued through regional and topical approaches to managing common resources.

Elisabeth charted her own course in many arenas, each shaping her work on nationality, internationality, and ocean governance. As a German-European transplant to North America, she claimed four different national affiliations in her 83 years: German, Czechoslovak, American, and Canadian. Leaving Hitler's Germany for Switzerland in 1933 with her family at age 15, five years later they moved again, to Princeton, New Jersey. There her family's circle included fellow exiles Albert Einstein and Giuseppe Antonio Borgese, whom she later married. Moving with him in the wake of World War II to the University of Chicago, Elisabeth became secretary to the all-male Committee to Frame a World Constitution. Establishing her own credentials as a scholar of comparative constitutions she worked with another German émigré, Max Rheinstein, who founded the discipline of comparative law in the United States. Returning with her husband to Italy in the early 1950s, she soon found herself a young widow with two small daughters.

Making ends meet by teaching German, editing Ford Foundation journals, and writing reviews, she published her first novel, *The Ascent of Woman*, in 1963. She returned to the United States to become the sole female fellow at the Ford Foundation Center for the Study of Democratic Institutions in Santa Barbara (1964–1978), where she pursued her own research on comparative constitutionalism and ocean governance. Her first four decades of life are emblematic of an entire class of young women displaced by World War II, each of whom made their way in foreign lands as wives, daughters, or on their own. Elisabeth's last move to a new country came in 1978 when she joined Dalhousie University in Halifax, Canada. As a political science professor, she built on her work in community decision-making, constitutional processes, and common heritage until her death in 2002. Key to founding the International Ocean Institute was what colleagues recognized as one of her "most significant accomplishments[:] bridging the gap between the Euro-American elites amongst whom she was raised and the emerging elites of the Third World. This is a highly personal accomplishment, based on the respect and trust of both sides."[1]

Elisabeth earned that trust and respect as a woman making her way in a male-dominated intellectual world, as a university professor with no formal academic training, and as a woman without a country advocating for countries without a voice to ensure fair access to marine resources. In these myriad roles, Elisabeth pointed us toward "The Future of Ocean Governance and Capacity Development" by engaging in both of those activities in concrete ways. The essays in this volume pay tribute to her pursuit of collaborative and practical solutions to better use of the world's oceans.

Betsy Baker
Anchorage, Alaska, United States
February 2018

1 This foreword is adapted from the author's essay "Elisabeth Mann Borgese: Making her Way," in *Elisabeth Mann Borgese and das Drama der Meere*, eds., H. Pils and K. Kühn (Mare Verlag, 2013), 88–97. The quotation is from a Draft letter to H. Hicks, President, Dalhousie University, Halifax, Canada, 1 August 1979, Elisabeth Mann Borgese Fonds, Dalhousie University Archives, MS-2-744, Folder 41.6.

Foreword

It is hard to believe that Elisabeth Mann Borgese would have been 100 years old in 2018. That is because it seems like it was only yesterday that my friend, Professor Edgar Gold, introduced me to Elisabeth in 1974 in Caracas, Venezuela, at the opening of the Third United Nations Conference on the Law of the Sea. All I knew about her at first was that she was the youngest daughter of the great German Nobel Prize-winning novelist, Thomas Mann, and that she was a close friend of Ambassador Arvid Pardo of Malta, the person who set the law of the sea initiative in motion at the United Nations. Little did any of us know then that the 1982 United Nations Convention on the Law of the Sea (UNCLOS) would become the second-most important multilateral treaty since the Second World War, surpassed only by the United Nations Charter, or how important Elisabeth would be in promoting the principles of the Convention over the remainder of her life! She, and I, believed the peace the Convention brought to the world's oceans was one of the greatest diplomatic achievements of the twentieth century.

Everyone who knew Elisabeth was astonished when she decided to spend the last third of her life in Nova Scotia, with her amazing dogs, in Sambro Head, a tiny fishing village outside Halifax. In her time in Canada, she left many legacies. The one that is most successful and that endures to this day is the Training Program on Ocean Governance—organized by the International Ocean Institute-Canada—that will enter its thirty-eighth year in 2018. This Program has trained nearly 700 alumni from more than 100 countries around the world. The former participants of the Program have been extraordinarily influential in ensuring that their countries dealt responsibly with their ocean assets, the ones granted to them by UNCLOS. Important aspects of the Convention are reflected in the Program's ocean governance curriculum and, from there, have found their way onto the pages of this book. Going forward, the essays are bound to provide useful orientation and guidance for the next generation of IOI alumni, ocean management practitioners, and policy-makers.

More than a decade after her death, those of us who were fortunate enough to have worked with Elisabeth still miss her explosive energy, her inherent kindness to all around her, and access to her incredible network of contacts worldwide. The "First Lady of the Oceans" was a life force the likes of which we will not soon see again in a world that is always in need of many Elisabeths. Her famous father, if alive today, would be proud of his favorite child and her crucial contributions to peace in the oceans of the world. Elisabeth would be delighted by this collection of essays inspired by her humanist ideals and lifelong advocacy for the ocean.

Brian Flemming, CM, QC
Halifax, Nova Scotia, Canada
February 2018

Editors' Preface and Acknowledgments

Following a decade-long global diplomatic effort of negotiations, the United Nations Convention on the Law of Sea (UNCLOS) was adopted in 1982.[1] Hailed as a constitution for the ocean, it contains many rules and regulations for all ocean areas, all uses of the sea, and all of its resources. The Convention also outlines the need for developing capacity to achieve the basic objectives concerning ocean governance. Provisions in Part XIV indicate an obligation of states and international organizations to promote the development of human resources by way of training and education, especially for nationals in less developed countries. As a forceful participant in the UNCLOS negotiations and trusted advocate of the rights of those countries, Elisabeth Mann Borgese (1918–2002) took an active role to ensure that such training and education opportunities were made available. She was instrumental in establishing a training program at the International Ocean Institute (IOI), which she had founded in Malta, and fostered vigorously as part of her tenure at Dalhousie University in Canada during the last quarter of the past century.

Elisabeth's humanist concepts, spirited discussions, and insightful publications on the ocean, ocean governance, and common heritage have not lost any of their relevance.[2] They have gained significance in light of the enormous challenges that humanity and the ocean are facing today, for example, economic and demographic pressures, technological transformation and globalization, and the repercussions of environmental pollution and climate change. Addressing these challenges requires more than adaptation; in fact, they call for sharpened attention to reach out to practitioners and concerned

1 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3.

2 Important works of Elisabeth Mann Borgese include *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), *The Future of the Oceans: Report to the Club of Rome* (Montreal: Harvest House, 1986), and *The Drama of the Oceans* (New York: Harry N. Abrams, 1975). The Elisabeth Mann Borgese fonds at the Dalhousie University Archives, Halifax, Canada, contain an extensive collection of research and personal papers at http://findingaids.library.dal.ca/index.php/elisabeth-mann-borgese-fonds. In 2018, Karolina Kühn prepared a tribute "Der Meeresraum ist eine neue Welt—Elisabeth Mann Borgese zum 100. Geburtstag," in *Neue Rundschau 2018/1* (Frankfurt: Fischer Verlage). In 2012, Holger Pils and Karolina Kühn edited a multi-faceted portrait *Elisabeth Mann Borgese und das Drama der Meere* (Hamburg: Mareverlag) which includes an extensive bibliography of her work (pp. 245–255). In 2004, Aldo Chircop and Moira L. McConnell edited a series of tributes to Elisabeth Mann Borgese in Volume 18 of the *Ocean Yearbook* (Chicago: University of Chicago Press, 2004), which also contained EMB's autobiographical 1999 Nexus Lecture "The Years of My Life."

citizens and increased action to advance ocean governance and capacity development for the future.

The year 2018 is an auspicious occasion to focus attention on the oceans and ocean governance. The annual IOI-Canada training program is approaching its fifth decade, its 'ocean ambassadors' the world over are commemorating the 100th anniversary of the birth of its initiator, and Dalhousie University, IOI-Canada's host, is celebrating 200 years of excellence in education and research. If here today, Elisabeth would likely demand that we focus attention on recurrent environmental and social justice problems and add emerging challenges to the continuously expanding ocean governance agenda.

To address these interconnected and multi-faceted issues in a positive and forward-looking way, this collection of more than 80 invited essays offers state-of-the-art views on key ocean governance-related themes, specifically, capacity development, law of the sea, ocean science, integrated ocean and coastal management, fisheries and aquaculture, ocean energy, maritime safety and security, maritime transportation, as well as communication, public engagement, and negotiation. These themes are rooted in IOI-Canada's long-standing and continuously evolving course curriculum on "Ocean Governance—Policy, Law and Management."[3] They complement the United Nations' 2030 Agenda for Sustainable Development, in particular Sustainable Development Goal 14 "to conserve and sustainably use the oceans, seas and marine resources."[4]

A large roster of experienced academics, practitioners, writers, and administrators has contributed these brief essays as thought-provoking orientation for government, the private sector, researchers, non-governmental organizations, philanthropic organizations and the interested public. Without exception, all of the contributors followed eagerly and with generosity our invitation to honor the work and memory of Elisabeth. Quite a number of authors count themselves fortunate of their personal and professional connections with her, either as research associates, students, members of staff, or ocean advocates. Others drew inspiration and gained expertise from her commitment and her extensive body of work on ocean affairs. The common goal of these contributions remains as apropos as UNCLOS itself—developing better capacity to foster fair and well-informed ocean governance regimes that support environmental sustainability and human well-being.

3 See "Training at IOI-Canada," International Ocean Institute-Canada, http://internationaloceaninstitute.dal.ca/training.html; "Welcome to the IOI," International Ocean Institute, https://www.ioinst.org/.

4 "Transforming Our World: The 2030 Agenda for Sustainable Development," United Nations, https://sustainabledevelopment.un.org/post2015/transformingourworld.

As members of the editorial team we are closely associated with the International Ocean Institute-Canada and the ocean governance training program. Our motivation to help advance its curriculum and to publish important contributions is reflected, in large part, on these pages and in our introduction and conclusion. We thank the authors for contributing their essays and appreciate the work of our professional reviewers. IOI-Canada gratefully acknowledges financial support through the IOI headquarters in Malta for this publication. The management and production team at Brill Nijhoff in the United States provided expert guidance and support to see the project through to completion. Numerous individuals have contributed to this volume. While many are closely affiliated with particular institutions, we note that the views expressed in these essays are those of the authors.

The Editors, International Ocean Institute-Canada
Dirk Werle, Paul R. Boudreau, Mary R. Brooks, Michael J.A. Butler, Anthony Charles, Scott Coffen-Smout, David Griffiths, Ian McAllister, Moira L. McConnell, Ian Porter, Susan J. Rolston, and Peter G. Wells
Halifax, Nova Scotia, Canada
April 2018

About the International Ocean Institute

Founded in 1972 by Elisabeth Mann Borgese, the International Ocean Institute is an independent, non-profit organization working globally to promote sustainable ocean governance. For decades it has contributed to capacity building through training and publications, with an emphasis on ethical and legal values and peaceful uses of the ocean. Its interdisciplinary course at Dalhousie University in Canada has provided training in key aspects of coastal and ocean management each year since 1981 and has built an influential network of leaders and practitioners equipped with the knowledge and skills to help advance responsible ocean governance in over 100 countries.

Editors' Biographical Notes

Paul R. Boudreau

Mr. Boudreau, B.Sc (1977), M.Sc. (1989), is an ecologist and environmental manager (retired) who worked for 32 years with the Canadian federal Department of Fisheries and Oceans. A three-year posting to the Land-Ocean Interaction in the Coastal Zone (LOICZ) was significant in his perception of the variety of human reliance on the world coasts. Ongoing interests include the adequate representation of public views in the often very technical processes of responsible coastal and ocean management. In 2012, he became a Senior Research Fellow with the International Ocean Institute-Canada.

Mary R. Brooks

Dr. Brooks is Professor Emerita at Dalhousie University's Rowe School of Business, Halifax, Canada. In 2016, she was appointed Chair of the Marine Board of the US National Academy of Sciences. Her research focuses on competition policy in liner shipping, port strategic management and short sea shipping. In addition to providing advice to governments and industry, Dr. Brooks has published more than 25 books and technical reports, more than 25 book chapters, and more than 75 articles in peer-reviewed scholarly journals since joining Dalhousie University in 1979.

Michael J.A. Butler

Mr. Butler was educated at London University (UK), Memorial University and McGill University (Canada) with a focus on the marine sciences. His career in Atlantic Canada has included the roles of Fishery Oceanographer at the then Marine and Fishery Training Centre in Summerside; Coordinator of Training at the former Huntsman Marine Laboratory in St Andrews; Director of Research at the Council of Maritime Premiers' Maritime Resource Management Service in Amherst; and, in Halifax, Director of the Secretariat for the Atlantic Coastal Zone Information Steering Committee; President of the Oceans Institute of Canada; and, since 2005, Director of IOI-Canada.

Anthony Charles

Dr. Charles is a professor at Saint Mary's University in Halifax, Canada. His research on fisheries, oceans and coasts focuses on integrated management, ecosystem-based management, community-based management, climate change, sustainability and resilience, and marine protected areas. He has authored and edited several major books, including *Sustainable Fishery Systems*, *Governance* *of Marine Fisheries and Biodiversity Conservation*, and *Governing the Coastal Commons*. He leads the Community Conservation Research Network, exploring linkages of environmental conservation and local economies. Dr. Charles is a Pew Fellow in Marine Conservation, a member of IUCN's Fisheries Expert Group, and a longtime contributor to the International Ocean Institute.

Scott Coffen-Smout

Mr. Coffen-Smout, B.Sc., DMA, M.Sc., is an oceans management biologist with Fisheries and Oceans Canada (DFO), Bedford Institute of Oceanography, Halifax, Canada. He studied biology and marine affairs at Dalhousie University and marine environmental science at Bangor University, Wales. He previously consulted in Somalia and Niue, South Pacific. Affiliations include: research associate at the Marine & Environmental Law Institute, Dalhousie University, co-editor of *Ocean Yearbook* (Brill Nijhoff), alumnus of IOI-Canada's training program, and senior research fellow at IOI-Canada. Areas of practice at DFO include marine spatial planning, spatial data and information management, sustainable fisheries certifications, oceans management, and area response planning.

David Griffiths

Mr. Griffiths is an independent researcher and former Canadian naval officer holding research fellowships with the International Ocean Institute–Canada, the Centre for the Study of Security and Development at Dalhousie University in Halifax, Canada, and Pakistan's National Centre for Maritime Policy Research at Bahria University in Karachi. He also serves as Chair of the Board of Governors of the Atlantic School of Theology, Nova Scotia's smallest university. He is a graduate of the Canadian Forces Command and Staff College and holds a Master's degree in Marine Management.

Ian McAllister

Dr. McAllister, long time economics professor at Dalhousie University, Halifax, Canada, has served on two Royal Commissions and advised Canadian and overseas governments. He headed the Development Department of the International Federation of Red Cross and Red Crescent Societies in Geneva. Among books he has authored are: *Projects for Relief and Development* (1991), *Sustaining Relief with Development: Strategic Issues for the Red Cross and Red Crescent* (1993), *Working with Neighbours: University Partnerships for International Development* (1996), *Through a Glass Darkly: From Disaster Relief to Modern Peacebuilding* (2004). He is a member of the Board of Directors of the International Ocean Institute-Canada.

Moira L. McConnell

Dr. McConnell is a Professor of Law Emerita and Honorary Fellow of the Marine & Environmental Law Institute at Dalhousie University in Halifax, Canada. Dr. McConnell's research interests are in the fields of public and private international law and domestic law. She has over 100 publications in a wide range of topics in these fields, including law of the sea, maritime law and policy, environmental law and governance systems. She is co-editor of the *Ocean Yearbook*, associate editor of the *Yearbook of International Environmental Law*, and member of the editorial board of the WMU *Journal of Maritime Affairs*.

Ian Porter

Stories about events and life in coastal communities in Atlantic Canada were a leading priority for Ian Porter as a radio and television reporter and producer with the Canadian Broadcasting Corporation. Going to sea for a story had an enduring appeal. While at CBC in Halifax, Ian took part in the IOI interdisciplinary training programme. Later, as a lecturer with the School of Journalism at University of King's College, Halifax, he returned to IOI as a presenter of the programme's Media and Marine Management module. Ian also has worked as a volunteer journalism instructor for independent news media in southeast Asia.

Susan J. Rolston

Ms. Rolston is sole proprietor of Seawinds Consulting Services, Hackett's Cove, Nova Scotia, Canada. She is a Research Associate of the Marine & Environmental Law Institute, Schulich School of Law, Dalhousie University, Halifax, Canada. She holds a Master's degree in Political Science (Dalhousie). Ms. Rolston's areas of special expertise include marine policy and management, maritime security, the environment, and international affairs and development. She has held research and management positions with marine-related institutes and programs at Dalhousie University. Ms. Rolston has contributed to numerous marine publications as an author and in an editorial capacity.

Peter G. Wells

Dr. Wells is a marine environmental scientist (retired) and Adjunct Professor and Senior Research Fellow at Dalhousie University and the International Ocean Institute-Canada, Halifax, Canada. He has a B.Sc. (Biology, McGill, 1967), MSc (Zoology, Toronto, 1969) and Ph.D. (Zoology/Aquatic Toxicology, Guelph, 1976). He worked 34 years for Environment Canada, primarily in Halifax. He taught environmental toxicology at Dalhousie and served the UN as a marine pollution science advisor. Current interests are ecotoxicology, use and influence of marine environmental information, community action on coastal environmental issues, and mountain recreation. He is an AAAS Fellow amongst other honors and has authored/co-authored many publications, including editor of five books.

Dirk Werle

Mr. Werle, M.Sc. (McGill, 1984), is a managing partner with Ærde Environmental Research in Halifax, Canada since 1987. His professional career as a geographer focused on innovative applications of Earth observation satellites for mapping and managing natural resources and for monitoring marine and terrestrial environments. He has worked as an advisor for government and non-governmental organizations and chaired Canada's National Remote Sensing Working Group for the Environment. He served as Officer and President of the Canadian Remote Sensing Society from 1999 to 2007. In 2010, he joined the Board of Directors of the International Ocean Institute-Canada.

INTRODUCTION

The Future of Ocean Governance and Capacity Development

Dirk Werle, Paul R. Boudreau, Mary R. Brooks, Michael J.A. Butler, Anthony Charles, Scott Coffen-Smout, David Griffiths, Ian McAllister, Moira L. McConnell, Ian Porter, Susan J. Rolston, and Peter G. Wells
International Ocean Institute-Canada, Halifax, Nova Scotia, Canada

We live by a global ocean that washes on many shores, supports the activities of many different peoples, and exacts our respect in many forms. At the height of her career Elisabeth Mann Borgese advocated that this ocean is our common heritage. She worked to promote a sharing of skills and knowledge to enable people of all countries to benefit more equally from its bounty. The knowledge and facilities have spread, but so too has a recognition of the critical state of ocean conditions and of unmet challenges to ocean and coastal governance. This book is about the evolution of our understanding of both the conditions and the challenges.

Ocean governance and training are deeply rooted in the United Nations Convention on the Law of the Sea (UNCLOS),[1] the 1982 international agreement often described as the "constitution of the oceans." As an active participant in the process of negotiation and ratification of the Convention, Professor Mann Borgese was determined that it incorporated the principle of equity among nations. More than that, she insisted that it must provide for training to enable small, developing and poor countries to implement the agreement for their own benefit. As she wrote later about the creation of exclusive economic zones (EEZs) under the Convention: "The acquisition of vast areas of ocean space and resources by itself meant nothing if coastal states lacked the resources needed for rational management."[2]

The foundation of the International Ocean Institute (IOI) in 1972 was a response to this need. During her tenure in the 1980s at Dalhousie University in Halifax, Canada, Professor Mann Borgese led the development and implementation of the IOI-Canada Training Program. Now well into its fourth

1 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3. Available at http://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf.

2 E. Mann Borgese, "The Training Programme of the International Ocean Institute," *Ocean & Coastal Management* 40, no. 1 (1998): 93–97, 93.

decade, the annual program brings participants from around the world to meet at Dalhousie University with experienced academics, practitioners, and administrators for lectures and discussion on current aspects of ocean and coastal governance. More than 700 mid-level professionals from more than 100 countries have taken part.

This compendium of over eighty essays is an outgrowth of IOI-Canada's flagship training course on ocean governance. It does not offer an in-depth review of any single aspect of ocean governance, but the diversity of themes and topics reflects the wide scope of IOI's training initiatives. Despite their brevity, most of the essays share a common denominator and analytical quality: consideration of the current state of ocean governance-related affairs and a critical look at the challenges and prospects ahead. The latter aspect is the subject of our essay at the end of the book looking at a number of significant crosscutting issues that emerge through this process. They include concerns about institutional arrangements and co-operation, environmental problems and pressures, technological advancements, challenges and opportunities, and matters concerning civil society.

As this collection attests, ocean governance spans an extraordinary range of issues and disciplines.[3] Its remit extends from matters as local as *who* gets to put a lobster pot *where,* to international disputes over control of ocean space. It relies on both formal and informal structures and fact-based evidence supported by science to maintain the health of the ocean and the well-being of coastal peoples. UNCLOS provided a framework of laws, institutions, and practices within which states might co-operate in the management of many different activities in, on and about the ocean and the sharing of its resources. An array of international agencies now exists to regulate everything from international maritime transport to tuna fisheries.

An emerging ethos of ocean governance found expression at the 1992 UN Conference on Environment and Development in Rio de Janeiro. Agenda 21 declared that "the marine environment—including the oceans and all seas and adjacent coastal areas—forms an integrated whole that is an essential component of the global life-support system and a positive asset that presents opportunities for sustainable development."[4]

Chapter 17 of Agenda 21 called for new approaches to marine and coastal area management and development. It urged States to undertake integrated

3 Although there is no general and widely accepted definition of *ocean governance* we can point to specific legal, institutional and implementation-related elements that, when combined in a holistic and inclusive way, form the basis for effective ocean governance regimes at local, regional, national and international levels, with the ultimate aim to sustain the health of the ocean and the well-being of humankind.

4 Available at https://sustainabledevelopment.un.org/outcomedocuments/agenda21.

management and sustainable development of coastal areas and to apply preventive and precautionary approaches in project planning and implementation. Coastal States should increase consultation with academic and private sectors, community and resource groups, and indigenous people. The capacity of developing countries to act on the recommendations ultimately would depend "on the technology transfer and financial resources required and made available to them."[5]

Equity and sustainability remain as core principles but, in this century, issues of ocean governance often concern shared exigencies. Climate change, population pressures, economic globalization, and unsustainable exploitation of marine resources challenge our ability to co-operate nationally, regionally, and internationally. The scale of these challenges is as vast as the ocean itself, but at least two considerations complicate our response to them all. None are resolvable by nations acting alone because so much of the ocean is beyond the legal jurisdiction of any one of them. Neither can any one branch of scientific inquiry or technology provide solutions. Only through interdisciplinary exchange can we hope to comprehend the complex relationships the ocean represents. Only through negotiation and compromise among nations can there be a possibility of effective action.

Such would have been the perceptions motivating the generation that produced UNCLOS and Agenda 21. Who could question that fish ignore maritime boundaries, urban sewage and agricultural runoff degrade coastal waters, or ballast water from bulk carriers is a source of invasive species. What may have been more difficult to foresee was the rapidity of the escalation of threats to ocean health. Late in the last century, for example, the consequences of climate change to the ocean received much less media attention than worry about the ozone layer. The plastic bags that now clog mid-ocean gyres only started to appear at grocery checkouts around 1980.[6] Meanwhile, the trends in such long-recognized indicators as levels of acidification, eutrophication of coastal waters, and fishery stocks have grown more ominous.

What also could not have been fully anticipated was the impact of digitized communication systems that made possible not only the Internet and social media, but also the accumulation and instant transmission of great volumes of data about the ocean environment, circulation patterns, and the movement of vessels. Shared with skilled associates, such data can enhance the capacity of

5 *Supra* 4.

6 S. Laskow, "How the Plastic Bag Became so Popular," *The Atlantic*, 10 October 2014, https://www.theatlantic.com/technology/archive/2014/10/how-the-plastic-bag-became-so-popular/381065/.

developing states to manage ocean activity and resources; withheld, existing disparities can only deepen. Similarly, the spread of the Internet led to the so-called digital divide between those with easy online access and those with limited or none. Yet the web serves as a virtual classroom for individuals seeking up-to-date credentials in science and technology and enables the exchange of significant findings between colleagues on opposite sides of the world. The intensity of current debates over cybersecurity and Internet governance is a good measure of its importance for the future of ocean governance.[7]

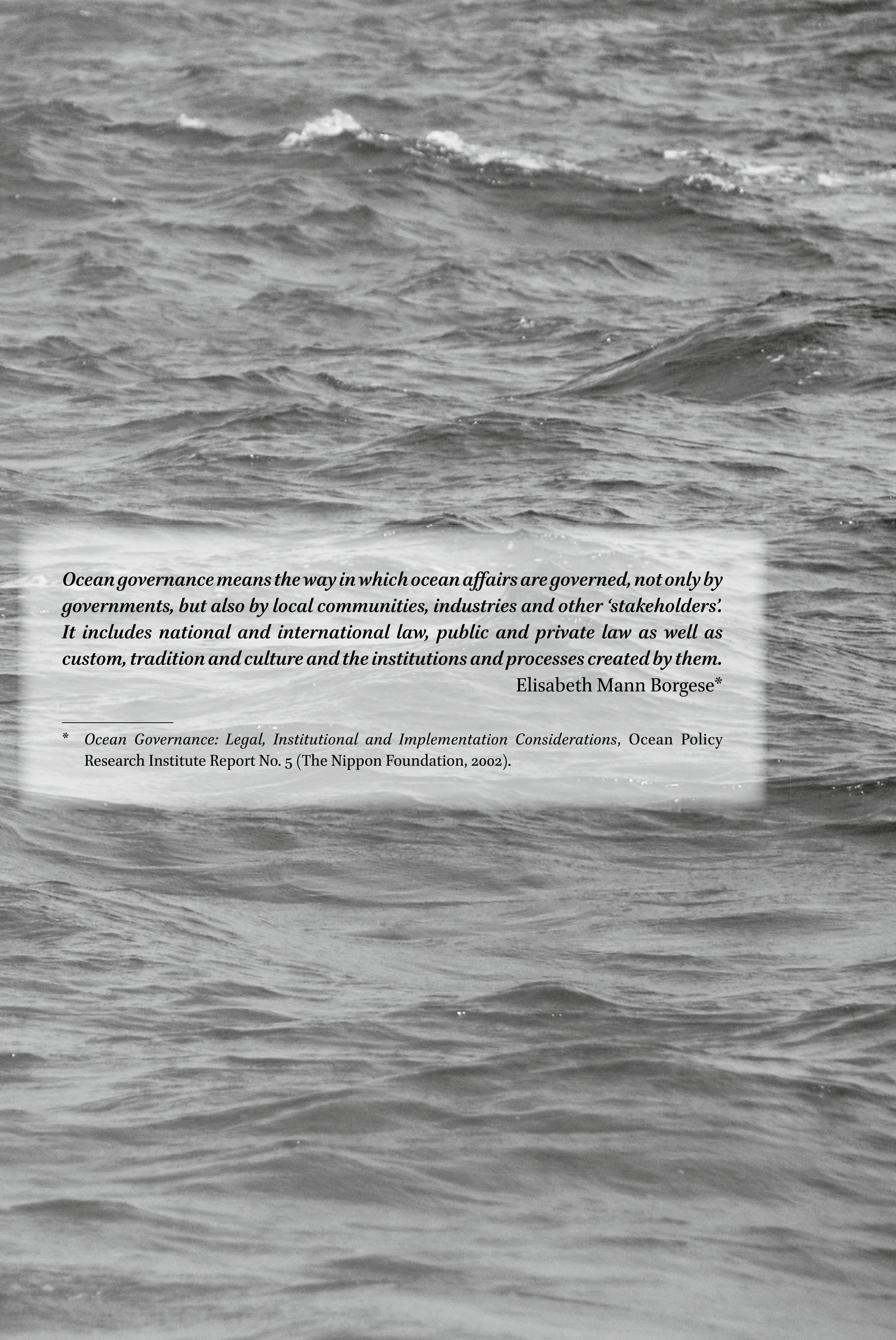
The hyper-charged pace of change in the early years of this century has had unequal consequences for people in developed and developing states. Whole communities in the South Pacific are looking afar for new islands to which they might move, and in the developed world rising flood insurance premiums are a concern for people along North American coastlines. Spreading drought brings bans on water-sprinklers in upscale communities in some countries, while for subsistence farmers it means desperation and mass migration. Just as unequal can be the distribution of benefits from advances in research, knowledge, and technological change. The cost of maintaining a large scientific establishment and acquiring the technology it demands is well beyond the financial capacity of most developing States. The knowledge base from which developed nations around the North Atlantic manage fisheries, maritime transport, and weather forecasting and so on, is vastly more detailed than that for developing States globally.

For Professor Mann Borgese, the gap in knowledge and capacity between developed and developing states reflected a power relationship in which the well-to-do will always advance faster and further than those with less. This was for her, and is for a large part of the world, no longer acceptable. What is also now more apparent than ever is that—like weak links in a chain—gaps in overall ocean governance expose all of us to the consequences of a breakdown in the sustainability of ocean ecosystems. This possibility weighs heavily on a generation of young people around the world in an era where human activity has a decisive impact on the environment. The foresight and commitment of Elisabeth Mann Borgese speaks to this generation as surely as at any time during her life. We have only one ocean to care for, she reminded us, and it is a responsibility and an interest we share with people on all its shores.

7 "Debates on Global Governance and Cybersecurity," Internet Governance Project, Georgia Tech, School of Public Policy, 3 April 2017, https://www.internetgovernance.org/2017/04/03/debates-on-global-governance-and-cybersecurity/.

PART 1

Perspectives on Ocean Governance



Ocean governance means the way in which ocean affairs are governed, not only by governments, but also by local communities, industries and other 'stakeholders'. It includes national and international law, public and private law as well as custom, tradition and culture and the institutions and processes created by them.

Elisabeth Mann Borgese*

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* *Ocean Governance: Legal, Institutional and Implementation Considerations*, Ocean Policy Research Institute Report No. 5 (The Nippon Foundation, 2002).

Introduction

Editor: Michael J.A. Butler

This part is focused on ocean governance *per se* and the contribution that Elisabeth Mann Borgese and her organization, the International Ocean Institute, have made to its development. There are numerous definitions of ocean governance that endeavor to explain the complexity and breadth of this topic. Chapter 17 of Agenda 21 refers to ocean governance in terms of sustainable development and integrated management, essential components of a global life support system. The *Ocean Yearbook*, Volume 18, which is dedicated to Elisabeth Mann Borgese, provides an exhaustive review of ocean governance and its importance,[1] the *raison d'être* for this volume.

The essays here continue the reviews and analyses documented in the *Ocean Yearbook* and contribute timely thoughts on the future governance of 73 percent of the earth's surface. The topics are as insightful as they are varied. They range from personal reminiscence of Elisabeth Mann Borgese and her ability to engage world leaders in her global quest to preserve the ocean for the benefit of humankind, to a critique of the current system of ocean governance that is fragmented and lacking unity. The complexities of ocean ecosystems and the difficulties of their governance are described as a 'wicked' problem, an innovative term in this context. The increasingly vital concept of ethics and its application to all aspects of ocean governance are reviewed and, in a similar vein, the importance of shared values in partnerships is stressed in terms of meaningful ocean governance. Reduced government involvement and an enhanced stakeholder engagement are posited for ocean governance in Canada. A following essay highlights the significance of the Peace and Friendship Treaty of 1760 with the First Nations and its relevance to ocean governance today. A 'two-eyed seeking' philosophy, aptly named by two Mi'kmaq Elders from Eskasoni (Cape Breton Island), pays respect to both Western science and Mi'kmaq traditional knowledge, to arrive at the best possible science. The formulation of ocean governance policy and its implementation is then explored from the perspective of environmental non-governmental organizations, their role and impact. The final essay describes the enduring relationship of the International Ocean Institute with China on oceans and that country's long-term vision of creating an 'ecological civilization' where people and nature can coexist in harmony.

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1 A. Chircop and M.L. McConnell (eds.), *Ocean Yearbook, Volume 18* (Chicago: University of Chicago Press, 2004).

DOI:10.1163/9789004380271_003

In 1987, Elisabeth Mann Borgese expressed regret at not living long enough to see the evolution of ocean governance. That progress is surely well documented in the essays in this part, and as the subsequent parts will further attest. Her modest words make a fitting prelude to these essays:

> Our generation can take pride in having contributed, no matter how fumbling and bunglingly, to the making of a new order for the seas and oceans, to opening of new ways of thinking about world order and the hammering-out of a platform from which, in the future, a great many new initiatives can be launched.[2]

2 "Foreword," *San Diego Law Review* 24, no. 3 (1987), 601.

Elisabeth Mann Borgese's Invisible Hand in Ocean Governance: Past, Present, and Future

*Awni Behnam**
Honorary President, International Ocean Institute, Malta

In the history of Planet Ocean (after all 75 percent of it is covered by ocean) three human beings as no others have defined its destiny through the genius of thought, passion, and craft: Hugo Grotius, Arvid Pardo, and Elisabeth Mann Borgese. For centuries, the Grotius principle of freedom of the seas was unassailable. Then came that virtuous day when Pardo, the then Ambassador of Malta at the United Nations, made his marathon speech to the United Nations General Assembly (UNGA) on 1 November 1967 advocating a new principle for a new law of the sea. That principle was destined to be that of the common heritage of mankind, which transcends both concepts of sovereignty and freedom in human relations with the ocean and its governance.[1]

That speech in its totality galvanized Elisabeth, who at that time was a fellow of the Center for the Study of Democratic Institutions. She saw Pardo's ideals aligning with those of the Center and her own beliefs, in particular Pardo's emphasis on the peaceful use of the ocean and its living and non-living resources. This was to lead to several narratives that impacted the convening and processes of the Third United Nations Conference on the Law of the Sea (UNCLOS III). She grafted Pardo's ideas on the framework of Pope John XXIII *Pacem in Terris*, thereby creating *Pacem in Maribus*. As Pardo's intellectual partner, and with the support of the Maltese government, she convened the 1970 *Pacem in Maribus* conference to discuss the broad issues of the use of ocean services and resources into internationally agreed law.[2] In 1972 she established the International Ocean Institute (IOI) in Malta as the think tank for the evolving negations at UNCLOS III. She wrote:

* Former President, International Ocean Institute; former United Nations Assistant Secretary-General, Affiliate Professor, University of Malta.

1 United Nations General Assembly (UNGA), 22nd Session, Official Records, First Committee 1515th Meeting, 1 November 1967, http://www.un.org/depts/los/convention_agreements/texts/pardo_ga1967.pdf.

2 E. Mann Borgese, "The Years of My Life," *Ocean Yearbook* 18 (2004): 1–21, 12–14.

DOI:10.1163/9789004380271_004

> We followed UNCLOS III very closely, analysed its emerging results, proposed new approaches and solutions. All major actors participated in UNCLOS III participated in Pacem in Maribus, coincidently the President of UNCLOS III, Shirley Amersighe, was also the President of the International Ocean Institute.[3]

Elisabeth had both the personality and the opportunity to influence the decision-making process to a large extent. As the ultimate friendly persuader, she also used IOI and *Pacem in Maribus* as the 'bully pulpit'; she was both the antagonist and the pragmatist in the crafting of the United Nations Convention on the Law of the Sea (UNCLOS).

As negotiations continued at UNCLOS III, developing countries were increasingly gaining their political independence and were in search of their economic independence. Development was at the center of the United Nations agenda. An atmosphere of euphoria prevailed. The negotiations for the New International Economic Order (NIEO) were also underway in several UN fora, and an optimistic commitment to global management including the ocean through the institutions of the United Nations predominated.[4] Elisabeth sought to combine both the principles of the NIEO and the objectives of UNCLOS. In contrast, Pardo was never happy about the way in which the NIEO was being promoted by the newly independent developing countries and feared for the dilution of the concept of the common heritage at the negotiating table.[5] UNCLOS, after some ten years of politically charged negotiations, was finally adopted in 1983 as the 'constitution of the ocean'.

After praising the achievements of UNCLOS in letter and spirit, Elisabeth stated in her 1999 Nexus lecture:

> This is not to say the convention is perfect. Nothing human ever is perfect; and this convention is riddled by political compromises, concessions to greed and power and vested interests, … so much so that Arvid Pardo, … was bitterly disappointed by what he thought was a dilution, even betrayal of his ideas. I, on the contrary, was surprised to see how much of his original design had survived the wrangling of the political arena from

3 Id., 13.

4 A. Behnam, "Developing Countries in the Group of 77: A Journey in Multilateral Diplomacy, 1964 to 2004," in *Towards World Constitutionalism: Issues in the Legal Ordering of the World Community*, eds., R. St. J. Macdonald and D.M. Johnston (Boston: Martinus Nijhoff, 2005), 355–380.

5 P.S. Inglott, "Elisabeth Mann Borgese: Metaphysician by Birth," *Ocean Yearbook* 18 (2004), 22–74.

> which no concept can emerge in its virginal purity! Arvid Pardo said, the glass is half empty. I said, the glass is half full.[6]

However, as early as 1996, Elisabeth, then Honorary President of IOI, was at the center of new and emerging international dialogue of globalization. She was frustrated at the way that the ocean and the principle of the common heritage of humankind within UNCLOS was being denied at international fora in preference to market solutions to ocean challenges, promoted in the rush to embrace globalization. In fact, by the beginning of the 1990s, the ocean was no longer on the sustainable development agenda. At the 1992 United Nations Conference on Environment and Development (the Rio Conference), the ocean did not figure specifically in the adopted text; nevertheless, and perhaps cynically, the language of UNCLOS was used very liberally in areas of conservation and the environment.

The neglect of the ocean and the threats to its health and the sustainability of its resources weighed heavily on Elisabeth's conscience. She strongly believed in the critical need for a new institutional focus through a forum that would motivate the international community to address ocean challenges and threats under UNCLOS, including capacity building for developing countries and countries in transition. She also criticized the manner in which individual international organizations addressed sectoral issues of the ocean, mainly the lack of an interdisciplinary and horizontal approach and the failure to integrate ocean challenges and uses under one common roof. She became increasingly committed to change the *status quo*, advocating for a forum at the United Nations that integrates ocean challenges, threats, and opportunities and brings them to the attention of the UNGA specifically.

Elisabeth decided to launch a new initiative in 1998, the Year of the Ocean. She sought the support of Ambassador Neroni Slade of Samoa, Chair of Small Island Developing States, and the Maltese government, with the strong backing of Ambassador Saviour Borg and Minister George W. Vella, to create a unique forum to address ocean issues and bring that to the attention of the UNGA.[7]

President Guido De Marco of Malta, in the plenary of the fifty-third session of the UNGA (1998), called for the creation of a forum to consider the closely interrelated problems of ocean space as whole. Elisabeth, who knew so well how the bureaucracy and culture of the UN system as whole functions,

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6 Mann Borgese, *supra* note 2, 14.

7 See E. Mann Borgese, "UNICPOLOS: The First Session," *Ocean Yearbook* 16 (2002), 1–21; see also iconic video interview with Noel Brown, Halifax, Canada, 2001, IOI Archives Malta; S.F. Borg, *50 Years (1964–2014) Malta's Foreign Policy with Dedication and Commitment* (2015).

pointed out that the proposal was not aimed at creating a new institution, but a mechanism to enable the General Assembly to make better informed decisions on ocean affairs and the law of the sea. Thus, the United Nations Informal Open-ended Consultative Process on the Law of the Sea (UNICPOLOS) was born.

This turned out to be a milestone in the history of the ocean. UNICPOLOS was not designed to replace UNCLOS, but rather to protect it as the constitution of the ocean. Elisabeth envisaged the General Assembly engaging in a universal informal consultative process regarding the law of the sea. Such a process would bring together member states, civil society, business communities, and institutions and organizations concerned within the remit of UNCLOS to facilitate an annual review on developments in ocean affairs by the UNGA in an effective and constructive manner. UNICPOLOS would suggest particular issues to be considered by the Assembly, with an emphasis on identifying areas where international co-operation should be enhanced. Elisabeth, celebrating its first meeting in 2000, wrote:

> The establishment of UNICPOLOS by the General Assembly must be considered a breakthrough in the process of building a global system of ocean governance. It is the only body of the United Nations system with a membership comprising the whole membership of the General Assembly and intergovernmental and regional organisations as well as major groups of civil society, and with a mandate to consider the closely related problems of ocean space as a whole. … The International Ocean Institute (IOI) has been deeply involved with the establishment of UNICPOLOS and will follow and support its activities in every possible way.[8]

Due to Elisabeth's persistent will and the traditional support of the Government of Malta, the ocean was back again on the international development agenda in the new millennium. She then lobbied for a focus on the protection of marine biodiversity, especially as it related to the area of common heritage under UNCLOS and the manner in which the International Sea Bed Authority (ISA) would conduct deep sea bed mining. She felt that the institutional architecture of the ISA was as outdated as its capacity to deliver its responsibilities. The enormous developments since 1973 in science and technology had made the deepest parts of the ocean accessible to exploitation. She was also aware that marine genetic resources were of increasing relevance, but were not addressed in UNCLOS.

8 Id., 1.

Also, for the first time, the nature of the interdependence of climate change and health of the ocean were being discussed. UNICPOLOS opened the door for civil society institutions and stakeholders to enrich the debate with experts and science for policy-makers and to understand and comprehend the need for ocean governance in certain areas. The first issue on the UNICPOLOS agenda was illegal, unreported, and unregulated (IUU) fishing, a neutral subject that brought all on board. The discussion consolidated the need for such an open ended informal consultative process and attracted the attention of decision-makers at the UNA.

Elisabeth Mann Borgese died in 2002. In 2004, UNICPOLOS addressed the subject of new sustainable uses of the oceans, including the conservation and management of the biological diversity of the sea bed beyond national jurisdiction. I can still remember the large number of delegates at that meeting recalling Elisabeth in their statements and paying tribute to what she started as a peaceful revolution in human international management of the ocean.

In 2004, on the recommendation of UNICPOLOS (now commonly referred to as the Informal Consultative Process), the UNGA established an Ad Hoc Open-Ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction, or the Working Group on BBNJ for short. This was not an easy decision; the United States, Canada, Russia, Republic of Korea, and Japan strongly objected to any such agreement. IOI has continued on the path of Elisabeth's mission by engaging in the process and delivering statements. Naturally, the IOI took the position to support a call for the elaboration of an implementation agreement under UNCLOS, thus backing-up the position taken by the European Union, developing countries, and China.

A turning point came at the United Nations Conference on Sustainable Development (Rio+20) in 2012. One of the Conference outcomes was support for the move towards an implementation instrument under UNCLOS and help in defining the areas of coverage. Consequently, the Working Group completed its task with a recommendation to the UNGA on 19 June 2015. UNGA resolution 69/292 approved the development of an internationally legally binding instrument under UNCLOS on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, together and as a whole, marine genetic resources, including questions on the sharing of benefits, measures such as area-based management tools, including marine protected areas, environmental impact assessments and capacity-building and the transfer of marine technology. The negotiating conference will be convened in 2018 after the preparatory committee made its substantive recommendations to the General Assembly in 2017.

It took ten years for the Working Group on BBNJ to conclude its deliberations and to make its recommendation to the UNGA. The major stumbling blocks were the nature of the international instrument and its scope of application. From the early days, developing countries in the Group of 77 and China, and later the European Union supported the call for elaboration of an internationally legally binding instrument.

The High Seas Alliance brilliantly submitted ten governance principles for the prospective international legally binding instrument on marine biodiversity in areas beyond national jurisdiction.[9] Those principles reflect already existing international obligations under UNCLOS and other international instruments, as well as global norms relevant to the subject of the proposed instrument on which nations will begin negotiations in 2018. Those principles refer to protection and preservation of the marine environment, co-operation, science, stewardship, the precautionary principle, ecosystem-based management, sustainability and equity, good governance, polluter pays, and respect for the law of the sea. Incidentally, these are also principles necessary and applicable to achieving the goals of Sustainable Development Goal 14 adopted at Rio+20.

Unless the ocean community promotes a culture of responsibility, policies of reason, and benefit sharing in the peaceful exploitation of ocean services and resources through science-based policy-making, there is no doubt that traditional negotiators will continue to resist changing the status quo, and the ocean will continue to deteriorate. It is time to stop this culture of procrastination and the pursuit of gains in one ocean sector at the expense of another. This requires a change of the current narrative to one of benefit sharing that is both equitable and sustainable.

More than a decade since Elisabeth Mann Borgese's departure, her legacy lives on. The forthcoming negotiations, which may take as long as UNCLOS itself took to complete, will open new opportunities to all countries, particularly small island developing states. The IOI must now step forward once more and be available to assist developing countries and countries in transition, particularly through building and developing human capacity, to be able to influence negotiations for the best outcome and to prepare their human resources for the prospective implementation international legally binding instrument on marine biodiversity in areas beyond national jurisdiction.

9 "Ten Governance Principles for International Legally Binding Instrument on Marine Biodiversity in Areas Beyond National Jurisdiction," High Seas Alliance, http://highseasalliance.org/ten-governance-principles-international-legally-binding-instrument-marine-biodiversity-areas-beyond, last accessed 16 February 2018.

Perhaps it is relevant to conclude this essay remembering words of wisdom that Elisabeth loved to quote from T.S. Eliot:

> *Time present and time past*
> *Are both perhaps present in time future*
> *And time future contained in time past*

Fragmented Governance of Our One Global Ocean

Wendy Watson-Wright
Ocean Frontier Institute, Halifax, Nova Scotia, Canada

J. Luis Valdés
Instituto Español de Oceanografía, Centro Ocenográfico de Santander, Spain

> How inappropriate to call this planet Earth, when clearly it is Ocean.
> *ARTHUR C. CLARKE*, British author, inventor and futurist

In her 1998 publication, *The Oceanic Circle*, Elisabeth Mann Borgese, articulates the conundrum that challenges the world when it comes to managing ocean activities. She notes that

> [t]he ocean is a medium different from the earth: so different, in fact, that it forces us to think differently. The medium itself, where everything flows and everything is interconnected, forces us to "unfocus," to shed our old concepts and paradigms, to "refocus" on a new paradigm.[1]

Unfortunately, this most necessary 'refocusing' remains very much a work in progress.

The United Nations Convention on the Law of the Sea (UNCLOS) states in its Preamble that "problems of ocean space are closely interrelated and need to be addressed as a whole."[2] And yet paradoxically, the global governance regime is essentially sectoral in nature, based around management and regulatory stovepipes aimed largely at individual industries and activities with rules and regulations emanating from innumerable oversight entities. Much has been written about the failures of this sectoral approach to ocean governance.[3]

1 E. Mann Borgese, *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 5–6.
2 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3.
3 "Towards a New Governance of the Ocean," in *Ocean Atlas*, ed., U. Bähr (Kiel: Bonifatius GmbH Druck-Buch-Verlag, 2017), 44–45.

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But first it is important to underscore Mme. Mann Borgese's assertion that the ocean is different from the earth—with its inhabitants knowing no borders, and its various ecosystems being part of an interconnected whole. There is but one global ocean, and the conventional reference to ocean(s) in the plural is inaccurate and damaging to the cause of those trying to ensure its sustainability. It is vital to make this distinction, and when and where we can, correct the misuse of the terminology, if for no other reason than for the sake of accuracy and improving public understanding of the ocean's significance.

Many have made the case for the use of the singular. First, regarding accuracy, as noted by Patricio Bernal among others, the ocean should be considered as one, simply due to the nature of fluids.[4] For its part, the National Oceanic and Atmospheric Administration of the United States points out that there is only one global ocean, but for convenience and ease of reference, it has been geographically divided into distinct named regions.[5] And according to the US National Marine Educators Association in their *Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages*, the very first principle is that "the Earth has one big ocean with many features."[6]

But the much more pragmatic reason for all of us to use the singular is that we humans, as part of our nature, tend to be much more defensive and caring about items if we know we have only one of them. We regard them as more precious and worthy of our care and protection. As long as we define the ocean in the plural with names that suggest separate and distinct locations—for example, the Atlantic versus the Pacific—it is easy to dismiss a pollution or other negative event that may be very far from where we live, and therefore not impacting us directly.

So the question remains. How can we properly convey that it is up to all of us, whether in coastal or land-locked nations, to look after our global ocean? That what we do in one part of the ocean will ultimately affect others? And that if we desecrate the one and only ocean on this planet, there is no replacement? Both accuracy and pragmatism should drive us all to reference the one global ocean, and to urge others to do the same.

Unfortunately, on another front, our system of governance is not helping matters. When it comes to ocean sustainability we have a regime that is

4 P. Bernal, "For the Ocean," in *Troubled Waters: Ocean Science and Governance*, eds., G. Holland and D. Pugh (Cambridge: Cambridge University Press, 2010), 13–27, 14.

5 US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), "How Many Oceans Are There?" NOAA, https://oceanservice.noaa.gov/facts/howmanyoceans.html, last accessed 21 February 2018.

6 Ocean Literacy Network, *Ocean Literacy: The Essential Principles of Ocean Sciences for Learners of All Ages*, Version 2 (March 2013), http://oceanliteracy.wp2.coexploration.org/brochure/.

fragmented, some would say fractured, lacking unity, cohesion and overall direction. To illustrate, UNCLOS, which is meant to be the overarching governance framework or 'constitution of the ocean', establishes different ocean areas. They include territorial seas extending 12 nautical miles from a country's coast, and exclusive economic zones up to 200 nautical miles, with the possibility of extension to 350 nautical miles provided a country can scientifically prove its continental shelf is geologically connected to the mainland.[7] In addition, the international ocean space is regulated by close to 600 bilateral and multilateral environment agreements,[8] while within a given country almost every ministry/department touches some aspect of ocean management and regulation. Add those countries with multiple governing jurisdictions and coastlines, such as Canada, and one can easily understand that complexities multiply rapidly. On top of that, there are regional organizations, such as regional fisheries management organizations, focused on one particular topic or activity in a given geographic area.

Within the UN system, numerous agencies and programmes are involved in ocean affairs, as shown in Figure 1. Only three UN organizations are involved *exclusively* with ocean issues: the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (IOC-UNESCO) for science, the International Maritime Organization (IMO) for shipping, and the International Seabed Authority (ISA) for marine mining. Other entities have broad mandates that include aspects of ocean affairs, such as UNESCO for underwater and marine cultural heritage as well as education for sustainable development, the Food and Agriculture Organization (FAO) for fishing and aquaculture, and United Nations Environment (formerly UNEP) for regional seas and marine environment. Additional UN organizations involved in their areas of expertise include the World Meteorological Organization (WMO), the World Health Organization (WHO), the International Atomic Energy Agency (IAEA), the UN Industrial Development Organization (UNIDO), the International Labour Organization (ILO), and increasingly, the UN World Tourism Organization (UNWTO). The UN Development Programme (UNDP), and the World Bank, including its Global Environment Facility (GEF), have become more heavily involved in ocean issues over the past number of years, while some divisions of the UN Secretariat, most notably the Division of Social

7 UNCLOS, *supra* note 2.

8 IOC/UNESCO, IMO, FAO, UNDP, *A Blueprint for Ocean and Coastal Sustainability: An Inter-agency Report on the Preparation for the UN Conference on Sustainable Development* (Paris: IOC/UNESCO, 2011), 22, http://www.unesco.org/fileadmin/MULTIMEDIA/HQ/SC/pdf/interagency_blue_paper_ocean_rioPlus20.pdf.

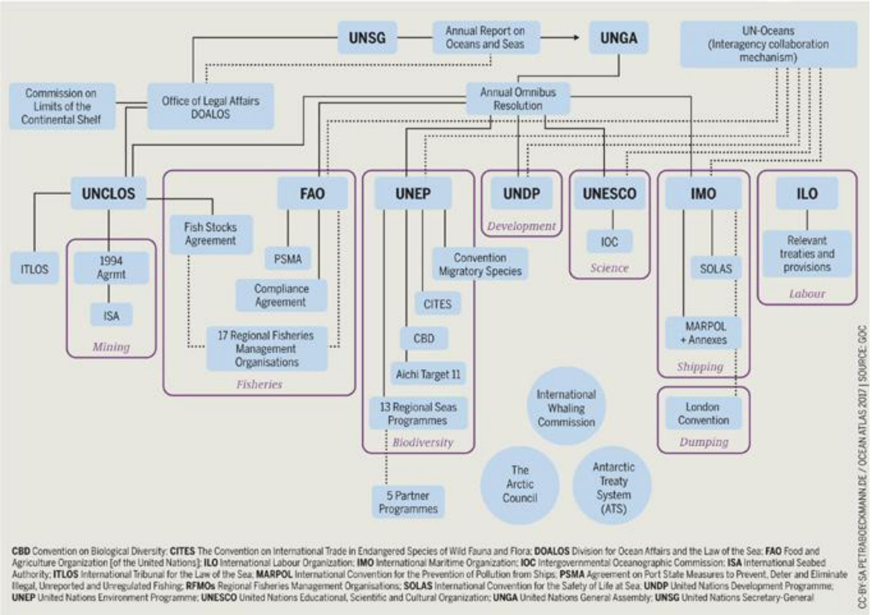

FIGURE 1 International governance structures for the ocean.
SOURCE: *OCEAN ATLAS*, *SUPRA* NOTE 3, AFTER GLOBAL OCEAN COMMISSION (GOC), *FROM DECLINE TO RECOVERY: A RESCUE PACKAGE FOR THE GLOBAL OCEAN* (OXFORD: GOC, 2014), 7.

and Economic Affairs (UN-DESA) and the Division on Ocean Affairs and Law of the Sea (UN-DOALOS), have played key roles in ocean issues for decades.

As a result of the myriad UN agencies, programs, and divisions that play a role in ocean affairs, a co-ordination mechanism known as UN Ocean(s!) was created in 2003 to provide an effective interagency mechanism for sharing information as well as workload. This mechanism was reviewed by the UN Joint Inspection Unit in 2011, with the result that the UN General Assembly in 2013 approved revised terms of reference which recognized "the need to strengthen the central role of the Division for Ocean Affairs and the Law of the Sea and the need to enhance transparency and reporting of the activities of UN-Oceans to Member States."[9]

Europe presents an especially interesting case study for ocean management. In a recent consultation, it was found that there is broad agreement that the current framework for ocean governance is not effective enough to ensure sustainable management of the ocean, not because the framework itself is

9 "About UN Oceans," UN-Oceans, last updated 23 May 2017, http://www.unoceans.org/about/en/.

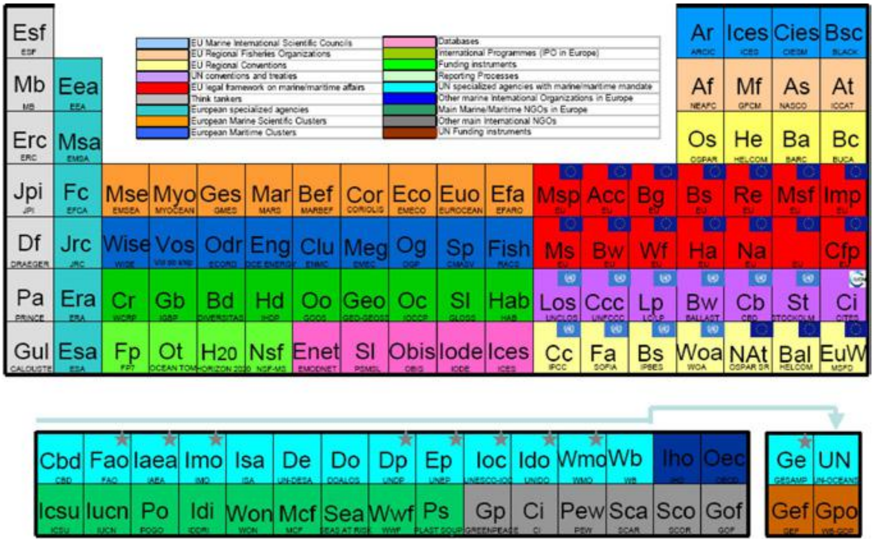

FIGURE 2 Periodic table of European marine and maritime elements in support of ocean science (L. Valdés 2013).

wrong, but because signed agreements are often not implemented, and there is a lack of co-ordination.[10] Perhaps the most elegant and striking depiction of the complex system of ocean organizations, agencies, and jurisdictions in the European Union can be seen here in one of the authors' 'Periodic Table of European Marine and Maritime Elements in Support of Ocean Science' (Figure 2). This periodic table summarizes and illustrates in a simple, comprehensive, and understandable manner the complexity of ocean governance at the European level alone. In fact, the number of ocean-related intergovernmental and non-governmental organizations has exploded over the past century,[11] stimulated by the fact that these organizations increasingly participate in international political processes. Most of these organizations have developed in North America and Europe, which demonstrates the aspirational vision of the Western world to be influential to policy leaders of most developed countries.[12]

10 European Commission, Directorate-General for Maritime Affairs and Fisheries, *Summary of the Results of the Public Consultation on International Ocean Governance* (Brussels: European Commission, 2015), 2, https://ec.europa.eu/info/sites/info/files/consultation-ocean-governance-summary_en_0.pdf.

11 E.A. Turner, "Why Has the Number of International Non-governmental Organizations Exploded since 1960?" *Cliodynamics* 1, no. 1 (2010), 81–91.

12 L. Valdés, J. Mees and H. Enevoldsen, "International Organizations Supporting Ocean Science," in *IOC-UNESCO, Global Ocean Science Report: The Current Status of Ocean Science Around the World*, eds., L. Valdés et al. (Paris: UNESCO, 2017), 146–169.

So, what is the solution to this ‘fragmented ocean governance’? Is there one? Should there be one big organization for the global ocean that covers everything? How do we create more order out of the apparent chaos? How do we more effectively bring together the economic, environmental, and social pillars of sustainability in our pursuit of a blue economy? We offer two examples where attempts are being made to address the inefficient stovepiped approach to ocean issues.

First, beginning in 2010, a series of workshops took place in Monaco to address the issue of the economic impacts of ocean acidification.[13] Sponsored by several organizations and spearheaded by the IAEA's Ocean Acidification International Coordination Centre, the organizers put together “the first real multidisciplinary meeting on ocean acidification” in an effort to produce viable recommendations to policy-makers for minimizing both the human and biodiversity costs of ocean acidification. All four workshops held to date brought together the worlds of natural sciences and economics to examine ocean acidification impacts on ecosystems, fisheries and aquaculture, coastal communities, and most recently, tropical coral reefs. This has been an extremely interesting experiment, since for the most part economists and natural scientists speak two different languages. Yet, over time, the language gap has been narrowing and several cohesive policy-relevant publications have resulted. The world is beginning to take notice of ocean acidification, and the terminology is now part of public parlance.

A second example involves a smaller geographic focus but an expanded list of participants. The Ocean Frontier Institute (OFI), headquartered at Dalhousie University in Halifax, Nova Scotia, Canada, and co-led with Memorial University of Newfoundland and Labrador and the University of Prince Edward Island, is a new international hub for ocean research. It brings together elite researchers and institutes from both sides of the Atlantic to understand the changing ocean—specifically the North Atlantic and Canadian Arctic Gateway—and to create safe, sustainable solutions for ocean development. OFI is truly interdisciplinary. It brings together oceanographers, marine biologists, lawyers, social scientists, management specialists, computer scientists, and engineers to focus on both ocean changes and ocean solutions. It is also transnational, representing an historic partnership among the flagship universities of three Atlantic Canadian provinces along with eight organizations from France (LabexMER), Germany (GEOMAR, Alfred Wegener Institute,

13 “Economics of Ocean Acidification: Bridging the Gap between Ocean Acidification Impacts and Economic Valuation,” International Atomic Energy Agency, https://www.iaea.org/ocean-acidification/page.php?page=2237, last accessed 21 February 2018.

CAU-Kiel), Ireland (Marine Institute), Norway (Institute of Marine Research), and the United States (Woods Hole Oceanographic Institution, Lamont-Doherty Earth Observatory of Columbia University). And it is cross-sectoral, involving academia, federal government scientists, managers, regulators and policy-makers, provincial governments, and more than twenty private sector companies, all aimed at collaborating to ensure the safe and sustainable development of the ocean frontier. It is as yet early days, but many agree that this inclusive approach holds great promise for success.

Will initiatives such as these instantly cure all the governance fragmentation realities noted above? Of course not. But they will help us refocus our efforts in saving the most important ecosystem we have—our global ocean. Mme. Mann Borgese would surely approve.

Transdisciplinary Perspectives on Ocean Governance

Ratana Chuenpagdee
Memorial University of Newfoundland,
St. John's, Newfoundland and Labrador, Canada

Ocean Governance as a Wicked Problem

Oceans are probably one of the most challenging ecosystems to govern.[1] Oceans are diverse, complex, and dynamic ecosystems that provide numerous functions and services to life below and above the water. Humanity, in particular, has relied on the oceans for food, livelihoods, transportation, recreation, and most recently, on other extractive resources, including oil, gas and minerals, among other things. Demands on the oceans have been rising with the continued growth in population, industrial development on land and sea, and many other pressures, which together make ocean sustainability an increasingly impossible goal to attain. As suggested in the United Nations Sustainable Development Goal on Oceans (SDG 14[2]), about 40 percent of the world's oceans are heavily affected by human activities and concerted actions from all nations are required in order to deal with multitude of problems in the oceans, such as pollution, resource overexploitation, and habitat loss.

Many characteristics of the oceans make governance a wicked problem.[3] For instance, oceans are full of 'unknown' and the 'unknowable'. As the saying goes, we know more about space than we know about the oceans. But like space, knowledge about the oceans is centralized around scientific exploration and research, which, while important, contributes little to addressing the complex problems of human–ocean interactions. Ocean governance, in this case, is not about doing more science in order to convert the unknown to known, but about recognizing the unknown as well as the unknowable as part of the wicked 'social' problems and dealing with them accordingly. This also means that while it may not be possible to precisely determine whether human use

1 U.R. Sumaila, "Seas, Oceans and Fisheries: A Challenge for Good Governance," *The Round Table* 101, no. 2 (2012): 157–166.
2 "Sustainable Development Goals: 14 Life Below Water," United Nations, http://www.un.org/sustainabledevelopment/oceans/, last accessed 19 February 2018.
3 H.W.J. Rittel and M.M. Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences* 4 (1973): 155–169.

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of the ocean resources has exceeded the carrying capacity, there is still no reason to drive the system to the edge. Oceans are fragile ecosystems, physically less stable than terrestrial, are susceptible to disruption, and are vulnerable to change. A precautionary principle is therefore highly applicable in any effort to govern the oceans.

As wicked problems go, insufficient information and uncertainty about the oceans are one of the factors leading to difficulties in defining what the problems really are, what they are caused by, and how to go about solving them. Scientists, policy-makers, industrial users, and coastal communities are likely to differ in their opinion about why oceans are not healthy. Their perception and understanding of the problems are based on knowledge and experiences that come from various sources and are expressed in many forms. One of the most classic examples was the Northern cod fishery, which, 25 years after the moratorium, still finds no consensus about what caused the collapse. Yet, having an agreement about the nature and the causes of the problem is not a guarantee that the proposed solutions will be broadly accepted, especially when they involve high costs or impose major losses to certain stakeholder groups. As in other resource sectors, ocean stakeholders are numerous and vary in terms of their urgency, legitimacy, and power to influence governance. Decisions about the oceans, especially those related to uses and access to resources, like where to place marine protected areas, are always contentious as they normally result in restrictions for some stakeholders. In this case, fundamental principles such as social justice, equality and equity, and human rights, have to be considered along with others. This is precisely what the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines[4]) aim to promote in order to address food security, poverty and sustainability concerns in small-scale fisheries around the world. Providing small-scale fisheries with access to marine resources (and markets) is also one of the SDG14 targets.

Another key characteristic about the oceans that creates challenges in governance is related to scale and boundaries. As an open system, ocean governance has to deal with spatial and institutional mismatches due to overlapping jurisdiction and other transboundary issues.[5] Formulating rules and regulations that correspond with the size and scale of the activities, and that take into consideration the flows of some resources and polluted substances, is a

4 Food and Agriculture Organization of the United Nations (FAO), *Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication* (Rome: FAO, 2015).

5 A.M. Song et al., "Transboundary Research in Fisheries," *Marine Policy* 76 (2017): 8–18.

daunting task that requires co-operation in various levels of governance. This also means that it might not be possible to isolate one problem in the ocean from the others, neither in the understanding of the problem nor in the way to address it. In the interconnected and transboundary system like the ocean, fixing one problem in one location may lead to a new problem in other areas.

Ocean Governance as a Transdisciplinary Process

Different thinking about governance is required to deal with the diversity, complexity, dynamics, and the scale issues in the oceans. Holistic and integrated approaches have long been promoted for ocean sustainability.[6] Among them is the 'interactive governance' theory,[7] which focuses specifically on the understanding of interactions both within the systems, i.e., the governing system and the natural and social systems that are being governed, and between them. According to Kooiman, these interactions are not only where the majority of the problems are situated but also where solutions can be found and opportunities created. Through a careful analysis of the systems and the understanding of their interactions, appropriate institutions can be designed, in accord with the underlying principles, values, and images that inform them.

Interactive governance encourages an elevation of the understanding of the problems through governance orders. Illegal fishing, for instance, could be seen as a violation of law and thus can be dealt with by issuing fines and strengthening monitoring, control, and surveillance. Here, illegal fishing problem is treated at the first-order of governance. However, illegal fishing could be a symptom of something more fundamental, including the incongruity between the rules and regulations and the characteristics of the fisheries (second-order), and the lack of agreement about why certain activities are considered illegal (meta-order). In effect, interactive governance requires a 'transdisciplinary' process of problem identification and of creative solution-making, one that relies on diverse expertise and knowledge from natural, social, and political scientists, among others, as well as from practitioners, resource users, and community stakeholders in an 'open' transdisciplinary process.[8]

6 See, e.g., A. Charles, *Sustainable Fishery Systems* (Oxford: Wiley-Blackwell, 2001).

7 J. Kooiman, *Governing as Governance* (London: Sage, 2003).

8 V.A. Brown et al., "Towards a Just and Sustainable Future," in *Tackling Wicked Problems: Through the Transdisciplinary Imagination* (eds.), V.A. Brown, J.A. Harris and J.Y. Russell (London & Washington, DC, Earthscan, 2010), 3–15.

The main differences between transdisciplinary approach and others like multidisciplinary and interdisciplinary approaches are the process and the expectation. Similar to multidisciplinarity, a transdisciplinary approach is a team-based effort. A transdisciplinary process goes beyond what a group of researchers from various disciplines do when working in a multidisciplinary project. The focus of a transdisciplinary approach is the deliberative and concerted effort in understanding and identifying what the problems are, in the exploration about what the possible pathways may be, and in the development, and, in some cases, the co-implementation, of agreed-upon solutions or ways forward. Scientists and other stakeholders in the open transdisciplinary practice are expected to work closely in a collaborative manner, contributing their expertise to the understanding of the problem, and iteratively building on each other's knowledge and ideas in a respectful and considered manner. Through that process, they will be able to reveal certain aspects of the problems that they do not see on their own, broaden their perspectives about the issues, and together come up with ideas and innovation that they would not have done otherwise. Thus, unlike interdisciplinarity, one should not expect to see a transdisciplinary researcher working alone on a problem. This also implies that there is no expectation that researchers involved in a transdisciplinary project need to have multiple skillsets the way interdisciplinary scientists do. Knowledge integration is not necessarily the aim. Instead, the co-creation of knowledge and co-learning is expected. While researchers in the transdisciplinary team will eventually gain new knowledge and additional skillsets, the most important contribution to the process is still their own expertise and experience.

Because of the wicked problems in ocean governance, and considering that decisions about the oceans have different consequences for stakeholders, a transdisciplinary process is required to understand the ocean natural and social systems and their interactions, assess the capability of the governing system in dealing with ocean issues, and determine the overall level of governability. The same process follows in framing the questions and in the exploration of the policy options and governance solutions to address them.

Transdisciplinarity as a 'Slow' Science

Given the above, transdisciplinary process cannot be anything but slow. Similar to the tenet of slow movement,[9] building of a transdisciplinary research

9 Including 'slow fish' as part of 'slow food' movement or 'slow fish for sustainability', see R. Chuenpagdee and D. Pauly, "Slow Fish: Creating New Metaphors for Sustainability," in

team and the production of a transdisciplinary outcome requires engagement, commitment, and perseverance. The making of the book *Fish for Life* is a good example of such an effort.[10] Even though it is an edited volume, the contributors engaged in an intense process of deliberation and negotiation in the writing of all chapters. Contributors were academics from a broad range of disciplines, from sociology, anthropology, political science, economics, philosophy to biology and ecology. Interdisciplinary scientists and practitioners were also part of the team. Many meetings were held throughout the five-year project period, which enabled the team to co-develop the content of the book and collaborate in the writing of the chapters. An internal review process was used as a mechanism to foster cross-fertilization, streamline concepts, and standardize language.

Fish for Life is one of the first volumes that applies the interactive governance perspective to examine fisheries systems. Except for the senior editor, Professor Jan Kooiman, all authors were new to interactive governance, and thus went together through a long journey of dissecting the theory and the philosophy behind it. The book took much longer to produce than if it were written by a small number of authors. This slow process lead to a unique book that went 'between, across and beyond' disciplines in offering a novel way of looking at fisheries and a new approach to govern them. Wicked ocean governance problems can be addressed through theoretical and conceptual frameworks that include interactive governance and transdisciplinary processes to assess the level of overall governability.

Overcoming Factors of Unsustainability and Overexploitation in Fisheries: Selected Papers on Issues and Approaches. International Workshop on the Implementation of International Fisheries Instruments and Factors of Unsustainability and Overexploitation in Fisheries, Siem Reap, Cambodia, 13–16 September 2004 (eds.) J. Swan and D. Gréboval, FAO Fisheries Report No. 782 (Rome: FAO, 2005), 69–82.

10 J. Kooiman et al. (eds.), *Fish for Life: Interactive Governance for Fisheries* (Amsterdam: University of Amsterdam Press, 2005).

Meaningful Partnerships in Meaningful Ocean Governance

Anthony Charles
School of the Environment and School of Business,
Saint Mary's University, Halifax, Nova Scotia, Canada

Introduction

I once thought of ocean governance as primarily a matter of institutions and processes. The ultimate description of ocean governance within such a perspective is through decision-making flowcharts and organizational charts. But if ocean governance is treated as a 'functional' matter of institutions and processes, it may be missing the key underlying ingredient. *Values*. Values tell us what kind of ocean, and what kind of ocean users, to be favoring. Values drive our individual and community choices. It is odd, then, that governance often focuses on institutions and processes, without *explicit* attention to the crucial underlying values. In reality, however, in such cases, governance still reflects *implicit* values—but not necessarily values that reflect what is truly desired. Surely, there is a strong case, then, for values being explicit, and accordingly, receiving greater attention in ocean governance.

There is a parallel with partnerships. I once thought of partnerships as largely a 'functional' vehicle of governance, within the context of institutions and processes. But underlying every partnership is the matter of who chooses the partners. If the choice is made by government, then that determines who has a seat at the governance table. A values-based view requires looking carefully at whether the choice of participants reflects underlying values. For example, does the partnership involve a diversity of ocean users and coastal communities, or does government choose as partners a few large companies controlling access to marine resources? These alternatives would reflect very different values.

Co-Management Partnerships

While ocean governance conventionally took place in a top-down manner, the more modern approach focuses on participatory decision-making, through co-management ('co-operative' or participatory management) that brings stakeholders into the institutions and the processes of decision-making. Co-management invariably involves a partnership of some form, with a certain set of ocean users or other stakeholders—those with 'management rights'[1] and thus entitled to be engaged in participatory decision-making on ocean management, whether sectoral (e.g., fisheries) management or multi-sectoral (as in multi-stakeholder integrated management).

The rationale for such co-management partnerships is typically based on several arguments:[2] (1) better decisions come from as full a knowledge base as possible, and incorporating the experience of those regularly using the ocean and its resources, (2) management decisions are better supported, and complied with, when those being managed have helped to design the rules and regulations, and (3) such participatory practices match the principles of good governance, which have been widely adopted internationally. These three arguments in favor of co-management partnerships have a strong logic to them, reflecting the achievement of 'functional' goals: better decisions, better compliance, and better governance.

I once thought that, based on those persuasive arguments, co-management was invariably a good thing, and that the corresponding partnerships must also be positive. But that view was naïve in neglecting the key matter of values. A lack of attention to values can manifest itself, notably, in a co-management system developed without considering who exactly is involved in the decision-making. For example, in Canada, some government choices on co-management partnerships in fisheries reflected preferences for a top-down approach, and are also present in the same government's moves to shift resource access away from small-scale ocean users to fewer, bigger players. It is not clear that these actions actually reflected societal values.

Concern over the values underlying who holds the power, who gets ocean access, and who is involved in management decision-making arise with governments engaging in partnerships all along the co-management spectrum[3]—from science and research, to policy and planning, to managing ocean use (i.e., co-management), to enforcement and compliance. Thus, values underlie

1 A. Charles, "Rights-based Fisheries Management: The Role of Use Rights in Managing Access and Harvesting," in *A Fishery Manager's Guidebook*, eds., K.L. Cochrane and S.M. Garcia (Oxford: Wiley-Blackwell, 2009), 253–282.

2 A. Charles, *Sustainable Fishery Systems* (Oxford: Wiley-Blackwell, 2001); J. Kearney et al., "The Role of Participatory Governance and Community-based Management in Integrated Coastal and Ocean Management in Canada," *Coastal Management* 35, no. 1 (2007): 79–104.

3 M. Puley, "Dissecting Co-management: An Examination of Fishermen Involvement in Fisheries Management in Nova Scotia, Canada," Thesis, Master of Environmental Studies, Dalhousie University, Halifax, Nova Scotia, Canada (2017).

which partners are chosen for co-operative research projects, for management of fishing decisions, or for policy development. Partnerships can be challenging in all these situations, but increasingly so, the more they involve significant decision-making, the greater the number of stakeholders affected, and thus the more sensitive is the interaction of values and the partnerships themselves.

Science Partnerships

In the case of science, partnerships increasingly involve government scientists working with fishers, on board their fishing vessels, or with other ocean use sectors. The partnership, in such cases, may be merely the ocean users providing scientists with access to the ocean, or it may involve a true participatory approach in which stakeholders carry out data collection themselves, and perhaps even engage in analysis of the data.

Such activities have a positive aura to them, given their participatory nature, and the contrast with past top-down approaches.[4] However, values arise in terms of which stakeholders can engage with government in research and science. For example, one factor influencing the Canadian cod fishery collapse[5] was a disconnect between small-scale fishers and government scientists. While scientists partnered with the large-scale fishing fleet and used its data, the corresponding knowledge in the small-scale sector received much less attention.[6] Following the cod collapse, a new partnership, the Fishermen and Scientists Research Society, sought to rectify this imbalance, by engaging small-scale fishers and scientists directly. That approach is also to be found in many other locations, now reflecting an important values-based scientific partnership model.

Research Partnerships

Knowledge-focused partnerships with ocean-use stakeholders also arise outside government, notably with academic researchers. This shifts away from the conventional role of the academic (collect data, analyze, publish results,

4 A.C. Finlayson, *Fishing for Truth: A Sociological Analysis of Northern Cod Stock Assessments from 1977–1990* (St. John's: Institute of Social and Economic Research Books, 1994).

5 A. Charles, "The Atlantic Canadian Groundfishery: Roots of a Collapse," *Dalhousie Law Journal* 18 (1995): 65–83.

6 Finlayson, *supra* note 4, 176.

typically in a professional journal) with stakeholders not engaged directly in the process (apart from being a source for the academic's data). That approach, which led to literally thousands of journal articles, has been much criticized by communities and ocean user groups, who are frequently asked by researchers for access to their territory, resources, and vessels, but who often never see the research results.

The old model also misses the insights and knowledge that come through participatory research, which brings together full-time researchers with ocean users, to jointly address key knowledge needs.[7] A fully participatory approach requires involvement in the multiple steps of the research process: with ocean users not only 'helping' with data collection, but also being involved in designing the research in the first place, and then in analyzing and interpreting the results. An ongoing challenge here is that the goals of the research can be quite diverse. While some in the partnership may aim for a professional journal article, the goal for others may be quite different—often more focused on meeting tangible social and economic needs (e.g., better knowledge of where a resource is located, or its sustainability, or better means to ensure local livelihoods and cultural aims).

NGO Partnerships

Around the world, non-governmental organizations (NGOs) often play a major role in environmental, social and/or economic aspects, whether locally, nationally, regionally, or globally. It seems that the more global the NGO, the greater tends to be the focus on just one of the three pillars of sustainable development—environmental, social, or economic. Thus, for example, some global ocean-focused NGOs focus solely on environmental aspects, particularly neglecting social considerations (contrary to wide acceptance that these are integral to sustainable development). On the other hand, locally-oriented NGOs often seem to better understand the crucial linkages of social, economic, and environmental concerns. This tendency seems to be true in both developing and more developed countries.

NGOs may partner with governments and multilateral global institutions (e.g., the Food and Agriculture Organization of the United Nations, FAO) or more locally, with ocean user groups and coastal communities. In all these cases, and as with other partnerships, values are key to NGO partnerships.

7 M. Wiber et al., "Enhancing Community Empowerment Through Participatory Fisheries Research," *Marine Policy* 33 (2009): 172–179.

In particular, each NGO brings its own values, notably reflected in its choices of how and where to spend its funds, and the priorities it is advocating. No NGO is merely a neutral funding body. Thus the crucial question facing a coastal community or an ocean user group, or indeed a government or a UN agency, is whether its own values and priorities are compatible with those of the NGO. That will not always be the case.

National and International Partnerships

At a larger scale, partnerships can be important both within a nation and at the international level. As with all other partnerships, these types are rooted in values, whether explicit or implicit. Two examples will be used here to illustrate this.

Following the passing of Canada's *Oceans Act*,[8] the government recognized a need to draw on expertise across the country in ocean and coastal management, as well as in social sciences connected with ocean use and sustainability. The government funded a new academic-based cross-country entity, the Ocean Management Research Network (OMRN), to bring together all those with an interest in research and knowledge on ocean use and management. This included not only academics, but also government staff, Indigenous organizations, industry bodies, coastal community organizations, NGOs, and many others. The OMRN operated throughout the decade 2000–2010, with its membership growing to over 800 participants. As a national-level partnership to support ocean governance, the OMRN generated many knowledge syntheses[9] and considerable networking and multi-sectoral interaction. The values underlying this initiative, though quite basic—a shared sense of the importance of oceans to that country—led to high levels of contributed energy and time, maximizing outcomes achieved from fairly modest funding.

An international example of a successful partnership arose from a growing recognition of the importance of small-scale fisheries globally, and a corresponding recognition of a lack of a formal international instrument to support those fisheries. Global fishery associations—notably the World Forum of Fisher Peoples, the World Forum of Fish Harvesters and Fish Workers, and the International Collective in Support of Fishworkers—collaborated with a wide range of civil society organizations to move an international governance

8 *Oceans Act*, S.C. 1996, c. 31.

9 A. Charles et al., "Canada's Coasts and Oceans: Identifying the Issues," Discussion Paper (Ottawa: Ocean Management Research Network, 2005).

agenda forward. The partnership was supported by the FAO and by many national governments. There was a very impressive display of consensus on core people-centered values within the process, rooted in human rights perspectives. Ultimately, in 2014, nations formally agreed to the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication.[10] The momentum of the partnership has continued since then, in implementing the values, goals, and approaches in the Guidelines.

Conclusion

Meaningful partnerships are inspiring. They can also be very effective in achieving key goals. But being inspiring is more important, because an inspiring partnership leads to a kind of enduring, fundamental effectiveness that transcends the 'functional' effectiveness we tend to focus on first. The reason is rooted in values. An inspiring partnership generates energy, momentum, good will—which brings along other people and other organizations, with shared values. So fundamentally, partnerships should be meaningful, inspiring, and rooted in values. The effectiveness follows as a result, leading in turn to meaningful ocean governance.

10 Food and Agriculture Organization of the United Nations (FAO), *Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication* (Rome: FAO, 2015).

Ethical Dimensions of Ocean Governance

Eduardo Marone
Center for Marine Studies, UFPR—IOI-TC-LAC—IAPG, Paraná, Brazil

Luis Marone
Facultad de Ciencias Exactas y Naturales, UN Cuyo—Ecodes
IADIZA—CONICET, Mendoza, Argentina

Some Initial Ideas

Exploring the ethical dimensions of ocean governance represents a challenge that has to be addressed with care, especially for those like us, who are not professional philosophers. When Elisabeth Mann Borgese, Ambassador Arvid Pardo, and others used the concept of 'common heritage of mankind'[1] to advocate for the approval of the United Nations Convention on the Law of the Sea[2] (UNCLOS), the ethical background was not explicitly analyzed in detail although it is evident that the core of the concept is absolutely linked with moral philosophy. We briefly examine the core concept of the common heritage in relation to the general understanding of ethics.

According to UNESCO,

> Governance has been defined to refer to structures and processes that are designed to ensure accountability, transparency, responsiveness, rule of law, stability, equity and inclusiveness, empowerment, and broad-based participation. Governance also represents the norms, values and rules of the game through which public affairs are managed in a manner that is transparent, participatory, inclusive and responsive. Governance therefore can be subtle and may not be easily observable. In a broad sense, governance is about the culture and institutional environment in which citizens and stakeholders interact among themselves and participate in public affairs.[3]

1 E.M. Borgese, *Pacem in Maribus* (New York: Dodd, Mead & Company, 1973).
2 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3.
3 "Concept of Governance," UNESCO, Education, http://www.unesco.org/new/en/education/themes/strengthening-education-systems/quality-framework/technical-notes/concept-of-governance/, last accessed 19 February 2018.

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It is the way the rules, norms and actions are structured, sustained, regulated and held accountable to keep a system going in a good shape and for all. But underlying the concepts of 'good shape and for all' is a notion of what is ethical, for what benefit, and for whom?

Ethics is a branch of philosophy having as many definitions as there are philosophers. It deals with the question of what is good and bad and to define our moral duties and obligations. Subtle differences exist between moral behavior, which is primarily about making the correct choices, and ethical conduct, which is about the proper reasoning for decision-making. The latter is what interests us in regards to the important concept of the 'common heritage of mankind'.

Behind the Common Heritage of Mankind Concept

The ancient approach of 'virtue ethics' focuses on the virtuosity of the acting person. A good action has to be judged by the intention not the consequence, as in the Good Samaritan principle for example.[4] In this way, recognized altruistic people, such as Elisabeth Mann Borgese, Ambassador Arvid Pardo, and many others promoting UNCLOS, acted on the grounds of classical ethical behavior.

Following from Aristotle's thought, Spinoza proposed that human beings are part of nature and thus derive happiness from other living organisms and the systems that support them.[5] Such thoughts strongly relate to the common heritage of mankind that involves the full ocean system, its living and non-living resources. Hume argues that natural benevolence accounts, in great part, for what he calls the origin of morality, in opposition to utilitarianism.[6] He accepts the need for the rules of justice, which are normative human conventions that promote public utility, because humans are motivated by a variety of passions, both generous and ungenerous. But these rules of justice will promote the necessary framework to benefit most of the people and even all of humankind, in opposition to a selfish utilitarianism. Kant indicated that the moral law is a purely formal principle that commands us to act only on maxims

4 D. Frede, "Plato's Ethics: An Overview," Stanford Encyclopedia of Philosophy Archive (Winter 2016 edition) (last revision 18 July 2013), https://plato.stanford.edu/archives/win2016/entries/plato-ethics/.

5 "Baruch Spinoza," Stanford Encyclopedia of Philosophy (last revision 4 July 2016), https://plato.stanford.edu/entries/spinoza/.

6 David Hume, *An Enquiry Concerning the Principles of Morals* (Stephen Buckle, ed.) (Cambridge: Cambridge University Press, 2007).

that have what he calls lawgiving form.[8] A core concept of Kant's ethics is that a maxim has morally permissible form only if it could be willed as a universal law, i.e. willing to be applicable to all people without contradiction. We can see the common heritage of mankind foreseen in Kant's claim that the expansion of hospitality with regard to "use of the right to the earth's surface which belongs to the human race in common" would "finally bring the human race ever closer to a cosmopolitan constitution."[7] Although he was not the first to propose a global idea of commonality, he was probably one of the most influential philosophers in the pursuit of the greater common good. The Kantian idea is a condition that will be reached by UNCLOS only when it becomes universally accepted.

The phrase 'common heritage of mankind' was first mentioned in an international law-giving form in the preamble of the 1954 Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict.[8] Then, it followed a path to UNCLOS, and into other conventions and rules. The concept follows the mandatory awareness of the results of any actions. It is consistent therefore with consequentialism, which holds that whether an act is morally right depends only on the consequences of the act or of something related to that act.[9] In addition, the explicit words 'for the benefit of future generations', refer us to the Golden Rule: "One should not treat others in ways that one would not like to be treated."[10]

Following Bunge:

> Far from preaching the joyless life, we repeat the slogan *Enjoy life and help live*, and add the following unavoidable platitudes: (*a*) at present most people do not have the means to enjoy life, and many of those who do have them mistake the good life for the ability to buy whatever they fancy; (*b*) unless we alter some of our values and learn to administer wisely our resources, we shall rob our offspring of their inheritance.[11]

7 Immanuel Kant, *To Perpetual Peace: A Philosophical Sketch* (Ted Humphrey, trans.) (Indianapolis: Hackett Publishing, 2003), 16.

8 The Hague, 14 May 1954, 3511 *U.N.T.S.* 216.

9 N. Heinzelmann, G. Ugazio and P.N. Tobler, "Practical Implications of Empirically Studying Moral Decision-making," Frontiers in Neurosciences 6 (2012): 94, doi.org/10.3389/fnins.2012.00094.

10 J. Finnis, "Natural Law Theories," Stanford Encyclopedia of Philosophy (Winter 2016 edition) (last revision 4 November 2015), https://plato.stanford.edu/archives/win2016/entries/natural-law-theories/.

11 M. Bunge, *Treatise on Basic Philosophy. Ethics: The Good and The Right*, Vol. 8 (Dordrecht: Reidel Publishing, Dordrecht, 1989), 361.

Recognizing that individual consciousness does not have the same altruistic or egoistic levels for all personalities, Kohlberg,[12] inspired by Piaget,[13] proposed that moral development has different levels, and postulated six stages of human moral development (Table 1). Kohlberg's theory holds that moral reasoning, the basis for ethical behavior, has six identifiable developmental stages, each of them more able to respond to ethical dilemmas than its predecessors.

Before UNCLOS, governance rules on oceans mostly fitted stages 1 to 3. At the pre-Convention levels, the main social drivers were the silent acceptance of the rules imposed by the dominant powers. Stage 3 was mostly the case of conformity with the governing *status quo*, maintaining some relationships convenient to both, the ones holding the power and those conforming to that power. The mere proposal of UNCLOS in support of ocean governance cannot be just classified as a Conventional level 4 but, as established as a social contract, it matches the Post-Conventional level 5.

At stage 6, action is an aim in itself; the individual acts because it is right and not to avoid punishment or to comply with social laws. He/she acts in the right way because it is mainly in his/her own interest. Although it is not easy to find individuals always acting according to the highest ethical stage, which may be considered somewhat utopian, we can consider this highest stage as a spur to push ourselves in that direction.

Ideally, any individual, organization, or nation must climb the six stages to the top, in order to elevate the ethical quality of their behavior. Most people rely on stage 5, assuming that following a given social contract, for example, a professional code of ethics/conduct, would be enough; others remain at stage 4, following the rules because they are in force, not by any deep conviction. The ultimate Stage 6 fits individuals with impeccable ethical credentials, because of their deep conviction and consciousness that their ethical values are the right ones.

Contemporarily to the quixotic fight of Borgese, Pardo and others advocating the need for UNCLOS in the mid-1960s, an article of great impact was published in the journal *Science* in 1968 by the ecologist Hardin, entitled "The Tragedy of the Commons."[14] He was inspired by the 1833 work of Lloyd, which mentioned a hypothetical dilemma of over-use of a common resource.[15] Hardin

12 L. Kohlberg, *Essays in Moral Development, Volumes 1: The Philosophy of Moral Development* (San Francisco: Harper and Row, 1981).

13 H.E. Gruber and J.J. Vonèche, eds., *The Essential Piaget* (New York: Basic Books, 1964).

14 G. Hardin, "The Tragedy of the Commons," *Science* 162, no. 3859 (1968): 1243–1248, doi.org/10.1126/science.162.3859.1243.

15 W.F. Lloyd, *Two Lectures on the Checks to Population* (Oxford: Oxford University Press, 1833), http://philosophy.lander.edu/intro/articles/lloyd_commons.pdf.

TABLE 1 Kohlberg's levels and stages of moral adequacy (adapted from Kohlberg[a])

Level	Stage	Social driver
Pre-Conventional (actions are judged by their direct consequences)	1	Obedience and punishment Blind egoism
	2	Self-interest orientation Individualism, Instrumental egoism
Conventional (actions are judged by comparing them to society's views and expectations)	3	Interpersonal accord and conformity Others approval, Social relationships
	4	Law and order Blind compliance, Social systems
Post-Conventional (individuals' taking precedence over society's principles; inclusion of basic human rights such as life, liberty, and justice)	5	Social contract orientation Agrees on common regulations Universal ethical principles
	6	Principled self-conscience and mutual respect

[a] Kohlberg, *supra* note 12.

extended the concept and pointed out the problem of individuals acting rationally in self-interest; if all people in a group used common resources for their own benefit and with no concern for others, all resources would still, sooner or later, be depleted. Hardin argued against relying on people's conscience or the potential benevolence of people as a means of governing the commons. He suggested that this favors selfish individuals (egoistic utilitarianism), over those who are more altruistic, thus promoting—explicitly or implicitly—the development of some kind of social contract or rules of justice. UNCLOS follows Hardin's warning.

The Application of Scientific Knowledge Assumes Ethical Correctness

Kant proposed that the human understanding is the source of the general laws of nature and that human reason gives itself the moral law.[16] This point of view is controversial.

16 Kant, *supra* note 7, 64.

Scientific knowledge, although not perfect, portrays how nature works, and it builds and organizes our rational understanding in the form of testable explanations, giving us logical tools to make predictions. Thus, if we have to reap benefits from nature in the form of environmental products and services, it is imperative to know how the system works. As a natural complex system, the ocean challenges society from the scientific point of view, not just in order to understand its functioning, but also to set the proper rules to benefit from its many services. Thus, proper governance has to be based on the best scientific available knowledge. However, scientific knowledge is equally necessary for an egoistic exploitation of the oceans as well as for an altruistic one and, if we agree that the tragedy of the commons has to be avoided, the altruistic approach has to be the rule. Thus, science is necessary, but not sufficient. Ethics is the essential tool for the conduct of decision-making, targeting the greater good, supported by the highest standards of moral behavior, rational thinking, and the best scientific knowledge. Proper moral behavior is necessary to make the correct choices, while ethical conduct helps the proper reasoning for decision-making, differentiating between what we have the right to do and what is the right thing to do. This is the key question for responsible ocean governance.

Both, science and ethics are therefore necessary conditions for good ocean governance. As asserted by Simeroth: "Science brings society to the next level, while ethics keeps us there."[17] Nothing expresses it better than the concepts presented by Pardo in his speech before the United Nations in 1967, as quoted by Elisabeth: "the world's oceans and seabeds should become the common heritage of mankind, and, in the interest of present and future generations, should be fostered and administered exclusively to peaceful ends."[18] To do so, not just the well-being of humankind has to be pursued, but also the wealth of all life forms and the systems that sustain them in good shape, in order to give future generations, and us, the opportunity to "enjoy life and help live."[19]

17 P. Mayer, *Bankbook Bodies: The Billion Dollar Business with Organ Trade—The Development of International Legal Measures and the Effectiveness in Curtailing the Black Market, Saar Blueprints*, Saar Blueprints, 12/2016 EN, http://jean-monnet-saar.eu/wp-content/uploads/2013/12/Bankbook-Bodies_FINAL.pdf, 44.

18 Borgese, *supra* note 1.

19 Bunge, *supra* note 11.

Participatory Ocean Governance in Practice

Daniel E. Lane
Telfer School of Management, University of Ottawa, Ontario, Canada

Introduction

Oceans are comprised of finite marine resources available to the global community. Each of us is not responsible for the oceans, yet the oceans are a collective responsibility of all of us as individuals. We recognize these truisms, yet the execution of joint stewardship responsibilities on oceans is fundamentally challenging and largely insufficient. This essay addresses the characteristics of ocean governance and posits a reduced role of governments, and an enhanced decentralized and authoritative participation of ocean stakeholders and the public toward realizing shared responsibilities for ocean sustainability.

The Evolution of Ocean Governance

Elisabeth Mann Borgese's passion and expertise were critical to modern ocean governance. Mann Borgese, the only female founding member of the Club of Rome (since 1968), encouraged world leaders to improve our understanding of the oceans and management of marine resources for the betterment of humankind.[1]

In its report, *Our Common Future*, the Brundtland Commission reiterated the urgent call for participation broader than government alone in its mandate for a 'global agenda for change':

> [W]e appeal to "citizens" groups, to nongovernmental organizations, to educational institutions, and to the scientific community… In the final analysis, this is what it amounts to: furthering the common understanding and common spirit of responsibility so clearly needed in a divided world.[2]

1 In the Club of Rome report, *The Oceanic Circle: Governing the Seas as a Global Resource* (United Nations University Press, 1998), Elisabeth Mann Borgese wrote: "the governance of the oceans … is nonhierarchical, participatory, and multidisciplinary, and includes the private sector as well as governments."

2 World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987), xiv–xv.

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In 1992, the United Nations Conference on Environment and Development (UNCED), the Rio Earth Summit, adopted Agenda 21, a comprehensive action plan applied to all areas of human impacts on the environment including the oceans.[3] Agenda 21 argues for (i) revamping prevailing systems of governmental decision-making, (ii) significant changes in existing institutional structures, (iii) new forms of dialogue for achieving better integration among national and local governments, industry, science, environmental groups and the public in a participatory process, and (iv) improving education and technical training through interdisciplinary approaches. Agenda 21 was reaffirmed in the 2012 Rio+20 UN Conference on Sustainable Development, which recognized the 'full participation of civil society' to "renew our commitment to sustainable development and to ensuring the promotion of an economically, socially and environmentally sustainable future for our planet and for present and future generations."[4]

Participation by all groups on assessing environmental ocean impacts and in the decision-making process is seen as a fundamental and significant characteristic of ocean governance. The assignment of global responsibility for the oceans through institutions that would enable participatory ocean governance is clearly recognized as the means to that desired end.

Ocean Governance in Canada

Ocean governance initiatives in Canada have sought to increase communication between ocean stakeholders to facilitate a more participatory decision-making process. Fisheries and Oceans Canada, the ministry responsible for Canadian freshwater and marine habitats, delivers ocean governance at the federal level under the *Fisheries Act*[5] and the *Oceans Act*.[6] Under the *Fisheries Act*, the Minister of Fisheries and Oceans has full discretionary power in all matters pertaining to the conservation of marine resources. The Minister's decisions on fisheries management and habitat measures, sector allocation and access issues, and how managers will implement integrated management plans, and monitor and enforce regulatory measures are made on the advice of the Minister's Science Branch. The *Oceans Act* directs the Science Branch to provide scientific advice, including collecting data, basic and applied research,

3 Available at https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf.
4 United Nations General Assembly, Res. 66/288, "The future we want" (2012), para. 1.
5 *Fisheries Act*, R.S.C. 1985, c. F-14.
6 *Oceans Act*, S.C. 1996, c. 31.

surveying, and publication of maps. Canada's Ocean Strategy provides the policy and operational framework for delivering 'integrated ocean management'.[7] In contrast to the regulatory function of the *Fisheries Act*, the *Oceans Act* is recognized as an enabling act that seeks to assemble Canadians to speak up, and to raise public awareness and improve our understanding of the country's vast ocean environment.

Since the implementation of United Nations Convention on the Law of the Sea and the establishment of Canada's exclusive economic zone (EEZ) after 1977, Fisheries and Oceans Canada has enhanced its scientific capabilities and management resources under the regulatory powers of the *Fisheries Act*. During the ensuing decades, however, the Ministry has been subject to (i) ongoing criticism of top-down regulatory control or 'paternalism', (ii) an evident lack of transparency of decision-making with respect to the inclusion of its clients and stakeholders in the ocean sector, commercial fisheries, and coastal communities, and (iii) increasingly difficult management decisions associated with conflicting interests such as the poorly defined requirement for First Nations to a moderate livelihood and the oil or the gas industry's desire to access coastal waters.

In response, the Ministry has attempted to apply integrated coastal zone management;[8] put in place joint co-management agreements among commercial fisheries and within larger land claim agreements with Aboriginal peoples;[9] created consultative bodies, such as the Fisheries Resource Conservation Council;[10] and established large ocean management areas (LOMAs) and associated integrated ocean management plans under the enabling terms of the *Oceans Act*. However, in general, these initiatives have failed to implement participatory decision-making. This is primarily due to degrading marine resources, declining fish stocks, and changing ecosystem conditions (recruitment, climate, and species interactions) and legislative difficulties stemming from the confounding co-existence of regulatory responsibilities under the *Fisheries Act* and the enabling perspectives of the *Oceans Act*.

The Ministry's historical regulatory authority, coupled with its broader intention to enable—with participation, but without authority—are conflicting.

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7 Fisheries and Oceans Canada, *2005–2010 Strategic Plan: Our Waters, Our Future* (2008), http://www.dfo-mpo.gc.ca/dfo-mpo/plan-eng.htm.

8 P. Ricketts and L. Hildebrand, "Coastal and Ocean Management in Canada: Progress or Paralysis?" *Coastal Management* 39, no. 1 (2011): 4–19.

9 A. Dale and D. Armitage, "Marine Mammal Co-management in Canada's Arctic: Knowledge Co-production for Learning and Adaptive Capacity," *Marine Policy* 35 (2011): 440–449.

10 D. Lane and R. Stephenson, "Institutional Arrangements for Fisheries: Alternative Structures and Impediments to Change," *Marine Policy* 24, no. 5 (2000): 385–393.

Fisheries and Oceans Canada continues to be characterized by (i) the regulatory authority of the Minister as defined in the *Fisheries Act*; (ii) a lack of co-ordination between science and management and a lack of a systemic approach to dealing with ecosystem problems; (iii) minimal engagement with and feedback to coastal communities and commercial entities; and (iv) a lack of transparency in the decision-making process, which negates participation by the wider public.[11]

The case of the Eastern Scotian Shelf Integrated Management (ESSIM) initiative is illustrative of these issues. ESSIM was a collaborative ocean planning process that was formed under the *Oceans Act* as part of the Eastern Scotian Shelf LOMA.[12] The ESSIM Plan was the product of an extensive collaborative and inclusive planning process from 2004 to 2007 among federal and provincial ocean scientists and managers, and the full spectrum of ocean stakeholders from fisheries, tourism, oil and gas, coastal communities, and environmental non-governmental organizations (ENGOs). The aim of the initiative was to develop a participatory integrated ocean management plan to guide the sustainable use, conservation, and management of the Eastern Scotian Shelf. The ESSIM review concluded that the Plan was never officially endorsed and the Plan's call for action regarding establishing indicators, the evaluation of ocean strategies versus objectives, and the declaration of a mandate for ESSIM, was never confirmed or implemented.[13] Fisheries and Oceans Canada effectively abandoned LOMAs and the concept of integrated ocean management planning following the Ministry's redesign after 2011 and the removal of the 'Oceans' line from the Ministry's organization chart.

Barriers and Solutions to Participatory Ocean Governance

Barriers to implementation of participatory ocean governance typically arise from the historic role of governments supported by outdated, centralized legislation. To deliver participatory ocean governance in practice, governments

11 Office of the Auditor General of Canada, *Report of the Commissioner of the Environment and Sustainable Development* (2011), Chapter 4, A Study of Managing Fisheries for Sustainability, http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201112_04_e_36032.html.

12 Fisheries and Oceans Canada, Oceans and Habitat Branch, *Eastern Scotian Shelf Integrated Management Plan* (Fs23-512/1-2007E, 2007).

13 J. McCuaig and G. Herbert, eds., "Review and Evaluation of the Eastern Scotian Shelf Integrated Management (ESSIM) Initiative," (2013), *Canadian Technical Report of Fisheries and Aquatic Sciences* 3025.

need to become auditors.[14] Government auditors evaluate the achievement of objectives of integrated ocean management plans. The role as auditor provides a level of realistic control for governments managing a distributed system driven by effective and efficient regional users.

One possible approach that has been proposed is the establishment of independent 'regional ecosystem review boards' that would be assigned regional authority mandates to make decisions for licensing, access, and allocation of ocean resources. Boards would receive applications for marine access that would include clearly defined and specified triple bottom line objectives (economic, social, and ecological). Marine users would be obligated to report to the boards and to provide feedback for their renewal on condition of meeting economic, social, and ecological targets as indicated in their contracts. If performance is judged to be insufficient by the board, then the contract is not renewed but made available by tender to new suppliers. The *Fisheries Act* would need to be revised in order to release the authority of the Minister to distribute and devolve responsibility and decision-making power to ecosystem-linked regional ecosystem review boards.

The complexity of ocean governance confounds disciplinary scientific knowledge and regulatory authority upon which many national oceans institutions are built. A pragmatic problem-solving approach to ocean governance via a participatory 'bottom-up' decision-making perspective is required. Decision theory provides a framework through which complex problems can be analyzed: (i) clear problem definition; (ii) strategic planning and objectives setting; (iii) relevant data collection; (iv) interdisciplinary systems modeling; and (v) ongoing validation and monitoring of decisions. The following characteristics define institutional arrangements for participatory ocean governance based on the problem-solving approach:

1. Co-management—define regional partnerships with scientists, managers, communities, and ENGOs having legislated responsibility and authority to act at the ecosystem level.
2. Cost recovery—empowering participants recognizes the value of decision support and administrative functions for access, licensing, data collection, marine resource assessment, monitoring and enforcement. The costs of these activities should be shared by sector participants.
3. Rights-based characteristics—participatory decision-making explicitly assigns rights and privileges to the participants. Allocative rights-based

14 D. Lane, "Canada's Commercial Fisheries: Share the Wealth or Create Prosperity?" *Optimum Online* 42, no. 2 (2012), http://www.optimumonline.ca/article.phtml?id=412&page=1.

systems indicate a shift toward community or private ownership and away from notions of 'common property'.
4. Interdisciplinary systems teams—marine activities must be managed with regard for the whole ecosystem and with the consideration of economic, social, administrative, and ecological impacts of alternative decisions.
5. Management by objectives and continuous improvement—effective, dynamic, multidisciplinary management requires movement toward corporate and institutional targets emerging from ecological, economic, and social objectives.
6. Precautionary approach—in complex marine ecosystems, scientists determine impacts with uncertainty. To adopt a precautious approach acknowledges this and indicates preference for recommendations that are more conservative.
7. Transparency—as a prerequisite for participatory ocean governance, adaptive management approaches require that information is rapidly, freely, and openly accessible to all participants, to the public, and to policy-makers.
8. Mechanisms for conflict response—conflict response mechanisms are necessary to reconcile the diverse interests of participating users.[15]

Elisabeth Mann Borgese's vision to develop a truly participatory system of governing our oceans remains as a work in progress that will be realized when the oceans sector and governments agree to revise their respective roles toward greater shared responsibility.

15 *World Ocean Review, Sustainable Use of Our Oceans—Making Ideas Work*, 4th edition (Hamburg: Maribus, 2015).

First Nations, Oceans Governance and Indigenous Knowledge Systems

Ken Paul
Maliseet First Nation at Tobique, New Brunswick, Canada
(wolastoqew neqotkuk)

Pacem in Maribus 1998

I met Elisabeth Mann Borgese only once, early in my career. It was during the *Pacem in Maribus* International Conference hosted in Halifax in 1998.[1] I was an employee of the Canadian federal Department of Fisheries and Oceans (DFO) and was invited by a colleague to attend the oceans sector papers. I was unaware of the profile of the international event and felt out of place amongst the world elites of the ocean sector at the week-long meeting. The respect that Professor Mann Borgese was given became apparent and I learned about the impact she had made towards oceans governance and its role on humanity.

The other person whom I met was Charlie Labrador, a Mi'kmaq Elder from a small community in Nova Scotia. Once we were introduced, I was able to spend the majority of my three days at the conference as his companion. He was very soft-spoken and humble, similar to many Elders I have met over my lifetime. Being Maliseet from a native community called Tobique in New Brunswick (*wolastoqkew neqotkuk*), he immediately felt comfortable with me; we were able to openly share our thoughts and feelings on this major event filled with scientists, business leaders, diplomats, and others with great responsibilities and influence over how international ocean laws, policies, and regulations were developed and enacted.

The conference chair had approached Charlie the morning of the last day and asked if he would be able to speak at the closing. Charlie was a man who understood the importance of responsibility and given that the conference was being conducted on unceded Mi'kmaq traditional lands, he obliged. I remember him coming to the microphone in front of several hundred delegates. He held an eagle feather as he spoke. Because he was so soft spoken, the crowd had quieted to allow his words to be carried by the microphone. I watched him physically shaking with the feather in hand and heard a slight tremble in his

1 "Pacem in Maribus (PIM) Conferences," International Ocean Institute, accessed 5 November 2017, https://www.ioinst.org/about-1/ioi-story/pacem-in-maribus-pim-conferences/.

 | DOI:10.1163/9789004380271_010

voice. He addressed the crowd by saying, "I've been watching you all this week and listening to your presentations. What I have learned is that you really don't know how to fish." I was shocked when he said this. He went on to say that he is a simple Mi'kmaw man from a small community a couple of hours away and that he has spent his life fishing, hunting, and gathering plants for medicine. He said that the key to his existence was to respect the natural resources and only take what was needed. He followed this with a closing prayer.

The words that he spoke were delivered with humility and respect; they left me with two significant teachings which were pivotal to my young career. The first was in his courage to speak truth to power. Although he was an underemployed Mi'kmaq Elder with a simple vision and message, he brought in the courage of the ancestors to deliver a message to high-powered world leaders in a respectful manner. The second lesson was in the way we had heard about all the challenges of balancing the many interests for ocean resources, such as oil and gas extraction, coastal erosion, threatened fish stocks, and international boundary disputes. His message was simple (as opposed to simplistic, which eliminates relevant factors). His message of only using what you need and respecting the natural world as you would a relative is a deep rooted value amongst all Indigenous tribes that I have encountered over my lifetime. It is clouded by the complexities of economics and governance but it is still a fundamental basis which has guided my thinking throughout my adult life.

The Marshall Decision and the Elders of Unama'ki

On 17 September 1999, the Supreme Court of Canada found Donald Marshall Jr. not guilty of commercial fishing for eels, on the strength of the Peace and Friendship Treaty of 1760.[2] This decision produced a fundamental change in Canadian law with respect to Treaty rights, commercial fisheries, aboriginal relations, and governance. At the time, I was a Hydrographer-in-Charge with the Canadian Hydrographic Service, a branch of DFO Science in Dartmouth, Nova Scotia. I had not paid much attention to court cases and had only a general knowledge of First Nations rights in Canada. My ambition at the time was to become the Dominion Hydrographer in Canada, and I had worked hard to attain knowledge and respect in the field of ocean mapping.

The Marshall decision caught everyone off guard. Both the federal DFO and Atlantic First Nation leadership were unprepared for the breadth of the decision and the chaos that followed. A number of First Nation community

2 *R. v. Marshall* [1999] 3 SCR 456; Case number 26014.

members took to the water to exercise their rights. There was a brutal response from the Canadian authorities, who sent in the Royal Canadian Mounted Police, DFO officers, and eventually the Canadian military to suppress Native fishers. This was a national and international embarrassment for Canada, as pictures and videos were broadcast almost nightly on the national news.

My world had changed significantly as well. I went from being an engineer with the Hydrographic Service to the Indian who works for DFO, literally overnight. I was only one of two Native people working for the federal department at the time, which led to my colleagues challenging me for answers on the Treaty at the water fountain, the cafeteria, or any other common area within the Bedford Institute of Oceanography where my office was located. It became obvious that none of my colleagues had any knowledge of Native peoples in Atlantic Canada and saw me as a target for expressing their frustrations and curiosities. The choice I had was either to educate myself to prepare for questioning that came from many different places or to leave the department. An Elder that I became close to, Gwen Bear, advised me to stay with my current employer saying, "The Creator had put me here for a specific purpose. You will be able to influence and help non-Natives understand our people."

To that end, I had a few supportive colleagues in DFO Science. One thing they asked me to do was to figure out a way to share the DFO science with our communities. I had worked with Charlie Dennis of the Eskasoni Fish and Wildlife Commission in Unama'ki (the Mi'kmaq name for Cape Breton Island) to set up a talking circle with community Elders and senior DFO scientists. There were approximately 15 Elders from the five Unama'ki communities who participated along with 17 DFO scientists. With such a large circle, I knew that we would only have a chance to do one round where each participant, in a clockwise order (to follow the path of the sun, moon and stars across our skies), would be permitted to talk about themselves and anything else that they felt necessary to share. To my surprise, every single scientist identified themselves by their job title and then followed with explaining their area of responsibility. Each Elder, without exception, identified themselves by the community where they were from. A few of them gave their talk in Mi'kmaq without translation into English. I received criticism for not providing translation in a follow-up meeting with my fisheries colleagues. The message I received from Charlie was that the Elders felt the scientists were not speaking to them in language they could understand, so they decided they would do the same. Although this was a first meeting of its kind, it stressed the importance of communication and also reminded me that the stories and knowledge of our Elders are rooted in place.

Fisheries Management and Traditional Knowledge Systems

Following a 20-year career with the Canadian public service, I accepted a position with an Atlantic Chiefs' organization responsible for fisheries policy, research and advocacy. During my three months, I met with senior DFO officials in New Brunswick who were responsible for managing the commercial snow crab (*Chionoecetes opilio*) fishery. Most of our Atlantic First Nations communities have entered into interim agreements to fish under DFO rules, in order to gain access to economic opportunities and to allow Canada and the Atlantic First Nations time to fully implement the 1760 Treaty right to fish commercially.

The DFO regional manager asked me to look at the fisheries management plan for snow crab.[3] It has a number of sections regarding the science assessment, fishing gear type, delineated areas, and numerous other directives on the health of the stock and how it should be fished. In the science assessment area, there was a section called 'Aboriginal Traditional Knowledge' that had an empty box beneath it. The manager asked if I could help the department fill in this box as a way to include First Nations in the fisheries management regime.

I had to decline this offer. While I appreciated that the department was open to including Aboriginal Knowledge into this science assessment, I knew instinctively that there are many pitfalls to going down this path. If there were holes in the information, there could be legal claims by Canada that First Nations had no claim to ocean resources. Also, contributing to federal management plans without legal oversight could be misconstrued as endorsement. However, this also forced me to think deeply about what people are seeking when they talk about Aboriginal Traditional Knowledge.

Traditional Knowledge and Oceans Governance

The idea of traditional knowledge brings out the image of respectful learning from Elders. Our Elders are indeed our knowledge keepers and are amongst our most respected persons in Mi'kmaq, Maliseet, and Passamaquoddy society. It is understandable that many policy-makers and Western scientists are enamored with the idea of gaining deep Elder knowledge to enhance their own understanding. It is also envisioned that this would be an enriching interaction,

3 "Integrated Fisheries Management Plan: Snow Crab in the Southern Gulf of Saint Lawrence," Fisheries and Oceans Canada, last modified September 2014, http://www.glf.dfo-mpo.gc.ca/Gulf/FAM/IMFP/2014-Snow-Crab-Gulf-Region#2.

as Elders are viewed by mainstream society to be wise, soft-spoken individuals with a link to a more natural and ancient wisdom.

While this may be true in many cases, there is little appreciation for the process of traditional knowledge. There is an emphasis in Western society to value knowledge over other attributes, and that attaining knowledge is an objective pursuit. However, Aboriginal (or Indigenous) Traditional Knowledge is something attained through a process. It takes a lifetime of observation and spending time on the land to understand how our plant and animal relatives interact with us and each other. Observing weather patterns and landscapes allows for planning for individual and community activities. Additionally, First Nations spirituality comes from having ceremonies to honor the Earth and the ancestors and allows for a deepened connection to the land.

Albert Marshall and Murdena Marshall are two Mi'kmaq Elders from Eskasoni, located in Unama'ki (Cape Breton Island). They have forwarded the concept of 'two-eyed seeking' which pays respect to both Mi'kmaw Traditional Knowledge and Western science as two ways of knowing.[4] By bringing both knowledge systems together, one will arrive at the best possible science. This concept elevates traditional knowledge of the natural world as a vital system of learning, independent of a Western scientific (deductive, inductive) methodology, while simultaneously acknowledging that the two approaches could and should work together.

When acknowledged as a knowledge 'system', traditional knowledge must then be supported with the modern tools necessary to gathering and sharing information for learning and interpretation. Because the acquisition and sharing of traditional knowledge is a process, First Nations are now training and investing in the latest technologies such as geographic information systems (GIS) databases, video equipment, social media, scientific laboratories, satellite imagery and drones, and any number of new innovations. The Atlantic First Nations have been able to bridge the gap, keeping traditional approaches to knowing, while utilizing Western science and tools to understand traditional lands and resources in order to help all peoples living in our territories.

Another important understanding is embedded in traditional values within the process of acquiring and sharing traditional knowledge. I have concluded that the reason why I had an immediate negative reaction to the invitation to

4 Advisory Panel for the Review of Federal Support for Fundamental Science, *Investing in Canada's Future: Strengthening the Foundations of Canadian Research* (Government of Canada, 2017), 98–99, http://www.sciencereview.ca/eic/site/059.nsf/vwapj/ScienceReview_April2017-rv.pdf/$file/ScienceReview_April2017-rv.pdf.

fill in the empty box in the snow crab management plan was that it would have been irresponsible to gather information that could have been used out of context. Instead, traditional knowledge systems would be better understood if First Nations were able to infuse traditional values throughout the entire fisheries management plan. This would be applicable to the basics of any plan by asking questions such as: What are we fishing? How are we doing this sustainably? When and where do we fish? Who is allowed to fish and who is receiving it for the food and monetary benefits? Which other species are affected by the fishing activity? These traditional values relate to governance. Again, through my understanding from the time I spent with Elders, I believe deeply that if First Nations were given any voice in the management of ocean resources, there would be much healthier fish stocks and less destructive impacts on the ocean from human activity.

Oceans Governance and Atlantic First Nations

While in Canada we have a number of historic treaties between First Nations and the Crown that allowed for the peaceful coexistence of visitors to our lands and waters, Mi'kmaq, Maliseet, and Passamaquoddy peoples have not been given any voice or position of influence in Canadian or international governance. Our treaties have enshrined the right to fish, but Canada has not acknowledged inherent Indigenous rights to self-governance or the management of ocean resources. As the negotiations between Atlantic First Nations and the Crown continue to try to determine how to bring a modern interpretation to treaties from the 1700s, many of our First Nations Chiefs are asserting themselves or working towards having jurisdiction over natural resources, including those in the oceans. These approaches will include using all the tools available in modern Western society but also will embrace and be rooted in traditional knowledge and traditional values.

Ideally, we will see openness by Canada and Canadians to allow First Nations to co-govern ocean resources. Up to now, any gains made by First Nations in Canada have been achieved through the court systems. Co-governance will demonstrate action towards Canada's commitment to reconciliation and a true Nation-to-Nation relationship.[5] Regardless, the demographics of First Nations (a growing population), the awareness shared by social media, and

5 "Reconciliation," Department of Indigenous and Northern Affairs Canada, last modified February 2017, https://www.aadnc-aandc.gc.ca/eng/1400782178444/1400782270488.

the strength of our communities will see a dramatic change in the capabilities, ambitions, and performance of our next generation of First Nations Elders and leaders. This hope gives me optimism that Aboriginal (or Indigenous) Traditional Knowledge will continue to adapt and contribute to resolving the challenges facing our relationship with the oceans.

Non-Governmental Organization Roles in Shaping Future Ocean Governance and Management

Alexandra Vance and Robert Rangeley
Oceana Canada, Halifax, Nova Scotia, Canada

Introduction

The future of the ocean rests on the effectiveness of good governance, holistic management, and most importantly, urgent and sustained action to address complex marine issues. Conservation practitioners and resource managers struggle to keep pace with the growing threats to marine ecosystems, such as climate change, ocean acidification, overfishing, habitat loss, and marine plastics. In response to these ecological crises and insufficient management actions, the number and diversity (as well as total memberships and revenues) of environmental non-governmental organizations (ENGOs) focused on ocean health has grown rapidly since the beginning of the environmental movement in the early 1960s.[1] Arguably more active than ever before, ENGOs have expanded their participation in ocean governance processes in recent decades, alongside many other key rights-holders (i.e., Indigenous communities) and stakeholders (e.g., industry, coastal communities, various levels of government), and have adopted a greater breadth of roles and responsibilities.[2] These roles may include influencing policy development and implementation, promoting community engagement and marine stewardship, and directly or indirectly contributing to scientific knowledge acquisition and dissemination.[3] An important consideration is how ENGOs will respond to the

1 B. Straughan and T. Pollak, *The Broader Movement: Nonprofit Environmental and Conservation Organizations, 1989–2005* (Washington, DC: The Urban Institute, 2008), 1, https://www.urban.org/sites/default/files/publication/32186/411797-The-Broader-Movement-Nonprofit-Environmental-and-Conservation-Organizations---.PDF.

2 Straughan and Pollak, id.; S.D. Fuller et al., "Informing and Improving Fisheries Management Outcomes: An Atlantic Canadian Large Pelagics Case Study by the Ecology Action Centre," in *Science, Information, and Policy Interface for Effective Coastal and Ocean Management*, eds., B.H. MacDonald et al. (Boca Raton: CRC Press, 2016), 419–443, doi.org/10.1201/b21483-24.

3 R. Blasiak et al., "The Role of NGOs in Negotiating the Use of Biodiversity in Marine Areas Beyond National Jurisdiction," *Marine Policy* 81 (2017), 1–8, doi.org/10.1016/j.marpol.2017.03.004; S. Oberthür et al., *Participation of Non-Governmental Organisations in International Environmental Governance*: *Legal Basis and Practical Experience* (Berlin: Ecoscript, 2013), 20, https://www.ecologic.eu/sites/files/publication/2013/ngo_participation_brief.pdf.

increasingly complex challenges in coastal and ocean environments and how to best achieve meaningful conservation throughout the science-policy-public interface. Throughout this essay, we will highlight some key ENGO roles, responsibilities, and achievements in shaping the future of ocean governance, by drawing on several examples and recent experiences in Canada. The discussion is not intended as a comprehensive list.

Key Management Approaches

Increasingly complex marine conservation and management challenges have necessitated broader engagement from a range of stakeholders, disciplines, and experiences. ENGOs catalyze participation by convening a diversity of expertise and promoting the development of professional skill sets.[4] Rather than adopting a single species or sectoral approach, as is often the case in fisheries, ENGOs have emphasized a more holistic and ecosystem-based management approach through marine spatial planning (MSP) and integrated coastal and ocean management (ICOM).[5] Together, MSP and ICOM are intended to address the many competing uses and actors in the ocean sector, which requires engaging multiple disciplines to sustainably manage a marine ecosystem and its resources.[6] Given the number and sheer complexity of marine issues today, these interdisciplinary approaches will continue to gain momentum and relevance in the future of ocean governance.

Training Marine Managers

Some ENGOs support academic programs and research projects that are aligned with the principles of ICOM, MSP, and other holistic and interdisciplinary management approaches. In these cases, ENGOs may partner with institutions to help train and hire the next generation of marine managers. While the total number of employment opportunities remains minor relative to government and industry sectors, ENGOs continue to employ skilled

4 Oberthür et al., id.; A. Chircop, "Teaching Integrated Coastal Management: Lessons from the Learning Arena," *Ocean & Coastal Management* 43 (2000): 343–359.

5 M. Bailey et al., "Canada at a Crossroad: The Imperative for Realigning Ocean Policy with Ocean Science," *Marine Policy* 63 (January 2016), 53–60, doi.org/10.1016/j.marpol.2015.10.002; S. Heileman (ed.), *A Handbook for Measuring the Progress and Outcomes of Integrated Coastal and Ocean Management*, IOC Manuals and Guides No. 46; ICAM Dossier No. 2 (Paris: UNESCO, 2006), http://unesdoc.unesco.org/images/0014/001473/147313e.pdf.

6 Heileman, id.

professionals from a wealth of disciplines. For example, the Canadian Revenue Agency lists revenues close to CA$1 billion in 2011 for 300 charitable organizations with significant environmental programs, including those with marine programs.[7] In the same fiscal year (2011–2012), the top 32 Canadian ENGOs employed 1,486 full-time staff.[8]

As a greater number of job opportunities in marine management have become available, especially in the field of ICOM, academic institutions have responded to this growing demand for skilled professionals by developing specialized training programs and courses.[9] In addition, ENGOs often provide direct training opportunities in partnership with these academic programs through internships and job placements, in turn making students more employable, given their recent and relevant experiences and skills.[10] For example, the Master of Marine Management program at Dalhousie University in Halifax, Canada, was established in response to an international call for interdisciplinary graduates, with an emphasis on enrolling students from developing nations. Between 2008 and 2015, 94 percent of graduates (88 of 94 graduates) were employed within their discipline, and 12.5 percent (11 of 88 graduates) were employed by ENGOs.[11]

Policy Influence

ENGOs have pushed for increasing transparency, accountability, and inclusivity through local, national, and international governance delegations and by engaging media and the public.[12] For example, the number of NGOs that have successfully obtained observer or consultative status with the United Nations Economic and Social Council (ECOSOC) has increased by more than 500 percent over the last three decades.[13] Nationally, there is no shortage of examples of ENGOs making significant marine conservation and policy contributions in

7 Straughan and Pollak, *supra* note 1 above.
8 J. Grady, "Environmental Charities in Canada," *Charity Intelligence Canada*, June 2013, https://www.charityintelligence.ca/images/environmental_charities_in_canada.pdf.
9 Id.
10 Chircop, *supra* note 4 above.
11 B. Field, Marine Affairs Program, Dalhousie University, Halifax, Canada, personal communication.
12 Oberthür, *supra* note 3 above; Chircop, *supra* note 4 above; M. Winfield, "Six Functions of Non-governmental Organizations in a Democratic Society," York University, last modified 12 February 2014, http://marksw.blog.yorku.ca/2014/02/11/five-functions-of-non-governmental-organizations-in-a-democratic-society/.
13 Oberthür, id.

Canada. From leading local stewardship initiatives (e.g., the Great Canadian Shoreline Cleanup), to informing local government policies that steer industry or institutional operations (e.g., influencing Montreal City Council to pass a ban on single-use plastic bags) and helping the federal government achieve national and international mandates (e.g., 'pushing' the Canadian government to commit to protecting 10 percent of its marine areas by 2020), ENGOs are often on the front line of positive policy change in Canada and around the world.

Science and Data Accessibility

By fostering meaningful collaborations with various stakeholders and other organizations, ENGOs can facilitate and strengthen important linkages across sectors and disciplines. They can act as the creators and compilers of science, policy, and economic knowledge, while being an objective source of information for governance and management decisions.[14] ENGOs also have a crucial responsibility to act as third-party watchdogs regarding information published by agencies, including those of the government, to ensure accuracy and transparency.[15] Providing access to the most comprehensive and timely information, regardless of whether the ENGO is itself the producer or reviewer, is an essential component and role for bridging the science–policy–public interface.[16] ENGOs are proven to be skilled at accessing such information, as well as translating important (and often complex) scientific data and policies to make them accessible for general audiences.[17] This is turn promotes better dialogue, compliance, and stewardship among decision-makers, resource users, media, and the public alike, while providing a fundamental step toward shared conservation objectives, actions, and trust.[18]

14 Blasiak et al., *supra* note 3 above; Winfield, *supra* note 12 above; E.M. De Santo et al., "Does Information Matter in ICOM? Critical Issues and the Path Forward," in MacDonald et al. (eds.), *supra* note 2, 447–463.

15 Heilman, *supra* note 5 above; De Santo, id.; S.S. Soomai, "The Science–Policy Interface in Fisheries Management: Insights about the Influence of Organizational Structure and Culture on Information Pathways," *Marine Policy* 81 (2017): 53–63, doi.org/10.1016/j.marpol.2017.03.016.

16 Soomai, id.

17 De Santo, *supra* note 14 above; A. Agarwal, "Role of NGOs in the Protection of Environment," *Journal of Environmental Research and Development* 2 (2008): 933–938.

18 Agarwal, id.; S.S. Soomai, "Understanding the Science–Policy Interface: Case Studies on the Role of Information in Fisheries Management," *Environmental Science & Policy* 72 (2017): 65–75, doi.org/10.1016/j.envsci.2017.03.004.

Public Outreach

Unsustainable human activity and resource use is the ultimate cause of the global environmental degradation we are now witnessing. How we communicate, manage and mitigate these activities will determine the future health of the ocean. Recent studies have pointed out that public awareness and perception of marine issues will govern the way individuals and the public will take action. It is therefore imperative that ENGOs due diligence includes engaging the public with marine issues so as to promote conservation-focused solutions.[19]

Many ENGOs have already invested in developing creative and compelling communication strategies to connect with people using digital and social media channels. These are an essential tool for ENGOs, as they allow information to be disseminated widely and cost-effectively, target specific or broad audiences, build a sense of community (even globally), and provide a forum to participate in and influence conservation actions and decisions that were traditionally left to government and industry.[20]

Recent statistics put the number of social media users worldwide at 2.46 billion people in 2017. This represents a 153 percent increase from 970 million users in 2010.[21] Communications strategies driven by public demand, particularly through the use of digital and social media channels, will continue to drive ENGOs to tell a compelling, and often visual, story that resonates with engaged audiences and promotes public support for marine conservation and ocean governance.

Industry Development

ENGOs' capacity to affect the development of sustainable industry products, standards, and practices has established an important and recent trend. By communicating science and encouraging the public to make more informed decisions, ENGOs have helped increase the demand for more sustainable

19 H.K. Lotze et al., "Public Perceptions of Marine Threats and Protection from around the World," *Ocean and Coastal Management* 152 (2018), 14–22, doi.org/10.1016/j.ocecoaman.2017.11.004.

20 S. Dosemagen, "Can Social Media Help to Save the Environment?" *Huffington Post*, last updated 28 January 2017, https://www.huffingtonpost.com/shannon-dosemagen-/social-media-and-saving-t_b_9100362.html.

21 Statista, "Number of Social Media Users Worldwide from 2010 to 2021 (in billions)," Statista (2018), https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/.

products. This provides new market niches in which industry has already begun to respond by developing and supplying environmentally responsible products. For example, ENGOs have been a significant driver of sustainable seafood campaigns (e.g., the Ocean Wise Seafood Program) that encourage industry, retailers, and consumers to purchase products that have minimized the risk of overfishing and habitat degradation, among other conservation concerns.

Compelling, fact-based messaging that discourages harmful fishing methods have led to a diversity of ENGO-based seafood eco-labelling programs. These in turn provide management transparency and promote fishery sustainability. While the effectiveness of eco-labels and the merits of their standards may be controversial for some fisheries, the fact remains that ENGOs have helped improve awareness and empowered the public to make informed choices and actions that have resulted in an industry shift towards sustainable fisheries management and marine conservation considerations.

Parting Thoughts

Scientists agree that the marine environment is deteriorating at a greater rate than ever before.[22] Fortunately there is now an unprecedented level of local to international attention and resources focused on the health of the ocean and its sustainable use. Among the myriad of stakeholders and users involved, there are significant increases in both the number and scope of ENGOs that play a principal role throughout the science-policy-public interface, and increasingly, this interface is inclusive of industry as well.

By helping develop and influence good management practices, creating and disseminating scientific knowledge, and connecting with the public to help make more informed and sustainable choices, ENGOs will remain not only relevant in the future but will continue to shape the next steps in ocean governance and management. Good marine governance will undoubtedly require all hands on deck for the benefit of a healthy ocean for our common future.

22 S.J. Gilbert, "The Value of Environmental Activists," Harvard Business School Working Knowledge, 8 September 2008, https://hbswk.hbs.edu/item/the-value-of-environmental-activists.

The Ocean and China's Drive for an Ecological Civilization

*Arthur J. Hanson**
Victoria, British Columbia, Canada

I first met Elisabeth Mann Borgese after joining Dalhousie University in the late 1970s, and we were colleagues and friends until her untimely passing. We shared many common interests concerning oceans, environment, and international development. Often I participated in International Ocean Institute-Canada (IOI-Canada) programs. Like so many others I felt challenged by her remarkable range of interests, her passion for *pacem in maribus*, and her prescience regarding many aspects of ocean governance and uses such as mariculture. I certainly agreed with her deep commitment to developing nations, especially for peaceful and sustainable ocean use. She brought integrative views and understanding about the law of the sea, and how its full application could link people from all parts of the world in common cause. But in 1982 the ocean situation was very different from today.

Nowadays we talk about a technologically sophisticated and vastly expanded global 'Blue Economy', with hopes that it may be doubled in the years ahead. However, there is a level of crisis in ocean use that worsens decade by decade. Threats are now regional and global. I am sure that Elisabeth would agree that the future health of the ocean will require much more attention to green development, environmental protection, and innovation in global governance. Indeed, for problems such as ocean acidification, impacts of plastics and other wastes, and from intensive coastal development, there is no single framework for addressing sustainable use. Chapter 14 of the UN 2030 Sustainable Development Goals provides a helpful start, but the legal framework for integrated approaches to marine sustainable use is not fully provided by the current law of the sea, or even by the combination of the many accords that in one way or another affect ocean use.

I have had the good fortune to work closely with environment and development authorities and scientists in three major ocean countries, namely, Canada, Indonesia, and China, plus carrying out ocean-related activities in a

* International Chief Advisor and Member of the China Council for International Cooperation on Environment and Development (CCICED) and former President, International Institute for Sustainable Development.

number of others. I often think of Elisabeth and her innate sense of optimism about *what could be accomplished* if behavior and circumstances are altered. The network of IOI Centers, the *Pacem in Maribus* Conferences and the string of *Ocean Yearbooks*, plus her own books and other activities, have contributed to her transformative legacy, and her strong belief—that we can shape the *Future We Want.* In this short essay, I will examine only China and its evolving perspectives on global ocean use and governance.

Elisabeth built an enduring IOI relationship on the oceans with China over a long period. This has included two *Pacem in Maribus* Conferences held in China (1996 and 2010), the establishment of IOI-China, which has trained many people from China and other countries in the Western Pacific, and participation by Chinese ocean specialists in other IOI activities. Especially in earlier years (1980s–1990s) as China gradually built its ocean policy and scientific capacities, the IOI played a very important role.

My own involvement in China began in 1992 when the China Council for International Cooperation on Environment and Development (CCICED) was initiated.[1] This body directly advises China's State Council on a wide range of environment and development matters. It is chaired by the Vice Premier of China and includes senior Chinese and international members. The CCICED is currently in its sixth five-year phase. From 2002 to the present I have served as International Chief Advisor. CCICED has addressed ocean policy matters at times, notably a 2010 study on sustainable development of China's ocean and coasts and a current initiative on Global Ocean Governance and Ecological Civilization. Over the 25-year span of CCICED activities we have seen the emergence of many new problems and approaches to eco-environmental concerns. Environment is now mainstreamed into China's political, economic, and social policy framework. An unprecedented financial commitment has been made to initiatives such as a 'war on pollution'.

Leaders in China have a long-term vision of creating an ecological civilization where people and nature can co-exist in harmony.[2] This view is similar to sustainable development, but is more integrative with attention to political and cultural considerations. While the prime effort is directed to applications within China, the concept has already been discussed and endorsed by the United Nations Environment Programme and likely will influence initiatives that China has with other countries. Ecological civilization may become

1 See the CCICED website, http://www.cciced.net/cciceden/.

2 See United Nations Environment Programme, *Green is Gold: The Strategy and Actions of China's Ecological Civilization* (2016), https://reliefweb.int/sites/reliefweb.int/files/resources/greenisgold_en_20160519.pdf.

important in China's efforts to address global governance concerns such as those related to major conventions, notably for climate change and for biological diversity, as well as for governing ocean use nationally and globally.

Ecological civilization is an important component of China's 13th Five Year Plan (2016–2020) and will likely be even more prominent in the future. China has now set out its key longer-term policy directions to build a modern society by 2035 and a more prosperous country (at the level of some Organisation for Economic Co-operation and Development nations) by 2050. A very important policy shift is to selectively take on leadership roles globally and regionally. In the past, China has preferred to be seen as a participant for many international activities rather than take on leading roles. That situation is explicitly changing, and at quite a rapid pace. In the important 19th Communist Party Congress (held in October 2017) President Xi Jinping noted that

> It will be an era that sees China moving closer to center stage and making greater contributions to mankind … play our part in ensuring global ecological security … China has become an important participant, contributor, and torchbearer in the global endeavor for ecological civilization …[3]

More generally, China seeks "a community of shared future for mankind." The idea is to work towards win–win outcomes.

How these Chinese ideals will play out for global and regional ocean issues is not yet very clear. There are hot issues between China and neighboring countries, in particular concerning the South China Sea, and between China and Japan. Elsewhere there have been gathering storm clouds over China's distant water fisheries fleet in several locations. China has limited experience concerning traceability of fish caught elsewhere but brought to China for processing and export, or consumed domestically. In its own waters, China has serious overfishing concerns. Many reef fish such as groupers have been imported illegally, as have sea turtles whose shells are sold as tourist items, illegally caught sharks from the waters of countries such as Ecuador, and other species such as seahorses used in traditional medicine. Yet such matters, important as they are, are really only the tip of the iceberg for China's new era in ocean use.

Marine and coastal biodiversity is under considerable threat globally, and China could play a helpful conservation role in many ways, for example, by participating actively in the creation of high seas and other marine protected areas. China will also be able to learn from some other countries regarding

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3 See "Full Text of Xi Jinping's Report at 19th CPC National Congress," China.org.cn (6 November 2017), http://www.china.org.cn/chinese/2017-11/06/content_41852215.htm.

coastal national parks, since its national park system is only beginning to be formed. The East Asian–Australasian migratory bird flyway depends very heavily on Chinese wetland protected areas, such as those found along the shores of the Yellow Sea. This is a topic of great concern to many local administrations in China that must permanently set aside major land and marine spaces, thus limiting other uses. This is a prime topic for international co-operation, and the Chinese government at a national level is fully committed to maintaining such co-operation. Even so, it is a difficult task for local administrators who are also seeking local economic growth through port development, aquaculture, and space for factories, etc.

Another fast growth economic theme for China is offshore energy development. The range of approaches goes well beyond the predictable, such as oil and conventional gas, and wind energy. There are active efforts to exploit ocean frozen methane deposits and significant investment in renewable energy in tidal, wave and ocean thermal energy conversion. As well, there are efforts underway to consider the potential for building nuclear power plants offshore, as well as solar panel arrays on the sea surface. Some of these efforts involve significant international co-operation, and also investments in other countries by ocean-related Chinese enterprises such as the China National Offshore Oil Corporation.

China is now taking much greater interest in the deep trenches and other relatively underexplored ocean waters, wherever they might be located in the world. The information gained is meant to improve the country's knowledge for economic, shipping, and naval uses. Starting as soon as 2019, China will begin seabed mining in Papua New Guinea's waters. However, these explorations also are important for better understanding of marine ecosystems, significant ocean and atmospheric ocean relations that are important in climate change, and for better understanding of marine biodiversity. Marine biodiversity is significant for biotechnology advances in a number of fields, including fisheries and aquaculture as well as medicine, food, and environmental biotechnology. Over time, China's commitment will likely position the country very well as a leader in understanding physics, chemistry, and biology of the oceans. Yet the existing global governance in these fields is not adequate. China can contribute not only to the science, but also to the technological innovation, management, and governance innovation required.

China is a country where natural disasters have been commonplace for centuries. The most important sources have been earthquakes, floods, droughts (sometimes with accompanying famines), and typhoons. In this age of climate change, weather is of increasing significance, with storms, rising sea levels, and the dangers of floods and droughts creating new levels of risk. The role of ocean phenomena such as warming trends in the Arctic are even being blamed for the difficulty in reducing smog for cities such as Beijing! Fortunately, in recent years, China has developed much improved disaster planning and management procedures that are helping to reduce the damage and loss of life found in the past. However, in the decades to come, there will need to be a tremendous investment, especially along China's east coast and in major river basins so that cities and infrastructure can be protected from rapid sea level rise and the effects of storms. The impacts on mariculture and ecological services of coastal wetlands will be considerable. Fortunately, investment in ecological restoration of such areas is taking place, and steps are being taken to stop destruction through ill-advised land reclamation.

There are four particular topics that have become focal points for China's growing influence on the world's seas. First is the rising importance of its naval strength. While this is still very much a work in progress by comparison to other major naval forces, there are perceptions that in another 10 or 20 years, China will certainly be a strong power on the high seas, and for some countries that is a concern. The second matter is the dominant role China now plays in ocean commerce. It is now the leading shipping nation with large fleets such as those of companies such as COSCO. There has been a remarkable rise in the number and scale of marine ports in China, and through port development in other countries (including Pakistan, Sri Lanka, various small island nations, and Greece), a global network. There is both a commercial and a rising naval superpower aspect to the network. The third element of concern has been the tension over China's claims in the South China Sea, its rejection of a law of the sea tribunal jurisdiction and decision on the claim brought by the Philippines, and China's infrastructure development on some of the reefs and islands. The conflicting claims are unlikely to be settled quickly. In some circles this tension is considered as one of the leading threats to ocean peace today.

The fourth focal point is quite remarkable. It is variously called China's Belt and Road Initiative (BRI), or the One Belt One Road (OBOR) initiative. These terms refer to the ancient land-based Silk Road across the deserts of China through other parts of Asia to the Middle East, plus the major ocean trading routes that existed from before Marco Polo's time to East Africa as well as coastal parts of Asia and elsewhere. The Belt refers to the land-based routes. The name now given to the ocean routes is the Maritime Silk Road. Most recently, there are suggestions of an Arctic Maritime Silk Road that would involve Russia and possibly other nations as Arctic ice disappears through climate change.

Introduced in 2013, this blend of ancient and future trading routes has been expanded to more than 60 nations in Africa, Asia, and the Middle East, and also countries in Eastern Europe. BRI/OBOR is a 'once in a generation' revision of world trading relationships, and along with it, a means for strengthening China's international development efforts and co-operation with many developing countries. Both trade and investment will increase to a level that may significantly change transfer of wealth to developing nations. The initiative can help China strengthen political links and opens steady access to resources and markets. For developing nations there are hopes for rapid economic development. However, environmental and social impacts may be considerable as many of the projects involve infrastructure, and certainly the whole endeavor depends on expanded use of the seas and coastal zones.

This brief introduction to China's growing dependence on the global ocean and the country's desire for a greater leadership role regarding global governance reform suggests major challenges *and* opportunities for the decades immediately ahead of us. China clearly is clearly well positioned to take bold steps in this direction, and has demonstrated in various ways that it has the will to do so. Examples include China's proactive steps first in the Antarctic and now the Arctic to build scientific knowledge; some of its efforts through the newly established Belt and Road Initiative; and its very significant efforts at ecosystem restoration along its own coastline. In pursuing a domestic agenda where the country's Blue Economy might double from today's 10 percent of gross domestic product, China will have to greatly improve ocean environmental protection and green development. An advantage in doing so will be to put China in a leadership role for new technology development. This is already happening in some sectors, but not necessarily in an integrated way. For example, to reduce wastes reaching the ocean from farms, factories, and urban cities requires a 'mountain to sea' perspective that is still not fully in place.

China takes action most swiftly when the country sees clear advantages in doing so. The concept of ecological civilization is at that point now, at least domestically. It is an effort to build new societal values consistent with global sustainable development goals. However, for such an inclusive idea to become operational, many inconsistencies must be addressed. These include China's current global fisheries practices, the imbalances still present on other development practices within China, the need to build credibility around the world about China's peaceful intent even as it continues to build naval power globally, and, above all, further strengthening of international co-operation to help address a broad range of ocean use concerns. Despite these challenges, no other large country is so well positioned to bring about transformative change towards ocean sustainable development. China will indeed find many innovative opportunities as it meets the challenges.

How different the situation is today compared to that time a half century ago, when Elisabeth Mann Borgese and her colleagues first made the case that the ocean and seabed should become the common heritage of mankind, administered exclusively for peaceful ends. Elisabeth was the pioneer in working with China. She helped make it possible for many of China's ocean planners and leaders to find ways that incorporated international experience with necessary Chinese characteristics. She would be proud to know that China is now in a position to help many other developing countries, and to have a global influence during the hard struggle for making ocean use sustainable, perhaps eventually even in the context of an ecological civilization.

PART 2

Capacity Development for Responsible Ocean Governance

The development of human resources, alias 'Education,' is an essential component of the emerging new system of 'governance.' More important than territory, natural resources or capital: more blatantly so in the ocean than anywhere else; for ocean management and conservation is based on science and technology, and science and technology, in our century and the next, are knowledge based.

Elisabeth Mann Borgese*

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* Introduction for the unpublished manuscript for a planned alumni book project, "IOI Alumni and the Future of Ocean Governance," Dalhousie University Archives, Halifax, Nova Scotia, Canada, Elisabeth Mann Borgese Fonds, Reference code, MS-2-744, Box 301, Folder 2, https://findingaids.library.dal.ca/alumni-book-miscellaneous-chapters.

Introduction

Editors: Michael J.A. Butler, Scott Coffen-Smout and Dirk Werle

If scientific knowledge and technical know-how are two essential elements for ocean management and conservation in this century, then developing capacity for responsible governance by way of ocean education and training of human resources is bound to be a third prerequisite. As the quote opposite intimates, knowledge in its most holistic form and people in the most inclusive way were obviously regarded by Elisabeth Mann Borgese as a strategic element and principal agents to achieve that goal. Following the successful conclusion of the United Nations Convention on the Law of the Sea during the early 1980s, she proceeded with the implementation of an ocean governance training program that marks a cornerstone of the International Ocean Institute (IOI) to this day, with ambitious plans for the future.

The seven essays in this part concentrate almost exclusively on IOI-related capacity development activities. They cover programmatic components and implementation issues, retrospective and forward-looking assessments, as well as evolutionary aspects and strategic requirements. All of these undertakings and related experiences are presented from the point-of-view of individuals with professional connections to the program, its concept and legacy, and future direction. The IOI perspectives on ocean governance and capacity development highlight practical program delivery, featuring current IOI course work in Canada as an example, and overall strategic planning considerations of IOI as a non-governmental actor headquartered in Malta.

At the outset, an essay on Elisabeth Mann Borgese's legacy, in conjunction with an overview of the long-standing IOI-Canada course on *Ocean Governance: Policy, Law and Management,* offers a unique window on this broad-based training and capacity development initiative and its philosophical underpinnings. Two alumni of the course reflect on their personal and professional experience as participants during the mid-1990s and in 2016, respectively. The different vantage points in time focus on a career informed by the learning experience more than two decades ago and a career marked by expectations instilled by a recent course. An aspect of that course experience is the subject of an essay that examines simulation and scenario-based learning as part of the most recent ocean governance course offerings to hone practical management, foster interactive learning skills and facilitate knowledge integration. Two essays on future aspects of IOI ocean governance training and capacity development conclude this part. They approach the topics in different yet closely related ways. In the first instance the emphasis is on urging the education of ocean leaders to take proactive planning decisions today in light of the emerging climate change realities. The second, and final, essay lays out in a more general fashion the overall strategic direction of IOI's capacity development plans for the near future.

The Capacity Development Imperative: Elisabeth Mann Borgese's Legacy

*François Bailet**
United Nations, Division for Ocean Affairs and the Law of the Sea, New York, United States

Elisabeth Mann Borgese's Vision

Elisabeth Mann Borgese often proposed that the development of a new international framework for the law of the sea offered a laboratory for humanity within which to develop new approaches to its relationship with nature, and with itself. This proposition was firmly rooted in the conviction that we should be courageous enough to step away from our traditional land-based approaches, and leave behind some of our old ways, which have often caused conflict and inequalities, all at the expense of humanity and nature.

The infectious beauty and humbleness of Mann Borgese's positive intellect was clear to those who worked with her, or even casually conversed with her. However, she was sometimes taken very literally by her contemporaries, and her propositions provided some with the excuse to stay on land and encourage the dismissal of her vision as nothing more than naivety, or perhaps even geopolitical manipulations of the times. Unfortunately, the importance and timing of Elisabeth's underlying ideas evaded them, as they could not see beyond the shores of their intellect.

But Elisabeth was not a pessimist, nor was she easily intimidated by complexity. Quite to the contrary, such situations brought out the best in her, as well as those she so selflessly shared her life with. Armed with conviction, humble persistence, and fundamentally human propositions, she continued to explain. Many of her ideas were eventually understood in the context of the Third United Nations Conference on the Law of the Sea, some even serving as elements of the nucleus of what has become the 'constitution for the ocean': the 1982 United Nations Convention on the Law of the Sea (UNCLOS). But Mann Borgese understood that this magnificent development could only be the beginning; hence she continued her mission within the law of the sea and the sustainable development intergovernmental processes. The convergence

* Former Special Assistant to Elisabeth Mann Borgese. The opinions expressed in this essay are those of the author and do not necessarily represent the views of the United Nations.

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of ocean affairs and the sustainable development agendas became her focus. In parallel, she also redoubled her efforts in developing human and institutional capacity in ocean affairs, as she was convinced the persistent lack of such capacity was detrimental to sustainability.

A Time for Common Approaches

It is in this spirit that humanity must now understand the situation it faces with respect to the state of the ocean, and start to craft new approaches in this great laboratory so as to redefine its relationship. There has never been a more important time in our history to take on this challenge. The ocean is on the brink of a tipping point; we now understand that our cumulative impacts are starting to outpace our ability to mitigate the harm we are causing.[1] The ocean, nature in all its complex processes, is reacting. Humanity, relatively speaking, is having difficulty to do so. Faced with complex and interrelated problems, the effort to understand, regulate, implement, and adapt must be significantly reinforced, as must the current lack of human and institutional capacity.

Our relationship with the ocean is complex. On the one hand, it is our life support system, and on the other, we have taken it for granted and made selfish use of it from time immemorial. Another paradox lies in that we know very little of what the ocean holds, let alone its physical, chemical, and biological characteristics and processes and how our activities affect these. From the beginning of our time, we have looked at that ocean as a medium for exploration, commerce, leisure, opportunity, and more recently for such undertakings as exploration of biotechnology and renewable energy, amongst the many emerging. While such pursuits have fueled the development of humanity and accompanied the ebb and flow of civilizations, this has often been done with little attention to, or understanding of, their effects on the ocean. In historical terms, until relatively recently, governance was by canon, and the ocean was limitless and plentiful. Today, this can no longer be the case, and we are bailing with all our might, each to a different drumbeat, each pursuing different visions of how to best govern our relation with the ocean and adapt to the oncoming. While many of these approaches have merit in of themselves, the current calculus of our positive cumulative efforts does not suffice to halt, let alone reverse the alarming trends.

1 Group of Experts of the Regular Process, *The First Global Integrated Marine Assessment: World Ocean Assessment I* (United Nations, 2016).

In order to begin effectively addressing this situation, it is imperative to understand the system within which we are operating. It is only from this position of understanding that we may start to identify lacunae and strategic priorities, and examine new ways of structuring our actions and developing capacity to effectively implement these. Such a common mutual understanding will also provide opportunity to better coordinate our individual actions within a clear strategic and common framework, thereby providing opportunities for our collective actions to yield meaningful positive cumulative impacts.

The Relevance of Elisabeth's Vision Today

There is no single approach to the governance of oceanic spaces, resources, and activities. It is not a Cartesian system that can be neatly unfolded. But ocean governance is not a 'black box' either, nor should it be elevated to such levels of complexity, or 'alchemy'. Our lack of understanding of this system cannot be used as an excuse for inaction, more importantly, justifying ineffective action. Elisabeth realized that decision-makers could not be allowed to hesitate when engaging in ocean affairs, nor could their decisions remain in the realm of the safe, floating above some of the most critical problems faced by humanity. She thus saw the importance of simplifying the complex, without losing meaning or substance while making progress. This led her to understand that governance structures are generally formed around political, legal, and institutional frameworks. These could also interact on various geographical scales, from the local to the national, and from the regional to the international. She also understood that a wide range of actors, or stakeholders, functioned within these frameworks, sometimes also across the geographic scales. Examining ocean sectors through these governance components provided insight into the structure and functioning of the system, and she firmly believed that this could also yield significant information regarding human and institutional capacity requirements for ocean governance.

Capacity as the Centerpiece

This last point, human and institutional capacity, was already identified by Mann Borgese in the 1970s as a fundamental component of our ability to put in place effective ocean governance frameworks. This requirement has not changed to this day. In fact, many note that it has continuously increased in importance over time as states have continued to develop legal and institutional arrangements at all geographical scales to manage human interaction with the ocean. However, the expansion of arrangements has not been accompanied by the necessary development and strengthening of capacity-development structures. And when this has been considered, it has often been relegated to general objectives and rarely to obligations. This is also the case with the larger envelope of financing mechanisms for the implementation of agreements and institutional arrangements, at all levels.

Thus, if there is progress to be made in the sustainable management of oceanic spaces, resources, and activities, there is an immediate need to establish and sustain strategic capacity development structures. Additionally, priorities must be identified within the ocean governance system, at all scales and across the frameworks described above, to ensure that necessary capacity is built to address the most pressing ocean issues.

Furthermore, while the multidisciplinary nature of ocean issues was famously recognized in the Preamble of UNCLOS, which codified the notion that all problems of ocean space are closely interrelated and must be considered as a whole, this imperative has not been widely or consistently treated in capacity development initiatives. This condition is largely a symptom of the ongoing management of ocean affairs along independent legal and institutional arrangements. A persistent use of a land-based approach, which Mann Borgese cautioned against, may be limiting in the context of ocean affairs.

Until fairly recently in history, this compartmentalization has also been a structural characteristic of education systems across the globe. While some academic programs are starting to address ocean affairs, including in a holistic manner, the number of programs are very few and certainly not enough to build the new generation of ocean professionals that is required. There is also much progress to be made in developing curricula that respond to the actual needs of ocean affairs, including the reinforcing of the science–policy interface. Many gains could also be achieved through the establishment of a standardized academic accreditation in ocean affairs, which would be recognized globally as a pathway to a defined profession. In many academic disciplines, universities have worked very closely with industry to ensure relevance of their programs to the workplace. But this is a difficult undertaking within ocean affairs, as the 'industry' is disparate and continues to be largely sectoral in its organization.

Elisabeth had also understood these challenges and the importance of overcoming them. Through consultations with the stakeholders of the ocean affairs frameworks, as well as with a myriad of relevant experts in academic disciplines, she proposed a comprehensive and relevant academic curriculum to be delivered through a virtual learning platform, leading to an internationally recognized degree. While this vision was too early for its time, it is now being successfully implemented by at least one university at the graduate level. Given the ocean issues humanity faces, it would seem that there is still much to be accomplished in academic education for ocean affairs.

The importance of resolving the academic bottleneck to sustainability cannot be overstated, particularly with respect to the creation of a new generation of ocean professionals which is needed to understand and start implementing solutions. But Mann Borgese had also understood the importance of developing capacity within the existing field of practitioners. She initially focused her efforts within the framework of the UNCLOS negotiations. She would often express the importance in ensuring that all those involved in this multilateral process seeking to develop a constitution for the ocean clearly understood the issues at hand as well as the process itself. She truly believed that the stakes could not be higher for humanity; active and meaningful participation by all was an imperative.

Once UNCLOS took shape, and eventually entered into force, Mann Borgese also saw the importance of providing support for developing states in the implementation of the new constitution. This vision was particularly important to her in respect to developing states, and it led her to establish training programs in ocean affairs. To this day, these training programs continue to assist in building human and institutional capacity in developing states.

Still today, almost four decades later, the importance of providing ocean-related professionals with opportunities to develop their capacities in a holistic and relevant manner is critical to the achievement of a sustainable relation with the ocean. As with academic degrees, training programs are growing, but collectively they are not sufficient. This, not only because their numbers remain small compared to the needs, but also because their curricula are often designed to only meet necessary sectoral technical needs. Also, and on the opposite end of the spectrum, curricula can be based on sound academic and holistic principles, but these may not be grounded well enough in the immediate needs of the stakeholders. Few capacity development programs work in tandem with ocean affairs stakeholders to overcome these limitations and to ensure that they remain relevant with the evolving needs. Again, in the face of the severity and diversity of ocean issues, much work remains to be done to develop the capacity that is so immediately required.

Elisabeth's vision recognized the importance of understanding the system being developed for the implementation of the new ocean order, including the need for a comprehensive and multidisciplinary approach firmly rooted in principles of sustainable development. She also recognized the imperative of ensuring that the necessary capacity was being built to accompany these developments. She worked tirelessly throughout the negotiation of UNCLOS and subsequently for some four decades in pursuit of this vision. Today, her vision still holds true, and perhaps it is worth recalling. This, as the international community has embarked on two major processes which speak directly to the vision: the development and implementation of the 2030 Agenda for Sustainable Development, and the elaboration of a new legal framework filling a lacunae of UNCLOS, namely, the development of an international legally binding instrument under UNCLOS on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction.

The importance of the success of both of these processes in relation to ocean sustainability, humanity's well-being, is clear. There is also no doubt that both processes will require enormous human and institutional capacity to progress meaningfully. The question is: Will the capacity imperative remain unaddressed as these processes move forward? As we continue to develop the framework for the law of the sea for sustainability, will we take advantage of the laboratory to develop new approaches to our relationship with nature, and with ourselves?

IOI-Canada's Ocean Governance Training Program

Michael J.A. Butler
International Ocean Institute-Canada, Halifax, Nova Scotia, Canada

Genesis of the IOI Training Programs

To understand the rationale for the establishment of the IOI-Canada Training Program, one must consider and appreciate the early life of Elisabeth Mann Borgese (1918–2002), the founder of the International Ocean Institute (IOI). Her 1999 Nexus Institute lecture, "The Years of My Life,"[1] provides an autobiographical insight into her privileged upbringing among globally acknowledged intellectuals and the Mann family's escape from Nazi Germany, prior to the Second World War, first to Switzerland and eventually to the United States. Her interests were eclectic, and even at a young age she could be passionately single-minded, for example, her life-long love of the ocean. She met Professor G.A. Borgese in Princeton, New Jersey in 1938 and married him in 1939.

In 1946 Chancellor Robert Hutchins of the University of Chicago launched a Committee to Frame a World Constitution as a response to the debacle of the Second World War. Elisabeth Mann Borgese became an active participant in the work of the Committee. In 1948 the Chicago Preliminary Draft of a World Constitution was published, and one of its provisions declared that earth, water, air and energy were "the common property of the human race,"[2] a foretaste of things to come! Later that decade, the Korean War and McCarthyism contributed to the demise of world federalism and the ideals developed, perhaps naively, by the Chicago team. Consequently the Borgeses moved to Italy where Professor Borgese died in 1952 at age 70.

In 1964, Dr. Hutchins established the Center for the Study of Democratic Institutions (CSDI), an antidote to McCarthyism, in Santa Barbara, California. In 1967, he invited Elisabeth Mann Borgese to become a Fellow of the Center and offered her a three-year project to draft a constitution for the oceans. Coincidently that same year, Arvid Pardo, Ambassador of Malta to the United Nations (UN), presented his seminal address to the UN entitled 'The Common

1 E. Mann Borgese, "The Years of My Life, The Nexus Lecture," *Ocean Yearbook* 18 (2004): 1–21; see also H. Pils and K. Kühn, *Elisabeth Mann und das Drama der Meere* (Hamburg: mareverlag, 2012).

2 See J.W. Boyer, "Drafting Salvation," *The University of Chicago Magazine* 88, no. 2 (December 1995), http://magazine.uchicago.edu/9512/9512Salvation.html.

Heritage of Mankind'. The subsequent symbiosis of Arvid Pardo and Elisabeth Mann Borgese would have far-reaching effects. Her project at the CSDI resulted in "The Ocean Regime,"[3] a proposal that applied the basic principles of the Chicago Constitution to the oceans. The posited regime was the basis for the first of many conferences entitled *Pacem in Maribus* (Peace in the Sea). The first conference (PIM I), in 1970, was appropriately held in Malta, the home of Arvid Pardo who became a friend and collaborator with Elisabeth Mann Borgese. The conference led to the establishment of the International Ocean Institute and IOI's active involvement in the Third United Nations Conference on the Law of the Sea (UNCLOS III). The IOI initially served as the Secretariat and think tank for the PIM conferences that were held annually and brought together representatives from all sectors of the marine community. IOI later grew to a network of centers worldwide. To fully appreciate Elisabeth Mann Borgese's prescient perspectives on ocean governance, involving environmental and cultural analyses, the reader is encouraged to read *The Oceanic Circle: Governing the Seas as a Global Resource*.[4]

IOI Training Programs: Their Debut

The concept of the IOI training programs arose in the context of the law of the sea negotiations.[5] Early drafts of the negotiation text indicated a high demand for qualified ocean experts. It was difficult for developing countries to meet this requirement, hence the loss of influence and opportunities. Accordingly, IOI introduced a 12-week Ocean Mining Course in Malta in 1980 with 19 participants from 11 developing countries. Scholarships were provided by the governments of Germany, the Netherlands, and Mexico and the European Economic Community (EEC). The Canadian International Development Agency (CIDA) subsequently became a contributor for many years thereafter, facilitated by a review from the then International Centre for Ocean Development (ICOD) in Halifax. Three training programs were developed: Ocean Mining (Class A);

3 E. Mann Borgese, "The Ocean Regime: A suggested statute for the peaceful uses of the high seas and the sea-bed beyond the limits of national jurisdiction," A Center Occasional Paper Vol. 1, No. 5 (Santa Barbara, CA: Center for the Study of Democratic Institutions, 1968).

4 E. Mann Borgese, *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998).

5 E. Mann Borgese, "Training Programme for the Management and Conservation of Marine Resources," in *Six International Development Projects*, ed., Ian McAllister (Halifax: Dalhousie University, Centre for Development Projects, 1982), 85–91; see also E. Mann Borgese, "The Training Programme of the International Ocean Institute," *Ocean & Coastal Management* 40, no. 1 (1998): 93–97.

Economic Zone Management (Class B); and Regional Courses (Class C, which included elements of A and B).

According to Professor Mann Borgese, the first two years of the IOI training programs were considered to be 'experimental' and the next three years 'consolidation'.[6] During this period two seminal events would profoundly impact the evolution of IOI's training initiatives. The United Nations Convention on the Law of the Sea was adopted in 1982 and in 1994 entered into force; an event of profound importance, as cogently expressed by Professor Mann Borgese in her Nexus Lecture:

> The emerging system of ocean governance, both structure and process, reaching from the local to the national to the regional subsystem, to the global system, comprehensive, consistent, participatory and non-hierarchical, in what Gandhi called "the majesty of the Oceanic Circle" will, I believe, respond to the requirements of the new Law of the Sea in conjunction with the new environmental international law as developed by [the United Nations Conference on Environment and Development].[7]

In 1986, the prestigious Club of Rome published an influential report, "The Future of the Oceans," the first publication of its kind on the ocean by the Club, and prepared by Professor Mann Borgese, a Club member. The plethora of uses and complexity of the oceans were succinctly described by the Club's co-founder, Aurelio Peccei, by the word '*problématique*', i.e. "the tangle of problems and issues that are interconnected and interacting by obvious and obscurely sensed mechanisms."[8]

In the experimental and subsequent consolidation period of the IOI training programs, i.e., the early 1980s referred to by Professor Mann Borgese,[9] a number of inevitable challenges were experienced and important criteria were established. They included the following: course location (economic zone management, to be delivered in Canada); process for selection of candidates (flexible); cultural differences (sensitivity required); length of course (psychological considerations in favor of 10–12 weeks, needing real commitment); number of course participants (20–25); ideal age (25–35 years); ideology of lecturers (progressive); character of program (interdisciplinary, foundation course); number of lecturers (6 for the duration of course and another 12–20

6 Mann Borgese (1982), id.

7 Mann Borgese, *supra* note 1, 20.

8 E. Mann Borgese, *The Future of the Oceans. A Report to the Club of Rome* (Montreal: Harvest House, 1986), xi.

9 Mann Borgese (1982), *supra* note 5.

for a day or two); follow-up options (alumni, newsletters, and regional refresher courses). These criteria continue to be evaluated each year as the current IOI-Canada Training Program goes through its planning cycle.

The IOI Training Program in Canada

Shortly before the first training program in Malta in 1980, Elisabeth Mann Borgese was appointed as a Senior Killam Fellow at Dalhousie University in Halifax, Nova Scotia, Canada. This one-year appointment was followed by a position in the Department of Political Science as a full professor. To quote Professor Mann Borgese, she was "the guest who stayed forever."

In 1981, the first IOI Training Program on Economic Zone Management, hosted by Dalhousie University, was sponsored by the then Centre for Foreign Policy Studies (now the Centre for the Study of Security and Development). Internationally recruited lecturers were joined by those from the former Dalhousie Ocean Studies Program (DOSP), the Bedford Institute of Oceanography, and local government and private sector organizations to deliver the Training Program. From the first training program in Halifax in 1981 to her death in 2002, Professor Mann Borgese chaired the Planning Council and retained a dominant oversight of the planning and delivery of the IOI courses.

The organization of IOI training programs at Dalhousie University was for many years a collaborative process involving the Centre for Foreign Policy Studies and the IOI Headquarters in Malta. In 1985 the Lester Pearson Institute for International Development joined the collaborators, followed intermittently by the Marine Affairs Program (Dalhousie University), the Oceans Institute of Canada (the successor of DOSP), and others. From 1993 onward, the organization and delivery of the Training Program became the sole responsibility of IOI-Canada, as it is now known.

The rationale for the Training Program and its curriculum have been consistent over the years: it remains intensive and interdisciplinary, while keeping a global perspective on ocean governance, and viewing the ocean as a complex system with varied users and multiple, often conflicting, uses (Figure 1). The course is primarily (but not exclusively) designed for mid-career professionals from developing countries who are prepared to step outside their area of specialization. Among other goals, the course challenges participants to deepen their understanding of complex ocean issues in sustainable development, to update their academic knowledge, and to assist countries to maximize benefits from the UN Convention on the Law of the Sea. In recent years, IOI-Canada has been unable to accept the optimum number of course applicants due to

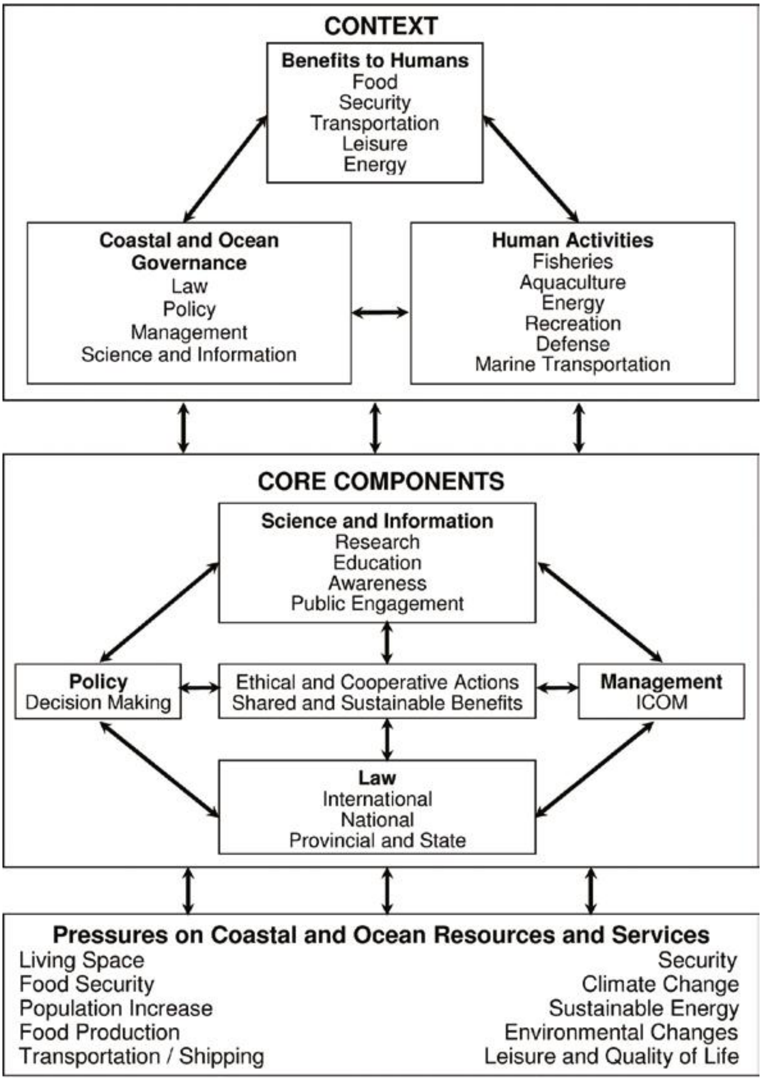

FIGURE 1 A graphical representation of ocean governance.

the challenge of securing sufficient scholarship funds. The actual number of participants accepted is determined by the balance of funds received from the IOI Headquarters in Malta and funds secured from numerous other sources through ongoing IOI-Canada efforts.

The title of the IOI-Canada Training Program was changed between 1981 and 2002 to reflect evolving priorities. Initially it was entitled 'Marine Resource Management: the Exclusive Economic Zone'. It then morphed into 'The Entry into Force of the UN Convention on the Law of the Sea, its Implementation and Agenda 21'. In 1996 it became 'The UNCLOS, Its Implementation and Agenda 21', a title it retained until 2001. The following year the course title became the familiar one of 'Ocean Governance: Policy, Law and Management' that has been retained to this day.

The IOI-Canada Training Program is organized as a series of thematic modules that have varied over the years in number and content to reflect current research and ocean priorities. Numerous resources, including issues of the *Ocean Yearbook*[10] and *World Ocean Review,*[11] both published in partnership with IOI, assist this process. The modules of the 2017 Training Program, for example, included the following: Orientation and Introduction to the Training Program; Ocean Sciences; Law of the Sea and Principled Ocean Governance; Maritime Security; Communication and Negotiation; Fisheries and Aquaculture; Integrated Coastal and Ocean Management; Marine Transportation; and Energy.[12] Examples of content update include the introduction of ethics and communication skills as subjects of increasing importance. Climate change and adaptation, sustainable development, the Blue Economy,[13] and areas beyond national jurisdiction are other examples of issues given increasing exposure. Material from a Massive Open Online Course (One Planet–One Ocean: From Science to Solutions), with which IOI is involved, will also be introduced in 2018. In addition to more than 240 classroom hours, a variety of field trips complement the Training Program. Halifax and the province of Nova Scotia, with its 13,300 kilometers of coastline, offer ideal venues for such experiential trips.

The importance of hands-on activities as an important pedagogical tool was clearly appreciated when a practical negotiation exercise was introduced in 1983. This activity was complemented by the introduction of a course-long simulation exercise in 2006. The simulation exercise has been significantly enhanced since that time. Its primary purpose is to facilitate the integration of the extensive information delivered to, and provided for, the course participants. A basic introduction to geographic information system (GIS) technology allows participants to fully benefit from, and contribute to, this simulation.

10 See the *Ocean Yearbook* (Brill Nijhoff) website, https://brill.com/view/serial/OCYB.

11 See the *World Ocean Review* website, http://worldoceanreview.com/en/.

12 See the IOI-Canada website, http://internationaloceaninstitute.dal.ca.

13 World Bank and United Nations Department of Economic and Social Affairs, *The Potential of the Blue Economy: Increasing Long-term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least Developed Countries* (Washington, DC: World Bank, 2017).

Additional benefits of the simulation exercise include the experience of working within multidisciplinary and multicultural teams, negotiation skills, leadership development, and the enhancement of communication skills.[14]

The planning, preparation and management of the IOI-Canada Training Program is the collaborative effort and responsibility of the IOI-Canada staff. A course director is responsible for the day-to-day delivery of the Program, with the assistance of a course co-ordinator. The foundation of the Training Program continues to be a diverse and experienced team of lecturers who now number between 100 and 120 per course. The lecturers are subject specialists from academia, government, non-governmental organizations, First Nations, and the private sector. Module leaders, also subject specialists, have been appointed since 2007, and in most cases are IOI-Canada senior research fellows or alumni. The module leaders provide guidance when required and help to highlight the relationship between the topics presented in their respective module. The lecturers and the module leaders generously contribute their time and expertise on a pro bono basis.

Detailed evaluations are regularly prepared by the participants, in addition to an intensive half-day of course review on the final day with the participants and module leaders. The evaluations provide the IOI-Canada staff with valuable insights and guidance for the preparation of the following year's Training Program. The compendium of current and anticipated ocean issues, documented in this publication, will also provide guidance. An external review is planned for 2018 to evaluate the structure, delivery, and validity of the Training Program.

In conclusion, the IOI-Canada alumni, now numbering 701 from 104 countries, represent a potentially dynamic and influential 'resource'. Course participants are obligated to pass on their newly acquired knowledge, the multiplier effect, on return to their home country. The relationships, both professional and personal, developed over the two months of the Training Program, may continue for years, facilitated by ubiquitous social media, the IOI-Canada website,[15] and the annual *Alumni News*. The future well-being of the ocean and its governance will surely benefit from this committed cadre of ocean practitioners. As Professor Mann Borgese would have wished, they constitute a veritable 'army' of 'ocean ambassadors' (the 'ocean mafia', as she referred to them), a fitting legacy for her devotion to the ocean and its governance.

14 For details of the simulation exercise see the essay by Fournier and Griffiths in this volume.

15 *Supra* note 12.

Alumni Reflections on the IOI Training Program

Igor Vio
Faculty of Maritime Studies, University of Rijeka, Croatia

During the mid-1990s, I had the opportunity to attend the training program of the International Ocean Institute (IOI) in Halifax as a young university lecturer from Croatia, along with 23 participants from Canada and every corner of the world from 19 countries. Looking back more than two decades later brings fond memories of a very interesting group of people and a genuine multinational and multicultural setting that provided a unique experience for all of us. Unlike other students at Dalhousie University, ours was not a group of individuals in their twenties who had just emancipated themselves from their families and would have had no problem finding their way in their new campus environment. We were a very different selection of individuals, mostly in our thirties and forties, with well-established personalities, and a well-developed professional and family life in our distant home countries. It was amazing how those individuals, after some initial adaptation difficulties, forged an incredibly homogenous group of colleagues and friends. In retrospect, the IOI program gave us a possibility to develop a network of friendships, individuals with whom we would remain in contact, exchange ideas and expertise at conferences, and even meet again in person during our travels, because some of us participated in *Pacem in Maribus* conferences. As the Class of 1996, we had become part of a much wider global network of IOI alumni.

The main advantage of IOI's ocean governance training program was its interdisciplinary approach. It enabled all of us to gain a broader knowledge base that one needs when engaging in issues of the marine management and ocean governance. So, those of us who were experts in oceanography, marine biology or geology, had to focus on and learn about the background and procedure of codification of the international law of the sea; those of us who had completed their legal studies and had known in detail various provisions of the United Nations Convention on the Law of the Sea (UNCLOS) had the opportunity to become familiar with main developments in the natural sciences, which are indispensable for understanding various aspects of exploration and exploitation of marine living and non-living resources. Hence, every participant of the IOI training program gained broad interdisciplinary knowledge and important skills that remain important tools in our professional activities as scientific researchers or as civil servants in government agencies or international organizations.

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During our time in Halifax, the participants were indeed immersed in an intensive academic program. We attended lectures of leading faculty members from Dalhousie and other Canadian and foreign universities, visiting lecturers from various globally relevant research institutes, and experts from international organizations. Besides these academic pursuits, including research in the excellent university library, the most fantastic feature of the IOI program was a variety of field trips to various parts of Nova Scotia, including visits to the Bedford Institute of Oceanography where we met with marine scientists, to small coastal communities where we met with local fishermen, or to Cape Breton where we explored cultural and natural landscapes of the island. Ever since, it has always been a privilege to pass on details of those experiences in lectures to my own students. Our group really felt that Halifax had become our second home because of the friends we gained among Canadian participants and among the staff of the IOI and at Dalhousie. It was a great personal pleasure to return to the International Ocean Institute a decade later to meet some old friends and to speak about straits and international navigation as a visiting lecturer to participants of the 2004 Training Program.

It is impossible to think back at the time in Halifax and not remember the fascination shared unanimously among all the IOI training program participants with Professor Elisabeth Mann Borgese. She was continuously capturing our imagination and interest during her inspiring lectures, challenging discussions in the short breaks, and visit to her fabulous home. She had a unique capability to establish a warm human interaction with every person she talked to, and to explain complex subjects in a very simple way. Her deep knowledge of the law of the sea was even more impressive. Her studies in music and political science probably gave her a broader perspective than legal studies alone. We came to appreciate that Professor Mann Borgese's persona had many facets: being born into a famous family and growing up with her siblings as children of a father, one of the most well-known writers of the twentieth century, living in Germany at first, then in exile in Switzerland and the United States, then finally making her home in Canada. To us, she was a scholar with almost renaissance-like intellectual diversity and a cosmopolitan personality who had a clear grasp of global socio-economic and political developments. She often referred to the causes of the gap between developed and developing countries and was able to outline the problems and find solutions. Her most impressive talent was to find ways to make her vision of ocean governance come closer to reality because she knew how to communicate her ideas, how to gain support and how to gently persuade politicians and diplomats to make just the right decisions that would enable her projects to become functional.

Moving forward twenty years after I attended the IOI training program in Halifax, I contemplate what might be done to improve ocean governance in the twenty-first century. In 2018, we commemorate the centenary of the end of World War I; we ponder inevitably the efforts of the League of Nations as the first global organization with the goal of preserving world peace, a task that had not been accomplished. Twice in a lifetime of our grandparents "the scourge of war has brought untold sorrow to mankind," as the Charter of the United Nations reminds us. After World War II it was firmly decided that everything should be done to save succeeding generations from another global armed conflict. This mission, at least, has been so far successfully fulfilled by the United Nations. Other solemn goals written in the UN Charter still remain unfulfilled: to reaffirm faith in fundamental human rights, in the dignity and worth of the human person, in the equal rights of men and women and in nations large and small; to establish conditions under which justice and respect for the obligations arising from treaties and other sources of international law can be maintained; and to promote social progress and better standards of life in larger freedom.

In her bold and comprehensive revision of the Charter, entitled "The United Nations 2020" Elisabeth Mann Borgese proposed the introduction of the most important global concepts that emerged during the second half of the twentieth century: protection of the environment and sustainable development, including them in all the relevant provisions.[1] For years we have witnessed discussions to reform the United Nations, one of the key demands being the redefinition of the Security Council. Professor Mann Borgese suggested it should be renamed the Commission for Comprehensive Security and Sustainable Development, and this name itself provides the functions of this new 'heart' of the international organization, abandoning the obsolete notion of its permanent members with their veto powers to be replaced with the third millennium concepts of regional representation, sustainable development, and comprehensive security based on decisions adopted by consensus whenever possible or by qualified majority if necessary, as "the logical formula for a body that serves as the executive organ of the General Assembly."[2] Further, she proposed changes in the functioning of the General Assembly and proposed ground-breaking concepts with regard to regular "Ocean Assembly" sessions devoted to the seas and oceans. These sessions were to be attended by member

1 E. Mann Borgese, *Ocean Governance and the United Nations* (Halifax: Centre for Foreign Policy Studies, Dalhousie University, Revised Edition, August 1995), 229–241.

2 Id., 239.

states and heads of their ocean governance structures, as well as representatives of specialized agencies and programs involved in maritime affairs, executives of the Regional Seas Programmes and non-governmental organizations. She also contributed significantly to the revision of regional maritime governance instruments like the Barcelona Convention and its related Protocols. These mechanisms should result in bringing more dialogue and mutual understanding to the shores of the three continents that surround the Mediterranean Sea.

Back in 1993, I had an opportunity to be included in the work of the Division for Ocean Affairs and the Law of the Sea, which is part of the United Nations Office of Legal Affairs. As a recipient of the Hamilton Shirley Amerasinghe Fellowship on the Law of the Sea, I witnessed the efforts and energy of the international civil servants highly specialized in the law of the sea. It was the time of the UN Highly Migratory Species and Straddling Stocks Conference and informal consultations organized by the Secretary-General to promote additional ratifications necessary for entry into force of UNCLOS. When contemplating changes to global ocean governance, one might conceive of a permanent structure within the United Nations that would replace informal consultative processes regarding oceans and the law of the sea. In my thinking, we should support the idea of Elisabeth Mann Borgese that the Trusteeship Council, as a UN body that had completed its mission during the period of decolonization and emergence of a multitude of independent states, could be transformed into a Council with a mandate to "hold in sacred trust the principle of common heritage of mankind," not only with regard to the seabed area but encompassing the entire ocean space, outer space, the atmosphere and the Antarctica, acting as "the conscience of the United Nations and the guardian of future generations."[3]

The charismatic personality of Elisabeth Mann Borgese has left a lasting impact on many of us IOI alumni. It has been fifteen years since she left us, and we miss her tremendously today. We are facing global challenges involving the ocean in various ways, witness the tragedy of migrants at sea, threats of piracy, and growing risks of pollution of the marine environment not only from land-based sources and shipping, but also from seabed activities. Furthermore, we are also experiencing political, economic, and social crises with ever-growing security dangers and military threats. In these times, I, and probably many of my IOI alumni, become aware of how much we lack people of wisdom, calm

3 Id., 236–237.

strength, knowledge and vision—people like Elisabeth Mann Borgese. In the year when we mark the centennial of her birth, our collective task is to take her ideas and develop practical methods to achieve the full potential of global and regional ocean governance, and to make it operational. This could be our contribution to the legacy of Elisabeth Mann Borgese.

Alumni Reflections on the IOI Training Program

Amy Aai Sheau Ye
Centre for Ocean Law and Policy, Maritime Institute of Malaysia, Kuala Lumpur, Malaysia

Introduction

I had the privilege to participate in the 2016 International Ocean Institute (IOI) Training Program for Ocean Governance: Policy, Law and Management in Halifax, Canada. I am pleased to take this opportunity to reflect on the program and share some thoughts on the future of ocean governance in the Malaysian context and the role of training for responsible ocean governance.

Ocean Governance in Malaysia

Malaysia's institutional and legal framework for ocean governance is sectoral. There are as many policies as there are agencies involved in various aspects of ocean governance, with each agency often working in isolation in decision-making as well as in competing for federal funding and resources. As the Malaysian constitution does not explicitly provide guarantees for a healthy and clean environment, the courts are hesitant to adopt a more robust approach in upholding environmental laws, facilitating public interest litigation, and clarifying the division of responsibility for environmental governance. Having environmental provisions in the constitution would lay the foundation for the development of environmental ethics in decision-making; however, there is insufficient push towards that direction from the people and the government, as in the case with many other countries, although some have begun to address the issue. This is where education comes into play in creating a deeper awareness of and the need for ocean leadership and governance, and to initiate this important and necessary discourse.

Training for Responsible Ocean Governance

The IOI Training Program offers more than just knowledge acquisition. Given its eight-week duration and the broad scope of coverage, much of what is taught understandably touches only the surface of ocean sciences and environment, legitimate uses of the sea, and the consequences of human–ocean interactions. Nevertheless, most contemporary issues were discussed, thus providing material for important conversations pertaining to responsible ocean governance. It is the opportunity for and emphasis on such conversations among peers from different disciplines, cultural backgrounds, and motivations that make for a uniquely personalized learning experience.

From the IOI training program experience, it struck me that the key to responsible ocean governance lies with having frequent and continuous meaningful conversations about our relationship with the ocean. Certainly, talking alone will not do, and must be followed through with actions and leadership that stresses having an 'ocean mindset'. Those with the ocean mindset ask the right questions, are open to engaging in difficult conversations, and are guided by a strong moral responsibility towards the ocean in decision-making. The attributes of such a mindset are best exemplified by the acronym OCEAN: Optimistic, Collaborative, Encouraging, Audacious, and Noble. A champion of the oceans is optimistic that our ocean planet can and will be saved, understands that success is achieved through collaboration, encourages and inspires others to do the same, has the audacity to promote big ideas and engage in difficult conversations, and is steadfastly principled in a moral responsibility towards the ocean and environment in the choices and decisions made.

Reimagining Training for Ocean Governance

Capacity development in relation to ocean governance in Malaysia has focused almost exclusively on knowledge acquisition and neglected the moral and ethical aspects in ocean leadership. As the ocean environment and its resources continue to degrade one cannot help but conclude that there are still too few champions of the ocean, doing too little too late. Training for responsible ocean governance needs to address the means to instill an ocean mindset and to sustain the momentum post-training, and how to train as many influencers as quickly as possible, in the most cost-effective way.

How to organize people, content, and delivery to inculcate the ocean mindset and impact behaviors is a major challenge for any ocean governance training program. This is even more so the case for a developing nation such as Malaysia where the environment agenda does not feature very highly on the list of priorities. This can be addressed through a different approach to ocean governance training and strong alumni networks.

Training for responsible ocean governance in Malaysia will need to evolve and go mainstream. Parallel to the IOI Training Program for mid-level professionals working in ocean-related fields, Malaysia will need a medium- to long-term ocean governance training agenda that will cast the net wider to include influencers from all levels and instill a deeper awareness of the importance of the ocean. This will allow Malaysia's vision for "a healthy and productive ocean, rich in biodiversity and heritage, wisely managed, safe and secure, and economically developed for the equitable benefit of all, now and in the future" to become the guiding principle towards which the myriad agendas are aligned.[1]

Gamification is emerging as an effective tool for engaging learners and influencing behaviors. It uses game design elements to inform, create awareness, and change behaviors through story, feedback, and reward mechanisms and can be applied to the wide spectrum of ocean governance. The IOI Training Program already applies gamification by using simulation exercises to facilitate collaboration for ocean governance. To some extent, gamification is applied in oil spill preparedness and response training in Malaysia. These exercises focus on familiarity with lines of communication and standard operating procedures. Whilst gamification has been applied in various contexts it has been limited to training for the job. It is suggested that ocean governance awareness and training need to go mainstream to reach the younger generation, and gamification is the way to do it.

Mainstreaming of training for ocean leadership should target the younger generation of Malaysians and make use of the Internet and e-learning to engage with them. This can be feasible for Malaysia considering its Internet penetration rate is almost two-thirds of the population. A combination of serious and alternate reality games, such as 'World Without Oil', for the ocean could go a long way toward initiating conversations about future planning for and soliciting design solutions for a possible breakdown of the ocean ecosystem. This could be a worthwhile investment with numerous possible narratives and derivatives in the context of ocean governance.

Alumni Networks in Promoting Ocean Leadership

A positive consequence of mainstreaming ocean leadership training through gamification is the creation of a community of ocean leader-gamers. In *The Element: How Finding Your Passion Changes Everything*, Sir Ken Robinson looks at the conditions that enable us to achieve our greatest potential. Among them

1 National Oceanographic Directorate, *Malaysia Ocean Policy 2011–2020* (Malaysia: Ministry of Science, Technology and Innovation, 2010).

is 'finding your tribe' whereby a group of people is connected through a common commitment to the things they feel born to do.[2]

In many ways, the IOI alumni network reflects a tribe, playing a significant role in the development of the Institute through the provision of support in bringing together participants, past and present, and in embodying the ocean mindset to sustain the momentum after the training is over. The IOI has done much to engage with and encourage its alumni to reach out and connect with each other. The alumni have volunteered as IOI Training Program facilitators and subject matter experts and have contributed to numerous publications on the subject. Perhaps, soon, the alumni could find new ways to contribute, such as launching a crowd-funding platform to back the development of gamified learning for ocean governance or contributing their expertise towards creating realistic content for an ocean governance game.

Embracing digital technology to elevate ocean governance training could be a game changer in facilitating information flow, encouraging innovation, and promoting further ocean leadership through the inculcation of the ocean mindset. In the words of Dave Logan in *Tribal Leadership: Leveraging Natural Groups to Build a Thriving Organization*, the alumni could build 'tribes that end up changing the world'.[3]

Conclusion

Capacity building for ocean governance needs to go beyond enhancing knowledge. It requires instilling a mindset and ethics necessary for effective ocean governance. Well-intentioned and well-designed policies will remain ineffective if decision-makers lack the ethics to do what is right for the environment. There is a need to rethink how digital technology can be harnessed in training for ocean leadership and ocean governance. Now, more than ever, there is an urgent need for ocean leadership, and for that we should leverage on the influence of strong alumni networks. The call to mobilize digital technology to elevate ocean governance training should complement conventional training programs.

The IOI Training Program has created a platform for like-minded persons to meet and exchange experiences. It has had a transformational effect on my

2 K. Robinson, *The Element: How Finding Your Passion Changes Everything* (Penguin Books, 2009), c. 5.

3 D. Logan, *Tribal Leadership: Leveraging Natural Groups to Build a Thriving Organization* (Harper Business, 2008).

sense of identity and purpose because the meaningful conversations throughout the program provided the opportunity for testing and validating ideas, inspired action, and demonstrated the power of synergy when people work together. In this tribute essay to Professor Elisabeth Mann Borgese, I would like to register my admiration and appreciation for her foresight, initiative, and commitment to the ocean as a common heritage of mankind.

Simulation and Scenario-Based Learning

Mélanie Fournier
IT IS GIS, Geneva, Switzerland

David Griffiths
International Ocean Institute-Canada, Halifax, Nova Scotia, Canada

Introduction

Every summer, during the first week of the International Ocean Institute-Canada's (IOI-Canada) Ocean Governance Training Program, each participant is asked to select an unmarked envelope. Opening it introduces them to an imaginary world in which they become members of diverse organizations creating an ocean and coastal policy for an imaginary country. For the next two months these mid-career professionals from a wide range of nations, cultures, and languages will engage in an immersive experience that illustrates the benefits, challenges, and opportunities of simulation as a learning and skill-development tool.

Origins

Techniques such as physical simulators, games, and practical learning exercises are nothing new. When ancient Rome committed its army to challenging the maritime power of Carthage, it taught its soldiers basic rowing techniques on simulated ships ashore. That idea evolved through Second World War analog flight and aerial gunnery simulators to today's digitally-powered, sophisticated mock-ups of ships' bridges and engineering spaces. Even board games have had serious uses; chess being the best example. Evolving from a sixth century Indian game called *chaturanga* (Sanskrit for a particular battle formation), it became known in medieval Europe as the 'royal game' because it sharpened strategic thinking.

At a more complex level, 'war games' (*Kriegsspiel* in German) began in 1812 with an ingenious tabletop game to train Prussian army officers. Navies soon adopted the idea, beginning with the United States in 1887. Today, 130 years later, its Naval War College employs approximately 40 full-time civilian and military professionals in its War Gaming Department, conducting an average

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of 50 national and international games per year.[1] The technique is useful not only for learning, but also for problem solving. Several navies incorporated gaming into campaign planning in the Second World War. In the United States,

> the war with Japan had been re-enacted in the game rooms [at the College] by so many people and in so many different ways that nothing that happened during the war was a surprise—absolutely nothing except the kamikaze tactics…[2]

Maritime Governance Applications

Each of these techniques has evolved into today's wide range of powerful and diverse uses. The sophisticated physical simulators at the Canadian Coast Guard College include a Joint Rescue Coordination Centre that not only trains search and rescue personnel but also contributed to international confidence-building when Arabs and Israelis conducted exercises together during the Middle East Peace Process and the subsequent Canadian-led Maritime Safety Colloquium for the Middle East and North Africa in the late 1990s. Board games are used to practice for complex and challenging real-world situations. One example, *Aftershock: A Humanitarian Crisis Game*, has been used in Canadian and American universities, as well as by Canadian, Chilean, and US military and police preparing for peacekeeping and humanitarian and disaster response (HADR) missions.[3]

Despite its bellicose name, 'war gaming' has been adopted and adapted by disciplines ranging from health care to education, ranging in complexity from 'tabletop' discussions to immersive role-play. In higher education, 'reacting to the past' exercises, produced by a consortium of forty universities and colleges, immerse students in historical events in a way that mere lectures or movies never could.[4] IOI-Canada's exercise is another example, but with broader functions and different objectives.

1 Naval War College, *War Gaming* (Newport, RI: Naval War College, n.d.), https://www.usnwc.edu/getattachment/e32b4fba-9daf-4462-9d32-d8a7875f2abb/War-Gaming-Brochure.aspx.

2 Chester W. Nimitz, quoted in *War Gaming*, id, p. 3.

3 "Aftershock: A Humanitarian Crisis Game," PAXsims, https://paxsims.wordpress.com/aftershock/.

4 "Reacting to the Past," Barnard College, https://reacting.barnard.edu/reacting-home.

A Curriculum Integration Exercise

For the past 37 years, IOI-Canada has been conducting a training program, 'Ocean Governance: Policy, Law and Management', for mid-career professionals. During eight intensive weeks, participants are exposed to all the themes reflected in this book through exercises, field trips, and over 100 lectures.[5] How, then, to help them absorb, integrate, and retain all that fact and theory, especially those working in a second or third language?

What began as a simple addition to the program some years ago has evolved into something quite different. Rather than a supplement to the curriculum, it has become an 'integration exercise', a framework for exploring all ideas generated by the program and incorporating them into a coherent whole. Participants become members of a simulated task force creating an integrated ocean and coastal policy for political approval, playing roles as senior officials from all levels of government, the private sector, advocacy groups, and Indigenous peoples. Roles incorporate both complementary and competing policy objectives and are assigned randomly to challenge individuals beyond their familiar experience. This approach even engages lecturers, who are no longer simply speakers but also players in the game—'advisors' to the task force.

The geography is entirely fictional for several reasons; primarily to avoid prejudice or political debate over real situations, but also to create a world in which anything can happen if required to make a point. In an imaginary world, ice floes can appear at the same latitude as tropical mangroves if necessary. The fictional region includes three countries (four counting a failed state over the horizon), which allows the flexibility of varying the scenario each year, or taking a regional approach if the number of participants increases.

As the exercise has evolved, lecturers have gradually drawn upon it for their individual uses. Communication specialists who expose participants to a videotaped interview by a real journalist now pose challenging questions based on the participant's role. Maritime security professionals who conduct an exercise on developing integrated maritime security policy include that as an integral part of the task force's work.[6] Speakers on topics including science, law, aquaculture, energy, fisheries, and marine transport, can all draw on the scenario's geography and socio-economics for hypothetical examples.

The methodology is different from most educational simulations. First and foremost, it is a self-directed learning tool, not a teaching device. Players receive

5 "Training at IOI-Canada," International Ocean Institute-Canada, http://internationaloceaninstitute.dal.ca/training.html.

6 Bob Edwards, "We Need a Navy, Right?" *Canadian Naval Review* 13, no. 1 (Spring 2017): 31–32, http://www.navalreview.ca/volume13-issue1/.

geopolitical facts and details of their role, and are then free to advance the process wherever their collective deliberations take them. There is no director or umpire; only an exercise coordinator playing the role of 'Cabinet Secretary', the senior bureaucratic advisor to government who knows nothing of maritime matters. He or she provides guidance on process, but for purposes of the game reminds task force members that they are the knowledgeable authorities and must rely on whatever they have learned from the curriculum, their colleagues, and their own experience. As mature professionals, they are encouraged to work out how to function as a multinational team and do whatever they would do if they were placed in the real-world situation. The deliverable of the exercise is not a graded policy; it is the process itself. Success equals a diverse group of professionals working as a multicultural team to increase their knowledge, develop their personal and interpersonal skills, and master the challenges.

But if the product is the process, how can success be measured? Traditionally, the annual two-day finale of the program invited guest commentators to assess the policy produced by participants, but as the 'integration exercise' concept evolved, so has that format. The first day is now a simulated conference, with participants, in their roles, playing panelists addressing topics that highlight some of the conflicting issues encountered. Not only does this add to the participant's skill set by being a 'conference speaker' it also enables the commentators to observe the knowledge, abilities, and confidence that they have developed over eight weeks. The final day is for open, unstructured discussion.

Digital Dimensions

Complex, scenario-based interactive learning exercises require creating, managing and displaying a lot of data and information. Consequently, traditional paper-based approaches can be enhanced by incorporating the best of digital technology. That does not necessarily make things easier—using digital tools well requires training and time—but certainly makes the process far more efficient, comprehensive, and effective.

IOI-Canada's first step was using a geographic information system (GIS) to present the geography (Figure 1).[7] This is not just a matter of making credible simulated maps (although that is certainly an asset). Spatial planning is a fundamental tool for ocean and coastal governance, so leaders and managers should at least be familiar with the capabilities and limitations of GIS, as well as the time and effort required to fulfill requests for GIS products. Using GIS to

7 The IOI-Canada Training Program uses ArcGIS (https://www.arcgis.com/) for which Dalhousie University has a license, although participants are advised that there are other options.

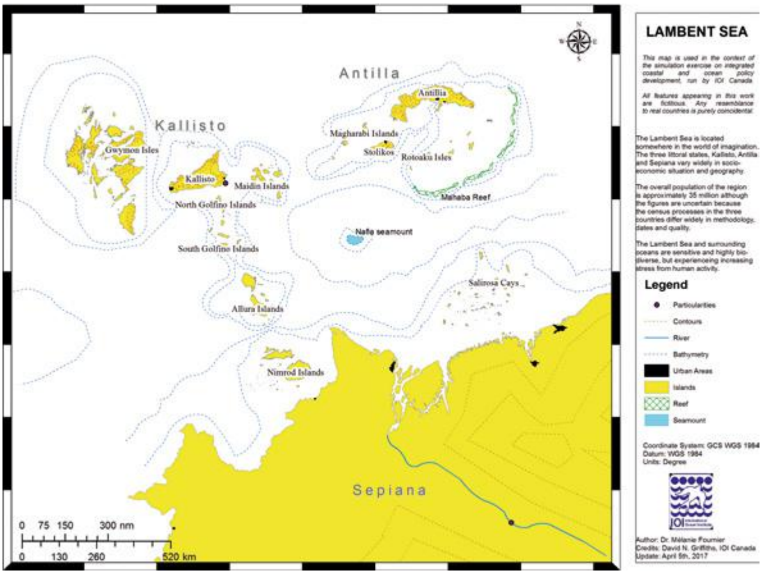

FIGURE 1 IOI-Canada's simulated geography.

establish a readily accessed, maintained, and adaptable geographical database was a first step, but much more is possible.

Increasingly sophisticated digital tools, many freely available, offer significant opportunities for enhancing realism, versatility, visualization and collaborative learning. Vivid digital visualization, for example, harnesses the power of visual perception for understanding and discovery.[8] Collaborative software not only helps participants work together, but also helps them gain confidence in advanced computer skills.[9] A collaborative platform is also an excellent tool in developing complex scenarios.

Developing Integration Exercises

Prominent educators have long understood that techniques for educating adults are different from educating children (the technical term is andragogy versus pedagogy).[10] Adults learn differently, being more self-directed, drawing

8 "The Digital Humanities: Digital Visualization," University of Southern California Libraries, last updated 11 December 2015, http://libguides.usc.edu/c.php?g=235247&p=1560835.

9 A good French language example is Framapad (https://framapad.org/).

10 The term originated in Europe in the 1830s and was popularized in the United States by Malcolm S. Knowles in the 1960s.

on life experience, and preferring active, application-focused practical work. That is why 'serious games' are so useful in educating professionals. Engaging adults in a realistic, dynamic, interactive, yet risk-free environment lets them think creatively about complex issues, experiment with new concepts, practice skills, and learn from mistakes without judgment—often the most effective way of reinforcing lessons. Consequently, participants come away with a good understanding of managing the complex challenges, risks and opportunities of, in this case, ocean and coastal governance, as well as the confidence to apply those lessons.

A curriculum integration exercise differs from many teaching simulations in several ways. No advance preparation is required because its purpose is to build on curriculum material as it unfolds. There are no limiting rules, algorithms or outcome definitions: the product is the process, and where that goes after roles are assigned is wherever participants choose to take it. There is no moderator, umpire or referee; only an unobtrusive guide to process, encouraging players to think critically, to do their own research, and to play the role as if it were real. This makes particular demands on the facilitator since each iteration will unfold differently depending on the makeup of the group and the issues, which mean most to them. The common feature with other complex simulations is that it must evolve continuously or lose relevance. Feedback from participants is essential, and a good facilitation team will always be adding improvements to keep up with curriculum developments and the benefit of experience. To that end, educators and trainers should seek opportunities to participate in other people's simulations to stay abreast of new techniques and technologies, share ideas and, not least, experience what it feels like to be a participant.

Summary

An integration exercise has proved to be an effective self-teaching and skill development tool for adults learning a complex subject. The process can be significantly enhanced with the increasingly sophisticated digital tools; not only to improve the learning process, but also to work with those used in reality. But, just as there is no 'royal road to learning', there is no easy road to creating a complex exercise scenario. Not only is a huge amount of work required to create the geography, socio-economic detail, policy factors, and role descriptions, but all that must be checked and double-checked for consistency, credibility, and continuity. That effort is measured in person-months, not days. If done professionally, it is expensive: if by volunteers, it must be a labor of love. But the benefits are well worth it.

Educating the Ocean Leaders of Today for the Ocean of Tomorrow

Lawrence P. Hildebrand
World Maritime University, Malmö, Sweden

Introduction

The ocean and coastal areas of the world are changing, but we—as societies, economies, and individual decision-makers—for the most part, are not. We are learning that the social-ecological coastal and ocean system of the coming decades will be significantly different from today—physically, energetically, chemically, and biologically. It will also be under rising pressure from social, economic, and technological developments brought about by hundreds of millions more people populating, further developing, and urbanizing these increasingly vulnerable areas. Present governance regimes that frame our laws, policies, and institutions at global and regional levels will have to adapt more quickly and in a more coordinated way than the piecemeal approach to adjusting current regulations taken to date.

So it is imperative that the International Ocean Institute (IOI) develop the capacity of ocean leaders on the magnitude and significance of these changes in the coastal and ocean system itself, on the growing pressure being exerted on its living and non-living resources, and on the evolving approach to ocean governance. We must also emphasize that the next generation of ocean leaders will be equipped with a deep sense of appreciation to take proactive planning decisions today; we must prepare them for this emerging reality and offer the theoretical knowledge and the practical skills and tools that can be applied in coastal nations around the world.

The IOI Training Portfolio

This is where the International Ocean Institute portfolio of training and capacity development courses in ocean governance comes in. It is also where the IOI must enhance, and rigorously build into its strategy and teaching orientation, the steps necessary to ensure that the professionals trained are equipped with ocean-focused vision, knowledge, and skills that will allow them to understand and motivate them to act on the growing evidence and projections

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on the changing ocean and coasts. They must also be fully prepared to take or actively promote practical steps now to adapt, protect, and sustain the coastal and ocean system in this near future of profound change. Carrying on as if these changes are minor or of debatable significance and require no changes on society's part, does not seem like a rational plan.

The core of the IOI capacity development courses over the years has proven to be sound.[1] They provide in-depth coverage of the legal, scientific, social, ethical, moral, economic, and ecological dimensions of ocean governance and address the holistic and interconnected nature of the ocean, coasts, and human well-being. The knowledge and skills imparted to participants—comprehension of the wider engagement in ocean governance beyond their areas of specialization; communication and negotiation skills; policy formulation and rule-making; sustainable ocean governance practices; and identifying current and, now more than ever, future challenges to ocean governance—prepares these ocean leaders for the ocean challenges of today and tomorrow. This has worked well for decades. But as detailed below, the ocean and coastal system is changing rapidly and fundamentally, and the IOI training and capacity development programs must similarly adapt and stay ahead of this curve.

The Changing Coasts and Ocean

Coastal and ocean areas are under assault from both the land and the sea. From the land, we continue to discharge carbon, nitrogen, and other emissions into the atmosphere and inadequately treated effluents and their constituent chemicals from cities, industries, and farms into our coastal waters.[2] We destroy critical coastal habitats such as beaches, mangroves, coral reefs, and seagrass beds for coastal development and economic growth[3] in a process referred to as ocean sprawl.[4] We continue to deplete fish stocks, both legally and illegally at an alarming rate.[5] And now, many coastal nations are expanding

1 "The International Ocean Institute," *Ocean Yearbook* 31 (2017): xvi–xxii.

2 A. Borja, et al., "Overview of Integrative Assessment of Marine Systems: The Ecosystem Approach in Practice," *Frontiers in Marine Science* 3, no. 20 (2016), doi.org/10.3389/fmars.2016.00020.

3 L.H. Pendleton, O. Thebaud, R.C. Mongruel, and H. Levrel, "Has the Value of Global Marine and Coastal Ecosystem Services Changed?" *Marine Policy* 64 (2016): 156–158.

4 E.C. Heery, et al., "Identifying the Consequences of Ocean Sprawl for Sedimentary Habitats," *Journal of Experimental Marine Biology and Ecology* 492 (2017): 31–48.

5 Food and Agriculture Organization of the United Nations (FAO), *The State of the World Fisheries and Aquaculture: Contributing to Food Security and Nutrition for All* (Rome: FAO, 2016).

or pursuing new ocean uses under the banner of a Blue Economy,[6] whether reasonable or not, sustainable or otherwise.

A seminal report by the Organisation for Economic Co-operation and Development (OECD) on the ocean economy in 2030 highlights several important demographic, economic, social, environmental, technological, and governance trends, as well as major uncertainties and risks, that are influencing world developments and, by extension, the ocean economy and marine ecosystem health.[7] The OECD reports that a wide range of global trends and macro-factors are set to influence the longer-term development of the ocean economy. We can expect that their combined effect will cut both ways. On the one hand, many of these developments hold out the promise of expanding economic, social, and health-related opportunities through ocean use; on the other, they point to a further increase in the pressures already weighing heavily on the ocean's capacity and health. At the heart of expansion in the ocean economy are population growth, urbanization, and migration to and development of coastal areas. Rising incomes and the growing middle classes with higher-end dietary choices and consumer appetites are adding to the pressure. Ageing populations in developed countries will also continue to favor coastal areas for vacation and/or retirement homes and motivate the medical and pharmaceutical communities to accelerate marine biotechnological research into new drugs and treatments. All of this is bringing increased pressure on the coasts and the ocean. Indeed, our uses and abuses of the ocean to date have seriously compromised the very foundations of the ocean and coastal system and led to growing marine environmental degradation and the consequent costs of an under-performing ocean economy, loss of essential ecosystem goods and services (which largely sustain the former), increased use conflicts, and challenging legal questions.[8]

An Existential Threat

The profound changes that are taking place on our coasts and in our ocean represent, quite frankly, an existential threat to our societies, economies, and ways of life. In addition to the traditional pressures discussed above, the ocean

6 United Nations Environment Programme (UNEP), *Blue Economy: Sharing Success Stories to Inspire Change*. UNEP Regional Seas Report and Studies No. 195 (Nairobi: UNEP, 2015).

7 Organisation for Economic Co-operation and Development (OECD), *The Ocean Economy in 2030* (Paris: OECD, 2016), doi.org/10.1787/9789264251724-en.

8 Global Ocean Commission (GOC), *The Future of Our Ocean: Next Steps and Priorities* (New York: GOC, 2016).

is now warming, rising, deoxygenating, and acidifying,[9] and filling with plastic at an alarming pace.[10] The Intergovernmental Panel on Climate Change highlights that storms are becoming more frequent and intense, and precipitation patterns and ocean currents are shifting. Coasts are also eroding at an accelerating pace, coastal aquifers are being inundated with salt water, fish stocks are overexploited and depleted, coral reefs are dying, and mangroves and seagrasses are being lost. We are also witnessing early-stage changes in the distribution, composition, and abundance of many living marine resources and system-changing regime shifts in several ocean ecosystems.[11]

Our most vulnerable coasts, particularly deltas, estuaries, and low-lying coasts and islands, already under considerable stress, are now receiving the majority of a growing global population (2.2 billion more people by 2050). Coastal settlements are growing rapidly and are increasingly urban with all that entails (consumption, energy use, waste disposal, and subsidence). We are also aggressively modifying, developing, and armoring the coast to accommodate our growing societies and economies.[12] Yet we cling stubbornly to the view that we can continue to live safely and even more intensively at the water's edge, that we can develop and modify the coast and its social-ecological structure at will without consequences, and that the ocean will continue to provide the goods and services where and at levels we have traditionally relied upon them. These do not seem to be reasonable assumptions or sensible planning scenarios. Neither are they an acceptable *status quo* in the IOI capacity development syllabi.

Common sense would have societies initiate and undertake proactive steps today, including, *inter alia*, managed retreat from vulnerable coastal areas, protecting and restoring the coastal habitats that sustain and protect us, implementing future-oriented ecosystem-based fisheries management, developing alternative livelihoods, and preparing for climate migration.[13] For the

9 Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Synthesis Report, Contribution to Working Groups I, II and III to the Fifth Assessment Report of the IPCC* (Geneva: United Nations, 2014).

10 M. Eriksen, et al., "Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea," *PLoS ONE* 9, no. 12 (2014): e111913, doi.org/10.1371/journal.pone.0111913.

11 United Nations, Division for Ocean Affairs and the Law of the Sea, Office of Legal Affairs, *First Global Integrated Marine Assessment* (New York: United Nations, 2016).

12 B. Neumann, A.T. Vafeidis, J. Zimmermann, and R.J. Nicholls, "Future Coastal Population Growth and Exposure to Sea-level Rise and Coastal Flooding—A Global Assessment," *PLoS ONE* 10, no. 3(2015): e0118571, doi.org/10.1371/journal.pone.0118571.

13 L.P. Hildebrand and N.A. Bellefontaine, "Ocean Governance and Sustainability" in *Shipping Operations Management*, eds. I.D. Visvikis and P.M. Panayides (New York: Springer International, 2017), 231–248.

most part, unfortunately, we are moving in the opposite direction. What does this trajectory hold for our societies and economies, and what should be the training and capacity development priorities the IOI must emphasize and impart?

Future Orientation

Looking further into the future, the coasts will not be where or as they are today (eroded and flooded), coastal cities, large and small, as well as some island nations will be lost, the fish and other living marine resources that so many of our societies are tied to spatially and dependent on today will not be available to us (overexploitation, redistribution and regime shifts), and climate conditions will make many areas uninhabitable.[14] How will society cope and how does the IOI prepare the ocean leaders for this future?

We do so by adding stronger emphasis in the IOI training curriculum on providing a more in-depth understanding of the conditions we will face in a future ocean. The curriculum must be updated and more future oriented to understand and present the profound changes the ocean system is undergoing and the steps we need to take today, to prepare for this new reality.

To test this approach, I posed a question in a course assignment in 2017 in the Master of Science specialization ocean sustainability, governance, and management at the World Maritime University, Sweden, a course inspired by the IOI capacity development course syllabi. The challenge posed and the question issued to the students was to research and document the projected changes to the coastal and ocean ecosystems of their country in 2050 and discuss what this will mean for the national economy, society, and communities. The second part of the assignment required them to develop a national plan of action that could respond to these projected changes and could be initiated today. The students found the future-orientation of this assignment challenging and highly relevant and explored it with open, but uncertain minds. While their findings made clear to them the significant scope of the changes coming to their national coastal zones (e.g., complete loss of beach systems and associated gross domestic product, flooding of communities and major infrastructure), their recommended goals were, at best, aspirational in scope (e.g., achieve a sustainable Blue Economy). And the recommended action was disappointingly timid (e.g., need for better education and stronger political will).

14 L.V. Weatherdon, et al., “Observed and Projected Impacts of Climate Change on Marine Fisheries, Aquaculture, Coastal Tourism, and Human Health: An Update.” *Frontiers in Marine Science* 3, no. 48 (2016), doi.org/10.3389/fmars.2016.00048.

This exercise demonstrated that even when we are presented with, or discover for ourselves through research, the dramatic changes coming to most coastal and ocean social-ecological systems, we find it difficult to imagine and push for the bold actions that will be required to prepare us for these changes. Clearly, contemplation will not suffice. Therefore, the IOI portfolio of ocean governance capacity development courses must place much more emphasis going forward on providing an in-depth understanding of the profound changes that are coming to our coastal and ocean communities, societies, and economies. We must be working with our course participants on bold, but practical, actions that will prepare and empower them to lead the adaptation to the future ocean. In other words, the IOI courses need to be about ocean literacy—understanding the ocean's influence on us and our influence on the ocean—with a focus on preparing for change.

Strategic IOI Initiatives for Developing Capacity in Ocean Governance

Peter W. Leder
International Ocean Institute, Malta

Daniel E. Lane
International Ocean Institute-Canada and Centre de recherche marine, Université Sainte-Anne, Petit de Grat, Nova Scotia, Canada

Introduction

This essay outlines challenges of future ocean governance and the strategic efforts of the International Ocean Institute (IOI) toward achieving the United Nations Sustainable Development Goals, in particular SDG 14, postulated at the Rio+20 Conference.[1] Major challenges arise from marine and coastal environmental, policy, and knowledge issues related to the changing climate, pressures on coastal and ocean development, and the international management of limited ocean resources. These challenges call for strategic initiatives with a focus on international ocean governance and developing capacity for effective local institutional arrangements, together with integrated ocean literacy and human resource development programs that incorporate research and promote continuous improvement.[2]

Strategic IOI Principles—Looking Back, Looking Forward

Elisabeth Mann Borgese, the founder of the IOI, emerged as an energetic proponent of a new ocean governance paradigm during the late 1960s. She saw the ocean as a significant frontier of humankind for the realization of a shared, secure zone and peaceful space for nations to behave and interact in a manner consistent with sustainable marine environmental use beyond national borders. She espoused the concept of 'sustainable management' based

1 "Sustainable Development Goals," United Nations, http://www.un.org/sustainabledevelopment/sustainable-development-goals/, last visited 13 February 2018.
2 This essay presents the personal views of the authors and does not necessarily represent the views of the International Ocean Institute.

 | DOI:10.1163/9789004380271_020

on equity and on a participatory, bottom-up system of decision-making as the future of ocean governance. The realization of the principles described below characterizes the IOI's perspective on the future of ocean governance and lays the foundation for the establishment of IOI strategic initiatives.[3]

The Principle of Common Heritage of Mankind. In 1967, Malta's Ambassador to the United Nations, Arvid Pardo, urged the UN General Assembly to recognize that resources of the seabed beyond the limits of national jurisdiction are the common heritage of mankind.[4] Pardo's initiative led to global efforts toward advancing the United Nations Convention on the Law of the Sea including the principle of the common heritage of mankind and reserving the ocean for peaceful purposes. As a common heritage space, the IOI supports the idea that the ocean cannot be owned, that all nations share ocean resources benefits and do not allow military installations in territorial commons areas, and that the ocean must be preserved for the benefit of future generations.[5]

Coastal and Ocean Security. For the IOI, the concept of coastal and ocean security includes social and human rights, as well as consideration of economic and environmental priorities of coastal communities. Regional co-operation for peaceful purposes, including joint surveillance and enforcement of regulations on peaceful uses and humanitarian operations, offers safeguards for regional security under the United Nations *Agenda for Peace*.[6]

Sustainable Development. The contribution of the ocean to the sustainable development of living and non-living resources is fully recognized in SDG 14, 'Life below water', with the stated goal to "conserve and sustainably use the oceans, seas and marine resources for sustainable development,"[7] while reducing negative anthropogenic impacts. The ocean provides sustainable nutritional sources from capture fisheries and aquaculture and makes a significant contribution to food and water security. Continued growth of energy from

3 E. Mann Borgese (ed.), *Peace in the Oceans: Ocean Governance and the Agenda for Peace Proceedings Pacem in Maribus XXIII, Costa Rica, 3–7 December 1995*, Intergovernmental Oceanographic Commission Technical Series No. 47 (Paris: UNESCO, 1997).

4 United Nations General Assembly, "Agenda Item 92," Twenty-second Session, First Committee, 1515th meeting, 1 November 1967, http://www.un.org/depts/los/convention_agreements/texts/pardo_ga1967.pdf.

5 J. Frakes, "The Common Heritage of Mankind Principle and the Deep Seabed, Outer Space, and Antarctica: Will Developed and Developing Nations Reach a Compromise?" *Wisconsin International Law Journal* 21 (2003): 409–434.

6 United Nations Secretary-General, "An Agenda for Peace," UN Doc. A/47/271, S 2411, 17 June 1992.

7 "Sustainable Development Goals: Goal 14—Life below water," United Nations Development Programme (UNDP), http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-14-life-below-water/, last visited 13 February 2018.

coastal and offshore regions in the form of hydrocarbons, the petrochemical sector, and renewable energy from wave, tidal, and wind power means that the ocean is key to sustainable energy development. As one of the world's largest industrial sectors, travel and tourism[8] have an important ocean presence encompassing cruise ships, sport fishing, sailing, surfing, swimming, sun-bathing, and eco-tourism, together with the supporting industries, and increased opportunities for sustainable coastal economic development. For the IOI, the sustainable development of all the aforementioned activities—now and in the future—are dependent on a system of responsible ocean governance.

Education and Development of Human Resources. Education and the development of human resources is the most important contribution of ocean development to the economic security of states. The IOI affirms that the rich resources acquired by states through their exclusive economic zones (EEZs) can only be realized through skilled human resources with scientific, technological, and management capacities for the ocean. This realization highlights interdisciplinary training and education and emergent forms of ocean governance and information technology associated with sustainable ocean management. The IOI is committed to providing ocean literacy in support of future ocean governance.

Major Challenges for Ocean Governance

The IOI's recently consolidated global network of operational centres and focal points, as well as its reorganized financial administration and management structures, are aimed to cope with the emerging challenges to the future of ocean governance. These major challenges are categorized as marine and coastal environmental, policy, and knowledge challenges.

Marine and Coastal Environmental Challenges. Uncontrollable environmental events affect the marine and coastal ecosystems and may have detrimental consequences on the physical environment. Environmental challenges arise from (i) global warming trends from the increasing presence of greenhouse gases in the atmosphere; (ii) increased frequency and severity of coastal storms; (iii) resource shifts attributed to changes in stock abundance, and spatial and seasonal redistribution of marine species; and (iv) increased human activity in the coastal zone. Extreme environmental events pose a serious threat to coastal and ocean security, and diminish management efforts to maintain sustainable development activities.

8 See "Global Travel and Tourism Industry—Statistics & Facts," *The Statistics Portal*, https://www.statista.com/topics/962/global-tourism/, last visited 13 February 2018.

Policy Challenges. The changing coastal environment presents acute management and policy challenges and threatens coastal community sustainability. Policy is required to institutionalize the principle of the common heritage of mankind through enforcement of the concepts of the peaceful uses of regional seas for sustainable development and maritime zones of peace. Ocean governance policy based on the strategic IOI principles of sustainable development and our common heritage recognizes (i) the need to define community priorities, vulnerability, resilience, and adaptive capacity over strategic planning periods; (ii) the establishment of a hierarchical chain of local, regional, and national decision-making authority; (iii) the development of ocean and coastal management plans based on precautionary and ecosystem-based approaches, as well as preparedness measures and emergency plans for extreme events; and (iv) the institutionalization of an ocean literacy program.[9]

Knowledge Challenges. Research and training are required to support policy challenges. Knowledge challenges influence the IOI principles of education and development of human resources. Ocean governance research presents particular challenges for (i) establishing a new 'ocean information baseline' to enable closer coastal community engagement and participation for collecting and validating unique local data; (ii) developing interdisciplinary and local adaptation strategies;[10] (iii) defining coastal community preparedness measures to account for physical, socio-economic, and cultural human impacts; (iv) developing new institutional arrangements to deal with the preparation, emergency planning, and decision analysis for extreme events; and (v) integrating stakeholders in education, training, and applied research processes. IOI resources focus on ocean governance training, education, and capacity development initiatives supported by pertinent publications and public outreach, and facilitated by international partnerships.

Strategic IOI Initiatives

The IOI principles and the marine and coastal environmental, policy and knowledge challenges act together to determine strategic IOI initiatives for ocean governance. The IOI initiatives respond to the challenges by (1) developing capacity toward defining an effective ocean governance

9 D.E. Lane, C. Mercer Clarke, D. Forbes and P. Watson, "The Gathering Storm: Managing Adaptation to Environmental Change in Coastal Communities and Small Islands," *Sustainability Science* 8, no. 3 (July 2013): 469–489.

10 D.E. Lane, "Planning in Fisheries-related Systems: Multicriteria Models for Decision Support," in *Handbook on Operations Research in Natural Resources*, eds., A. Wentraub et al. (Springer, 2007), 237–272.

institutional framework; (2) providing ocean literacy in support of national institutions and for the ongoing delivery of applied ocean research; and (3) improving international outreach and communication.

Developing Capacity for Ocean Governance Institutions. The IOI affirms the need for new ocean governance institutions for all coastal nations and commits to supporting initiatives that align the IOI principles to institutional development. Ocean governance institutions respond directly to major policy challenges. Through its strategic outreach programs, the IOI supports the establishment of ocean governance institutions characterized by levels of local, regional, and national authority, supporting legislation, collaborative arrangements, and the appropriation of funds for management operations and research.

The ocean governance institution is authorized through established strategic ocean management plans based in statutory law with a clear mandate and the authority and responsibility to make decisions. Decision-making in the institution includes the capacity to evaluate and analyse options through effective strategic planning, while monitoring and tracking measures the impacts and outcomes of decisions taken. Local institutions are responsible for decision-making on sewage treatment, water management, coastal development and zonal planning, access and allocation for inshore and nearshore fisheries and aquaculture and energy projects, marine conservation planning, and commercial and recreational marine activities. At the regional and national levels, governance mechanisms are established for integrating local coastal and ocean management plans, formulating and implementing national oceans policy, and the assurance of prioritized resources for implementation. The budgets of ocean governance institutions for coastal nations are designed to achieve the goals of SDG 14 and their designated mandates. Sources of budgetary funding for ocean governance institutions should be prioritized by national governments.

The 'participational structures' at the local governance level are pioneered by Agenda 21 and its concepts of "integrated coastal and marine management."[11] This collaboration brings together local government, non-governmental organizations, academic institutions, political leaders, business and professional communities, the media, and the public at large in the decision-making process. Collaborative policy ensures that decisions are compatible with the core cultural values of the coastal communities and the integration of traditional indigenous knowledge. Collaborative ocean policy also integrates natural science with social science information.

11 United Nations Secretary-General, *supra* note 6.

The IOI seeks to extend its mission to promote effective ocean governance institutions and structures internationally. The IOI has the unique opportunity to define ocean governance institutions and provide assistance to coastal nations as they prepare their new institutional arrangements. This role aligns the IOI training and education program with the delivery of policy and knowledge responses to the stated challenges. Based on the fundamental principles of the IOI's vision, mission, and goals,[12] an international network of ocean governance institutions is envisioned as the key delivery of Elisabeth Mann Borgese's legacy. For the IOI, ongoing institutional funding is assumed from IOI's main donor, the Ocean Science and Research Foundation, to maintain IOI's independence from changing political trends and economic agendas.

Ocean Literacy and Support for Research. Education, training, and applied research in coastal and ocean science, engineering, management, and socio-economics support the ongoing activities of ocean governance institutions and the ocean industry. Ocean governance institutions embrace careers in the ocean sector developed by virtue of education and training programs. The IOI, as an experienced and credible 'honest broker', holds a strong strategic position as an international leader for the delivery of global ocean education and training in support of ocean governance institutions and in response to knowledge challenges. Accordingly, the IOI mission to "conduct training and education for developing capacity to meet the crucial demand for knowledgeable future leaders in ocean governance" is critical.[13] The IOI strives for accreditation and certification of its training courses to ensure that they remain a global benchmark for high-quality, state-of-the-art capacity development programs in ocean governance education. This includes expanding IOI outreach through Internet-based training offerings, and open access to relevant documents and research papers through the IOI-supported publications *World Ocean Reviews* and the annual *Ocean Yearbook*.[14]

Finally, the IOI actively relies on coastal and ocean natural and social science researchers in the presentation of its training and education programs. While not a central activity of the IOI, inherent research capacity is retained through affiliation with universities hosting IOI centers and through networks of senior research fellows and international and regional ocean institutions. These ties ensure that cutting-edge information and current scientific, legal,

12 "IOI Vision, Mission and Goals," International Ocean Institute (IOI) (2015), https://www.ioinst.org/about-1/vision-mission-and-goals/.

13 Id.

14 "Publications," IOI (2016), https://www.ioinst.org/publications-1/; see also *World Ocean Review* website, https://www.ioinst.org/publications-1/ and *Ocean Yearbook* website, https://brill.com/view/serial/OCYB.

and policy developments are integrated into all practical IOI activities to support ocean governance.

International and Alumni Outreach. As a strategic priority, IOI maintains memoranda of understanding with key partners in the sphere of ocean affairs, capacity development, and education. Experts who lecture in IOI training courses ensure that current scientific and political knowledge is included in our courses. The IOI promotes responsible ocean governance at all levels of co-operation, for example, the United Nations, the Commonwealth, national development agencies, and regional initiatives. The IOI enjoys special consultative status with the United Nations Economic and Social Council and with other UN specialized agencies.

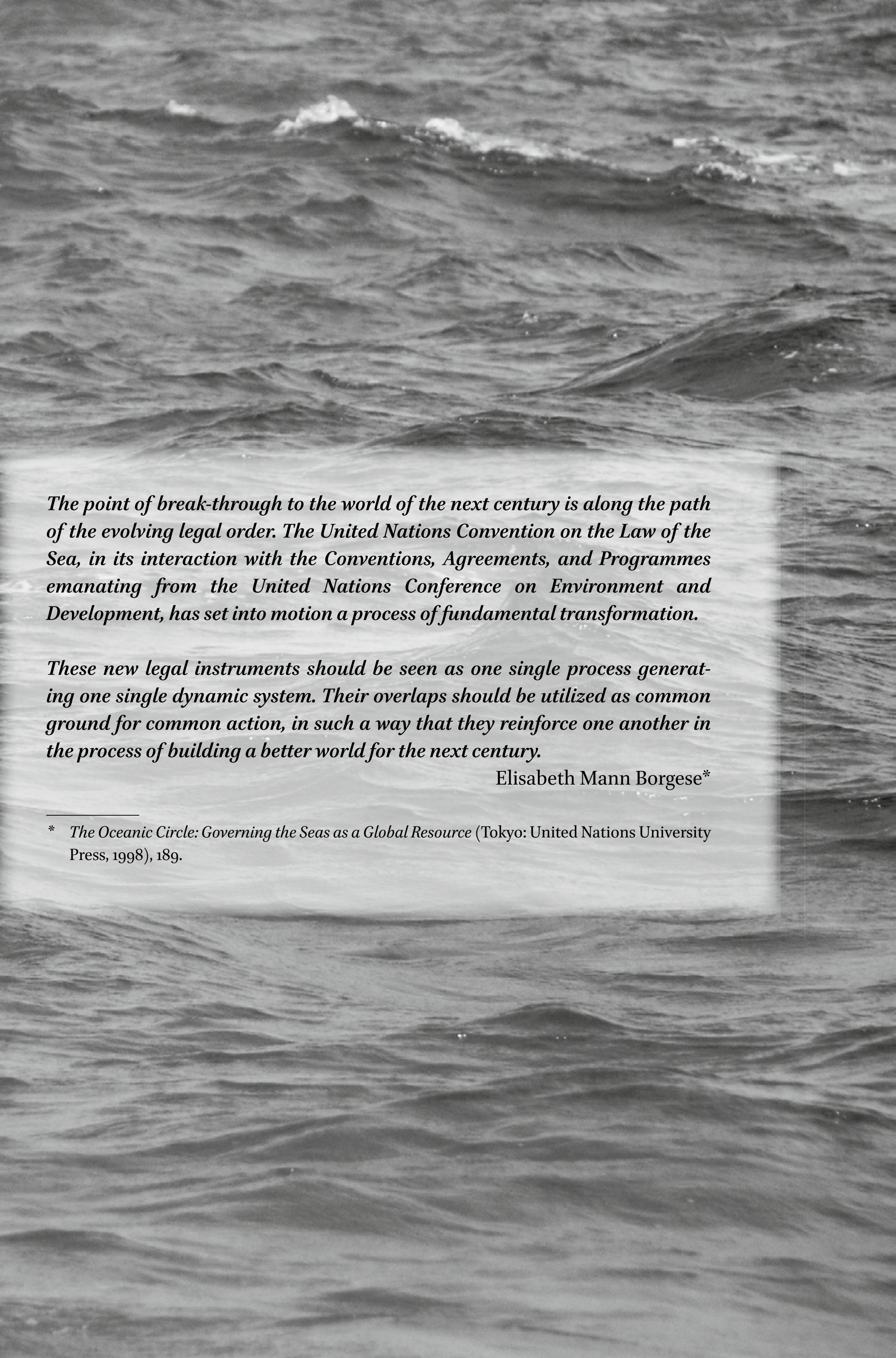
The IOI's network of thousands of alumni comprises country leaders, ministers, ambassadors, scientists, politicians, negotiators, and leading employees of government authorities and academic institutions. Many IOI alumni are professionals in maritime affairs and are dealing daily with issues related to ocean governance. As a strategic initiative, the IOI will increase its efforts to mainstream experience and knowledge of alumni back into IOI's activities and training offerings. This will benefit the developing international ocean governance community and future IOI course participants.

Summary

The future outlook of the IOI in participating in the delivery of ocean governance is optimistic. Elisabeth Mann Borgese inspired the vision, mission, and goals of the IOI to consider the ocean as a common heritage for humankind and to adopt the *Agenda for Peace*. Through its strategic initiatives for developing capacity in ocean governance, the IOI takes up the challenge to influence coastal nations toward establishing ocean governance institutional arrangements and delivering the goals of SDG 14. The IOI's capacity to deliver its ocean literacy mission is dependent on the international community's willingness to prioritize the place of the oceans, to establish an international network of ocean governance institutions, and to support ocean education and applied research.

PART 3

Law of the Sea and Principled Ocean Governance



The point of break-through to the world of the next century is along the path of the evolving legal order. The United Nations Convention on the Law of the Sea, in its interaction with the Conventions, Agreements, and Programmes emanating from the United Nations Conference on Environment and Development, has set into motion a process of fundamental transformation.

These new legal instruments should be seen as one single process generating one single dynamic system. Their overlaps should be utilized as common ground for common action, in such a way that they reinforce one another in the process of building a better world for the next century.

Elisabeth Mann Borgese*

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* *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 189.

Introduction

Editor: Moira L. McConnell

Elisabeth Mann Borgese's commitment to the law of the sea and her role in the development of the 1982 United Nations Convention on the Law of the Sea (UNCLOS) is well known, as is her life-long advocacy for its implementation as a way to bring about a change to the international socio-economic system. Elisabeth's faith in the role of international law as a 'break-through' point[1] (see quotation on facing page) on the road to system transformation may seem surprising as she was not a lawyer; many, especially political scientists, might question both the role and importance of international law as a force for social change. However, she was neither uninformed nor was she naïve. She was a political scientist with a sophisticated appreciation of the role of institutions and power relations, or, as she described the law of the sea negotiations in a 1976 meeting, the "grand game."[2] This meant she was able to adapt to, and appreciate, the importance of the interaction between the rapidly changing post-colonial political context and the necessary evolution of the international legal system. Even as early as the mid-1970s she foresaw the development of international law to include more diverse forms of legal obligations that have various names and levels of enforceability, now called 'principles', 'guidelines', and 'codes', for example, with the terminology of 'governance' as way to bring about wider global agreement and implementation action.

As many of the essays in this part illustrate, Elisabeth was engaged in a bigger project than merely updating or modernizing the law of the sea. She and others of like mind were engaged in a quest for a system-wide change in global governance. The world's oceans as the common factor among states were seen as an avenue, a medium, to achieve wider social and economic justice and improved global governance. In an important meeting in 1976 she spoke of the oceans as a 'test case' to establishing this new order for global governance.[3]

The essays focus on several key aspects of the law of the sea and principled ocean governance that Elisabeth emphasized as central. These include the promotion of the goals of the movement for a New International Economic

1 E. Mann Borgese, *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 189.

2 See, Elisabeth Mann Borgese Fonds, "The New International Economic Order and the Law Of The Sea, Seminar organized jointly by UNITAR and the International Ocean Institute, 7–8 April 1976," Dalhousie University Archives, Halifax, Canada, MS-2-744, Box 301, Folder 2.

3 Id.

Order, although it no longer exists as a political force, through the common heritage and related provisions adopted in 1982 in UNCLOS. This was the result of what is described in an essay in this part as the 'package deal' approach to reaching agreement. This aspect was also perhaps a disappointment as she described this part of UNCLOS as its "centerpiece" albeit "fundamentally flawed: shaped by political and ideological compromise rather than responding to the needs of a modern high-tech undertaking."[4] As these essays also demonstrate, she was prescient in foreseeing the potential far-reaching evolution of UNCLOS after 1982, such as the agreement related to fisheries or the forthcoming agreement related to biological and other resources in areas beyond national jurisdiction. In that respect these essays demonstrate the importance she placed on maritime boundary delimitation and the institution and system for resolution of disputes as essential in establishing a new legal order, beginning with the world oceans.

In her later years Elisabeth began to be more concerned with technology and science and she spoke less of law. In two essays published in the *Ocean Yearbook* in the two years before her death she wrote of the "The Crisis of Knowledge," referring mainly to the impact of the high level of uncertainty and understanding about technological developments in all ocean sectors.[5] A concern about the rapid development of technology and the widening gap between the developed and less developed economies was also the theme of one of her last essays, which reported on a meeting of United Nations Open-Ended Informal Consultative Process on the Oceans and the Law of the Sea.[6] Thus Elisabeth's concern returned always to the quest for a new world order and greater equity and for peace.

4 Mann Borgese, *supra* note 1, 112.

5 E. Mann Borgese, "The Crisis of Knowledge," *Ocean Yearbook* 15 (2001): 1–6.

6 E. Mann Borgese, "UNICPOLOS: The Second Session," *Ocean Yearbook* 16 (2002): 22–34.

Edging Towards Principled Ocean Governance: Law of the Sea and Beyond

David L. VanderZwaag
Marine & Environmental Law Institute, Dalhousie University,
Halifax, Nova Scotia, Canada

Introduction

Elisabeth Mann Borgese is well known for her commitment to advancing the legal order for the improved regulation of the world's oceans. Her advocacy with respect to the United Nations Convention on the Law of the Sea (UNCLOS)[1] is the subject of other essays in this volume. However, in the decades since 1982, legal principles, sometimes linked to provisions in treaties, have become critical in the global quest for sustainable seas and healthy coastal communities. Principles, such as precautionary and ecosystem approaches, have influenced the negotiation, implementation, and interpretation of international agreements.[2] They may also guide national ocean law and policy reforms, for example, encouraging adoption of integrated coastal and ocean management approaches and enhancement of public participation in ocean-related decision-making.[3]

The continued importance of principles and the long list of what are considered to be key ocean governance principles can be seen in the 2016–2017 UN Preparatory Committee discussions trying to hammer out possible elements for a new international agreement for the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction.[4] Wide convergence

* The research support of the Social Sciences and Humanities Research Council of Canada (SSHRC) through the OceanCanada Partnership Grant is gratefully acknowledged, as is the support of the Marine Environmental Observation Prediction and Response Network, based at Dalhousie University and funded by the Government of Canada's Networks of Centres of Excellence Program. The research assistance of Jamie Gamblin, J.D. candidate, Schulich School of Law, is also recognized.

1 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3 [UNCLOS].

2 P. Sands et al., *Principles of International Environmental Law*, 3rd ed. (Cambridge: Cambridge University Press, 2012), 94–134.

3 D.R. Rothwell and D.L. VanderZwaag eds., *Towards Principled Oceans Governance: Australian and Canadian Approaches and Challenges* (London: Routledge, 2006).

4 See the essay by David Freestone in this volume.

was reached on what key principles might be included in a future agreement. Among others, they are sustainable development; ecosystem approach; precaution; integrated approach; science-based approach, using the best available scientific information and knowledge, including traditional knowledge; adaptive management; polluter pays principle; public participation; transparency and availability of information; and good faith.[5]

Getting a firm grip on ocean governance principles is difficult for at least five reasons. First, the term 'principle' is itself slippery with other terms sometimes used interchangeably such as concept, approach, and norm.[6] An especially confusing terminological issue is whether the terms ecosystem approach and ecosystem-based management are synonymous, or whether they represent different paradigms.[7] Second, the legal status of principles is often uncertain, whether they are legally binding or merely 'soft law'.[8] Third, the practical implications of principles are often contested, for example, as to the precautionary measures required by the precautionary principle.[9] Fourth, the definitions of principles may vary, for example, some versions of the precautionary principle call for measures to be cost-effective while others do not.[10] Fifth, the interrelationship of principles tends to be confusing, for example, the relationship between the preventive principle and the precautionary approach.[11]

This essay provides an overview of how the international community has edged forward in developing ocean governance principles. Principles emanating from the UNCLOS and its progeny, such as the Rio Declaration on Environment and Development (Rio Declaration),[12] are summarized and the importance of UN General Assembly (UNGA) resolutions and processes in promoting principled ocean governance is highlighted. This is followed by a

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5 United Nations General Assembly (UNGA), Report of the Preparatory Committee established by General Assembly resolution 69/292, UN Doc. A/AC.287/2017/PC.4/2 (2017).

6 S. Schiele, *Evolution of International Environmental Regimes: The Case of Climate Change* (Cambridge: Cambridge University Press, 2014), 104–118.

7 C. Engler, "Beyond Rhetoric: Navigating the Conceptual Tangle Towards Effective Implementation of the Ecosystem Approach to Oceans Management," *Environmental Reviews* 23 (2015): 288–320; K.A. Waylen et al., "The Need to Disentangle Key Concepts from Ecosystem-Approach Jargon," *Conservation Biology* 28, no. 5 (2014): 1215–1224.

8 E. Hey, *Advanced Introduction to International Environmental Law* (Northampton, MA: Edward Elgar, 2016), 53–55.

9 S.A. Atapattu, *Emerging Principles of International Environmental Law* (Ardsley, NY: Transnational Publishers, 2006), 208–273.

10 S. Marr, *The Precautionary Principle in the Law of the Sea* (The Hague: Martinus Nijhoff, 2003), 38–40.

11 A. Trouwborst, *Evolution and Status of the Precautionary Principle in International Law* (The Hague: Kluwer Law International, 2002), 35–44.

12 31 *I.L.M.* 874 (1992).

brief consideration of the role of the Food and Agriculture Organization of the United Nations (FAO) in developing principled approaches to fisheries and aquaculture. The essay also reviews the contributions of key multilateral arrangements and agreements, such as the Convention on Biological Diversity (CBD),[13] to the evolution of principles. The role of courts and tribunals in interpreting ocean-related principles is not addressed.[14]

UNCLOS and Its Progeny

Besides the 'common heritage of mankind' principle, UNCLOS is noted for articulating three other governance principles.[15] First, the protection and preservation of the marine environment principle is set out in Article 192 as an unqualified obligation.[16] Second, Article 194, paragraph 2, affirms the principle of preventing transboundary harm. While this principle is considered an obligation under customary international law,[17] UNCLOS expands the obligation to include a responsibility by states to prevent the spread of pollution beyond their zones of maritime jurisdiction. Third, the principle of co-operation also receives broad support in multiple UNCLOS provisions, for example, Article 197 requires states to co-operate on global and regional levels in developing international rules and standards for the protection and preservation of the marine environment. Co-operative conservation efforts are required for fish stocks not recognizing national boundaries including stocks shared across exclusive economic zones (EEZs), stocks straddling EEZs and the high seas, high migratory species, marine mammals, anadromous stocks, and catadromous stocks.[18] States are also obligated to co-operate in the conservation and management of living resources in areas of the high seas.[19] States bordering on enclosed or semi-enclosed seas are encouraged to co-operate in managing living

13 Rio de Janeiro, 5 June 1992, 1760 *U.N.T.S.* 79 [CBD].

14 T. Stevens, *International Courts and Environmental Protection* (Cambridge: Cambridge University Press, 2009); D.L. VanderZwaag, "The ICJ, ITLOS and the Precautionary Approach: Paltry Progressions, Jurisprudential Jousting," *Hawaii Law Review* 35 (2013): 617–632.

15 T. Stephens and D.R. Rothwell, *The International Law of the Sea* (Oxford: Hart Publishing, 2010), 474–475. See also the essay by Prue Taylor in this volume.

16 D. Freestone, "Principles Applicable to Modern Oceans Governance," *The International Journal of Marine and Coastal Law* 23 (2008): 385, 387.

17 P-M. Dupuy and J.E. Viñuales, *International Environmental Law* (Cambridge: Cambridge University Press, 2015), 58–60.

18 UNCLOS, *supra* note 1, arts. 63–67.

19 Id., arts. 118–119.

marine resources, protecting and preserving the marine environment, and in marine scientific research.[20]

Since UNCLOS does not include specific provisions spelling out legal principles, there might be some argument over whether it also includes other principles. For example, the Preamble recognizes a version of the integration principle which matured after the adoption of UNCLOS: "*Conscious* that the problems of ocean space are closely interrelated and need to be considered as a whole …."

Similarly, the UN Agreement on Straddling and High Migratory Fish Stocks (UNFSA),[21] which supplements UNCLOS, also modernizes it through express incorporation of the precautionary approach.[22] While UNFSA does not explicitly adopt the ecosystem approach, various provisions in it are supportive of such an approach.[23] UNFSA also fleshes out the principle of co-operation in relation to straddling and high migratory fish stocks. States are required to give effect to their duty to co-operate by not accessing stocks subject to a regional or sub-regional fisheries management organization or arrangement unless they are a member or a participant, or agree to apply the measures of the organization or arrangement.[24]

Earth Summits and Their Documents

Any consideration of principles for ocean governance must take account of the wider environmental events and agreements occurring after 1982 which also articulated principles regarding ocean governance. The 1992 Rio Conference on Environment and Development (Rio Earth Summit) produced two non-legally binding documents which substantially advanced the aspiration for principled governance. The Rio Declaration sets out 27 principles with an overarching aim to encourage sustainable development. The principle or concept of sustainable development is specifically recognized in Principle 1, "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature." Principle 3 highlights the closely associated principles of intra- and inter-generational

20 Id., art. 123.

21 New York, 4 August 1995, 2167 *U.N.T.S.* 3.

22 Id., see, e.g., arts. 5 and 6, and Annex II, s. 7.

23 Id. Article 5 requires coastal states and states fishing on the high seas to protect biodiversity in the marine environment and to adopt measures for species belonging to the same ecosystem or dependent on or associated with the target stocks.

24 Id., art. 8, para. 4, see also para. 5 regarding co-operation in other cases.

equity whereby development must ensure the meeting of environment needs of present and future generations.

The Rio Declaration is particularly important in pushing for several principled reforms relevant to environmental management at the national level, but also applicable more broadly to ocean and coastal management. For example, Principle 15 urges the adoption of the precautionary principle:

> In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

The polluter pays principle is encouraged in Principle 16 and the principle of public participation and access to justice is voiced in Principle 10. Principle 22 sets out the community-based management principle recognizing the important role of Indigenous peoples and other local communities in the achievement of sustainable development.

The Rio Declaration's principled contributions have left numerous implementation issues in their wake. For example, in relation to precaution, when are strong versions of precautionary measures appropriate, such as reversing the burden of legal proof or prohibiting risky activities versus weaker versions such as adaptive management?[25] For polluter pays, precisely who is the polluter and what damages should be compensable?[26] For public participation, who represents the public and what should be the scope of participation, for example, information sharing, consultation, or shared decision-making?[27] For community-based management, what are the implications of the subsequent UN Declaration on the Rights of Indigenous Peoples[28] for Indigenous peoples and their communities in terms of ocean management and development?

Also emerging from the Rio Earth Summit, Agenda 21 is the non-legally binding global plan of action for mobilizing actions and financing towards

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25 See, for example, International Union for the Conservation of Nature (IUCN) Guidelines for Applying the Precautionary Principle to Biodiversity Conservation and Natural Resource Management (67th IUCN Council Meeting, 14–16 May 2007), Guideline 12.

26 G. Roller, "Polluter Pays Principle," in *Environmental Law and Sustainability*, eds., K. Bosselmann, D.S. Fogel and J.B. Ruhl (Great Barrington, MA: Berkshire Publishing, 2013), 168–170.

27 D. VanderZwaag, *Canada and Marine Environmental Protection: Charting a Legal Course Towards Sustainable Development* (London: Kluwer Law International, 1995), 35–37.

28 UNGA Res. 61/295 (2007).

achieving sustainable development.[29] Chapter 17, addressing ocean issues, reaffirms the need for a precautionary approach to prevent degradation of the marine environment[30] and emphasizes the need to actualize the principle of integrated coastal and ocean management.[31] Each coastal state is encouraged to establish national and local co-ordination mechanisms for management of coastal and marine areas and to promote the development and implementation of integrated management plans.[32]

At the 2002 World Summit on Sustainable Development, the Johannesburg Plan of Implementation[33] added little on the ocean governance principles set out above. It encouraged application by 2010 of the ecosystem approach to fisheries and called for the promotion of integrated, multidisciplinary, and multisectoral coastal and ocean management at the national level.[34]

The main outcome document of the 2012 Rio+20 Conference on Sustainable Development, "The future we want,"[35] merely reconfirmed previous principles. Governments renewed their commitment to sustainable development and its three pillars of economic, social, and environmental sustainability.[36] All the principles of the Rio Declaration were affirmed.[37] A specific commitment was made to effectively apply ecosystem and precautionary approaches in marine management in accordance with international law.[38]

UNGA Resolutions and Processes

Annual UNGA resolutions have consistently emphasized the need for ecosystem and precautionary approaches in marine management. For example, the UNGA 2016 resolution on oceans and law of the sea urges states to enhance efforts towards applying an ecosystem approach and encourages competent

29 Available at https://www.sustainabledevelopment.un.org/content/documents/Agenda21.pdf.
30 Id., para. 17.21.
31 Id., para. 17.1(a).
32 Id., para. 17.6.
33 Report of the World Summit on Sustainable Development, UN Doc. A/CONF.199/20 (2002), Resolution 2, Annex.
34 Id., paras. 30(d) and 30(e).
35 UNGA Res. 66/288 (2012).
36 Id., para. 1.
37 Id., para. 15.
38 Id., para. 158.

organizations and bodies that have not yet done so to incorporate an ecosystem approach into their mandates.[39]

UNGA processes have also promoted principled ocean governance. For example, the UN Informal Consultative Process on Oceans and Law of the Sea (UNICPOLOS) at its June 2006 meeting addressed the topic of ecosystem approaches and oceans. While recognizing there is no universally agreed definition of an ecosystem approach, the meeting identified a long list of key elements. They include the need to use integrated decision-making processes, strive to balance diverse social objectives, restore degraded marine ecosystems where possible, assess the cumulative impacts on marine ecosystems, and seek to minimize adverse impacts on marine biodiversity, especially on rare and fragile ecosystems.[40]

In September 2015, the UNGA launched the 2030 Agenda for Sustainable Development, transforming the concept or principle of sustainable development into a 15 year plan of action for meeting 17 sustainable development goals and 169 targets.[41] Goal 14 is to conserve and sustainably use the oceans, seas, and marine resources for sustainable development. The Goal is supported by ten targets, including increasing access by small-scale artisanal fishers to marine resources and markets.[42]

FAO Code of Conduct and Guidelines

In considering wider principles of ocean governance, the principles specifically relevant to living resources are key. The FAO Code of Conduct for Responsible Fisheries (the Code) encourages principled governance approaches to all fisheries.[43] The Code calls for application of the precautionary approach and setting precautionary reference points for fisheries.[44] Although not specifically referring to the ecosystem approach, it encourages many elements of such an approach, for example, broadening management measures to ensure conservation of not only target species but also species belong to the same ecosystem;

39 UNGA Res. 71/257 (2016), paras. 227, 229. See also UNGA Res. 71/123 (2016) (sustainable fisheries), para. 11.

40 Report on the work of the United Nations' Open-ended Informal Consultative Process on Oceans and the Law of the Sea at its seventh meeting, UN Doc. A/61/156 (2006).

41 UNGA Res. 70/1, Transforming Our World: The 2030 Agenda for Sustainable Development (2015).

42 Id., Target 14.b.

43 (Rome: FAO, 1995).

44 Id., art. 7.5.

promoting selective and environmentally safe fishing gears and practices; protecting and rehabilitating all critical fisheries habitats; and managing fisheries as a biological unity over entire areas of distribution.[45] The Code also encourages the integration of fisheries into coastal area management.[46] It further encourages application of the social equity principle, calling on states to protect the rights and access of small-scale of fishers to secure just livelihoods.[47] Specific guidelines on all four principled aspects of the Code have been developed, namely, the ecosystem approaches to fisheries and aquaculture, integrated coastal management, and sustainable small-scale fisheries.[48]

Multilateral Agreements and Arrangements

Finally, it must be noted that there are other key components in facilitating principled ocean governance, and only a broad overview is possible in this short essay with a focus on adoption and implementation of precautionary and ecosystem approaches. At the global level, international agreements vary widely in the strength of their precautionary embraces. The 1996 Protocol to the London Convention (LP)[49] adopts a strong 'reverse listing' approach to precaution whereby only wastes listed on a global 'safe list' may be considered for ocean dumping and only after undergoing waste assessment audits.[50] Through 2013 amendments, future ocean fertilization activities will be restricted to small-scale for research purposes and authorization will be subject to stringent environmental impact assessment requirements.[51] The CBD calls for a precautionary approach through its preamble and various decisions have emphasized the need for taking a precautionary approach to proposed

45 Id., arts. 6.2, 6.6, 6.8, 7.3.1.

46 Id., art. 6.9.

47 Id., art. 6.18.

48 Respectively the following FAO documents: *The Ecosystem Approach to Fisheries*, FAO Technical Guidelines for Responsible Fisheries No. 4, Suppl. 2 (2003); *Ecosystem Approach to Aquaculture*, FAO Technical Guidelines for Responsible Fisheries No. 5, Suppl. 4 (2010); *Integration of Fisheries into Coastal Area Management*, FAO Technical Guidelines for Responsible Fisheries No. 3 (1996); and Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (2015).

49 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972. London, 7 November 1996, 36 *I.L.M.* 1 (1996).

50 D.L. VanderZwaag, "The International Control of Ocean Dumping: Navigating from Permissive to Precautionary Approaches," in *Research Handbook on International Marine Environmental Law*, ed., R. Rayfuse (Cheltenham: Edward Elgar, 2015), 132–147.

51 International Maritime Organization, Res. LP.4(8) (2013).

climate-related geo-engineering activities through biodiversity impact assessments and restricting activities to small-scale scientific research studies.[52] The Stockholm Convention on Persistent Organic Pollutants[53] has adopted a weak version of precaution, requiring detailed scientific risk assessments before a chemical can be listed for elimination or restriction.[54] Although the Conference of the Parties (COP) is required to decide on a precautionary manner whether to list a chemical, only 28 chemicals have been listed to date.[55] The Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC) might be described as adopting a discretionary rather than a precautionary approach to climate change mitigation since it give parties broad discretion to determine their nationally determined contributions.[56]

The CBD has encouraged an ecosystem approach to fisheries and broader ocean management. The Strategic Plan for Biodiversity 2011–2020 sets a target of ensuring by 2020 that all fish and invertebrates are managed and harvested sustainably, legally, and applying ecosystem approaches.[57] Two COP decisions advocate the ecosystem approach as a strategy for integrated coastal and ocean management that promotes conservation and sustainable use of biodiversity in an equitable way and provide 12 principles to guide implementation.[58]

Efforts towards more principled governance have also occurred at the regional level, but overall progress is difficult to assess in light of the numerous forms of regional co-operation. They include 18 regional sea programs,[59] large marine ecosystem projects and arrangements,[60] and over 40 regional fisheries bodies.[61]

Common constraints in applying precautionary and ecosystem approaches do stand out for regional fisheries management organizations and arrangements.

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52 CBD, COP Decision X/33, Biodiversity and Climate Change (2010), para. 8(w).

53 Stockholm, 22 May 2001, 2256 *U.N.T.S.* 119 (Stockholm Convention).

54 D.L. VanderZwaag, "The Precautionary Approach and the International Control of Toxic Chemicals: Beacon of Hope, Sea of Confusion and Dilution," *Houston Journal of International Law* 33 (2011): 605, 618–620.

55 Stockholm Convention, *supra* note 53, art. 8(9); "All POPs listed in the Stockholm Convention," Stockholm Convention Clearing House, accessed 30 November 2017, http://chm.pops.int/TheConvention/ThePOPs/AllPOPs/tabid/2509/Default.aspx.

56 UNFCCC, Decision 1/CP.21 (2015), Annex, "Adoption of the Paris Agreement," art. 4.

57 CBD, COP Decision X/2, Strategic Plan for Biodiversity 2011–2020 (2010), Annex, Target 6.

58 CBD, COP Decision V/6 (2000) and COP Decision VII/11 (2004).

59 See UN Environment, *Moving to Strategy and Action: Regional Seas Outlook for the Implementation of the Sustainable Development Goals*, Regional Seas Reports and Studies No. 200 (2017).

60 See essay by Kenneth Sherman in this volume.

61 "Regional Fisheries Bodies (RFB)", FAO, accessed 4 December 2017, http://www.fao.org/fishery/rfb/en.

Precautionary approach implementation has often floundered through the setting of high total allowable catches even when scientific information is lacking or limited and ignoring or over-riding precautionary scientific advice because of socio-economic and political pressures.[62] Implementation of the ecosystem approach has been hindered by managerial fixation on standard single stock assessments,[63] limitations in multispecies and ecosystem modelling,[64] failure to consider changing ocean conditions in decision-making,[65] limited political interest in subjecting all transboundary fish stocks to co-operative management,[66] and nominal progress in controlling fisheries bycatch and discards.[67] Limited understanding of complex social-ecological systems is a cross-cutting issue.[68]

Conclusion

As reviewed above, principled ocean governance has certainly edged forward from the limited inclusion of the four key principles in UNCLOS. A broad array of environmental principles, promoting the overarching goal of sustainable development, but equally applicable to the oceans, has now emerged through both legally-binding agreements and soft law documents.

62 D.A. Russell and D.L. VanderZwaag, "Ecosystem and Precautionary Approaches to International Fisheries Governance: Beacons of Hope, Seas of Confusion and Illusion", in *Recasting Transboundary Fisheries Management Arrangements in Light of Sustainability Principles*, eds., D.A. Russell and D.L. VanderZwaag (Leiden: Martinus Nijhoff, 2010), 61–67.

63 M.G. Burgess et al., "Describing Ecosystem Contexts with Single-species Models: A Theoretical Synthesis for Fisheries," *Fish and Fisheries* 18 (2017): 264–284.

64 See, for example, M.J. Fogarty, "The Art of Ecosystem-based Fishery Management," *Canadian Journal of Fisheries and Aquatic Sciences* 71 (2014): 479–490.

65 M. Skern-Mauritzen et al., "Ecosystem Processes Are Rarely Included in Tactical Fisheries Management," *Fish and Fisheries* 17 (2016): 165–175.

66 See, e.g., D.L. VanderZwaag, M. Bailey and N.L. Schakell, "Canada-U.S. Fisheries Management in the Gulf of Maine: Taking Stock and Charting Future Coordinates in the Face of Climate Change," *Ocean Yearbook* 31 (2017): 3–26.

67 E. Gilman, K. Passfield and K. Nakamura, "Performance of Regional Fisheries Management Organizations: Ecosystem-based Governance of Bycatch and Discards," *Fish and Fisheries* 15 (2014): 327–351.

68 R. Biggs et al., "Strategies for Managing Complex Social-Ecological Systems in the Face of Uncertainty: Examples from South Africa and Beyond," *Ecology and Society* 20, no. 1 (2015): 852–866.

Moving from paper to practice is sure to be a 'never ending voyage'. Conflicts over human values and interests are bound to continue.[69] Debates over the appropriate balance among economic, environmental, and social dimensions of sustainability will not go away.[70] Principles, such as ecosystem-based management, will continue to evolve.[71] We are all on the road to kingdom come.[72]

69 K. Blosselmann, *The Principle of Sustainability: Transforming Law and Governance* (Burlington, VT: Ashgate, 2008), 207–208.

70 C. Voigt, *Sustainable Development as a Principle of International Law: Resolving Conflicts between Climate Measures and WTO Law* (Leiden: Martinus Nijhoff, 2007), 3–5.

71 R.D. Long, A. Charles and R.L. Stephenson, "Key Principles of Marine Ecosystem-based Management," *Marine Policy* 57 (2015): 53–60.

72 D.L. VanderZwaag, "On the Road to Kingdom Come," in *The Challenge of Arctic Shipping: Science, Environmental Assessment, and Human Values*, eds., D.L. VanderZwaag and C. Lamson (Montreal: McGill-Queen's University Press, 1990), 219–244.

The Deep Sea Floor as a Battleground for Justice?

Tirza Meyer
Department of Historical Studies, University of Science and Technology, Trondheim, Norway

The Promise of Wealth in the Unknown Depths

In the second half of the twentieth century, marine minerals appeared on the radar of scientists, politicians, and industry. Technology was advanced enough that seabed mining no longer seemed a futuristic dream, and the area where these minerals were found was uncharted territory, meaning that, for a short moment, the wealth of the oceans seemed up for grabs.

The mineral that looked most promising in the 1960s, the polymetallic nodule,[1] had been discovered in 1873 by the crew of the research vessel HMS *Challenger*. The first marine manganese nodule was taken on board southwest of the Canary Islands, and the vessel continued collecting nodule samples until 1876. The largest deposits reported by the crew were located in the Pacific and Indian Oceans, often at great depths.[2] It was another 90 years before the geologist John L. Mero attempted to calculate the economic value of nodule deposits in the oceans. In 1964, he published his study, *The Mineral Resources of the Sea*.[3] The estimates looked promising. The nodules, if they were harvested, could bring great wealth to those exploiting them.

To prevent a race amongst states or private actors to claim the seafloor, the United Nations (UN) set up the Ad-Hoc Seabed Committee to examine the use of seabed resources outside national jurisdiction in the interest of mankind.[4] A race was prevented, but the concept of 'interest of mankind' needed to be given legal meaning. This essay argues that advocates for developing countries

1 Polymetallic nodules are also referred to as manganese nodules. They are one of the three marine mineral resources that are regulated and administered by the International Seabed Authority (ISA). The others are polymetallic sulphides and ferromanganese crusts. See "Deep Seabed Mineral Resources," ISA, last accessed 2 February 2018, https://www.isa.org.jm/mineral-resources/55.

2 *Cf.* G.P. Glasby, "Historical Introduction," in *Marine Manganese Deposits* (New York: Elsevier Oceanography Scientific Publishing Company, 1977), 1.

3 J.L. Mero, *The Mineral Resources of the Sea* (New York: Elsevier Oceanography Scientific Publishing Company, 1964).

4 United Nations General Assembly (UNGA), UN Doc. GA Resolution 2340 (XXII), 18 December 1967, A/RES/22/2340.

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used the marine polymetallic manganese nodule, and its potential value, as a vehicle for justice in preparation for and during the Third United Nations Law of the Sea Conference (UNCLOS III). They pushed for a holistic 'ocean treaty', where revenue from marine mineral mining in areas beyond national jurisdiction would be allocated to the benefit of all mankind.

Arvid Pardo's Speech Fuels Developing Countries' Hopes

Mero's estimates made their way to the UN, transmitted through the Maltese ambassador, Arvid Pardo, when he delivered his famous speech about the application of the concept of common heritage of mankind to the seafloor outside national jurisdiction in the First Committee of the UNGA on 1 November 1967.[5] Pardo had been working on a proposal since 1966, when the United States (US) had commissioned the UN to compile a report on deep-sea resources.[6] The Maltese government had tested Pardo's proposal against the "interest of some poor countries (but not the major powers) in the sea,"[7] and it was forwarded to the UN in the form of a 'note verbale' in August 1967,[8] which finally led to Arvid Pardo's speech in November.

Arvid Pardo painted a rosy picture of the resource deposits of the deep seas, in which he relied heavily on Mero's calculations, stating that "the commercial exploitation of the mineral resources of the ocean floor, … are imminent."[9] He anticipated a bright future for the industry, and told his audience that prototypes of commercial mining vehicles were already "under construction."[10] The same applied to the extraction technology, which sounded quite simple: "The nodules will be raked from the ocean floor and pumped into the vessel; from the submersible the nodules will be transferred easily to an accompanying cargo-ship by means of floating conduit."[11]

5 UNGA, "Statement of Arvid Pardo," 1 November 1967, First Committee, 1515th Meeting, UN Doc. A/C.1/PV.1515, para. 5.

6 *University of Malta—Arvid Pardo Study Area—Pardo Room,* Personal Correspondences and Materials, Undated letter from Dr. Arvid Pardo to Salvino Bussutil.

7 Id., 2.

8 UNGA, "Malta: Request for the Inclusion of a Supplementary Item in the Agenda of the Twenty-second Session," Plenary, 22nd Session, 1583rd Meeting, UN Doc. A/6695, 18 August 1967.

9 UNGA, "Statement of Arvid Pardo," *supra* note 5, para. 34.

10 Id.

11 Id.

Today we know that Mero's estimations were optimistic,[12] and that the extraction technology was more costly and challenging than Pardo had anticipated in 1967. Still, Pardo's speech did not come out of the blue. Several countries, led by the United States, had been looking into seabed resources, and his speech kick-started activity to realize the concept and potential for utilizing marine minerals.

A Constitution for the Oceans?

Elisabeth Mann Borgese "contacted him [Pardo] immediately,"[13] when she heard of his speech. At that time, she was working at the Center for the Study of Democratic Institutions in Santa Barbara, California. She had already started drafting a proposal on ocean governance and the common heritage of mankind, to which an "unknown gentleman in Connecticut"[14] had drawn her attention. Elisabeth and Arvid started working together during the preparations for UNCLOS III, launching four workshops and two conferences, *Pacem in Maribus* (PIM) I and II, which were held in Malta in 1970 and 1971.[15]

The original idea of their collaboration was to draft "A Constitution for the Oceans"[16] that would address all issues related to ocean governance in a holistic way, but would take care of developing countries in particular, by allocating the resources of the deep sea for their benefit. The goal was to avoid "institutionaliz[ing] the division between developed and developing nations,"[17] and to promote "systematic planning for the conservative use of ocean resources."[18] Thereby underlining the importance of utilizing the resources on and below the seabed.

12 *Cf.* C. Sanger, *Ordering the Oceans: The Making of the Law of the Sea* (London: Zed Books, 1986), 18.

13 *Dalhousie University Archive—Elisabeth Mann Borgese Fond*, MS-2-744, Box 345, Folder 4, Arvid Pardo Retrospect and Prospect, 1999, 1 [MS-2-744].

14 Id.

15 *Cf.* Id., 2.; PIM Conferences were held until 2013. See "Pacem in Maribus (PIM) Conferences," International Ocean Institute, https://www.ioinst.org/about-1/ioi-story/pacem-in-maribus-pim-conferences/.

16 MS-2-744, id, Box 43, Folder 48, discussion on "a constitution for the oceans." See also, S.V. Scott, "The LOS Convention as a Constitutional Regime for the Oceans," in *Stability and Change in the Law of the Sea: The Role of the LOS Convention*, ed., A.G. Oude Elferink (Leiden: Martinus Nijhoff, 2005), 9–38.

17 MS-2-744, id, Box 43, Folder 48, 2.

18 Id.

The first PIM conference was about bringing together scientists, political leaders and industry to represent "the internationalization of research & development," "the world community of science," and "the world community of production."[19] Their task was to discuss the utilization of resources, the ecology of the ocean and the role of scientists.[20] Elisabeth compiled the outcomes of PIM I in a final report. Not all participants agreed on all issues. The US oil industry and its supporters in Congress wanted to operate on a "first come, first served"[21] basis, and were critical towards the concept of "common heritage."[22] There had been a "*de facto* boycott called by the American Petroleum Institute,"[23] not to appear at the Malta conference.

James Dawson, an insurance expert from Britain pointed out that the industry was oblivious to the challenges ocean-based mining would pose. He warned that land-oriented industry was "leaping into the sea as if the seabed were a flat prairie where skies are always blue and the sea-weed as high as a sea-elephant's eye."[24] The American economist Neil Jacoby warned against a "carry-over of terrestrial thinking into the maritime environment,"[25] since "too little is known about seabed geology to evaluate concession areas today …."[26]

There was concern from scientists that they were "caught in an acute professional crisis,"[27] torn as they were between fast-developing new technologies and industry interests. Paul Ehrlich, a Center Associate, warned of "ecocide"[28] if the oceans were swamped by industry interest without regard for scientific knowledge. Others, meanwhile, were concerned that freedom of research would be put at risk if researchers had to avoid collecting data from remote places for fear of causing "exploitation by foreign commercial interests."[29]

The differing opinions on successful ocean mining and meaningful allocation of revenue showed even in the 1970s that the discussions in the United Nations would not be easy. Not only was there a mixture of more or less verified scientific knowledge on the technological possibilities and the potential economic value of the marine minerals, there was also no agreement on how

19 Id., Box 43, Folder 49.
20 Id., 1.
21 Id., Box 125, Folder 2, 25.
22 Id., 24.
23 Id., 26.
24 Id., 6.
25 Id., 8.
26 Id.
27 Id., 9.
28 Id., 10.
29 Id., 11.

to govern those resources once they were accessible. Elisabeth concluded, "Ocean resources are not static, but are the product of a rapidly changing marine technology."[30]

No Peace without Economic Justice?

The discord amongst participants of PIM I was reflected in the discussions at UNCLOS III. Those who wanted to use the revenue of the resources in the area outside jurisdiction for the benefit of all mankind found themselves battling resistance from industry and politicians, who wanted to keep the freedom of the seas intact and, if possible, apply it to the seafloor. The first draft of Arvid Pardo's 'Ocean Space Treaty'[31] was taken to Caracas by the Maltese delegation, but was not carried further, since it was too 'holistic'. Ultimately Part XI of the 1982 United Nations Convention on the Law of the Sea[32] (UNCLOS) secured the principle that resources on the seafloor beyond national jurisdiction would be the common heritage of mankind, and the International Seabed Authority (ISA) was established. Unfortunately, the later 1994 Implementing Agreement to the UNCLOS abolished much of its meaning,[33] risking that those who ratified the Convention, many of them developing countries, would have to pay for an administrative authority without ever seeing any revenue.[34]

Prognosis of Commercial Exploitation of Seabed Resources

Despite Arvid Pardo's positive prognosis that 'commercial exploitation' of seabed resources was just around the corner, deep-sea mining has seemed to be

30 Id., 4.

31 UNGA, "Draft of Ocean Space Treaty, paper submitted by Malta," Committee on the Peaceful Uses of the Sea-bed and the Ocean Floor Beyond the Limits of National Jurisdiction, 23 August 1971, UN Doc. A/AC.138/53.

32 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3 [UNCLOS].

33 For a discussion on amendments and the agreement that modified Part XI of the UNCLOS, see E. Mann Borgese, *The Oceanic Circle: Governing the Seas as a Global Resources—A Report to the Club of Rome* (Tokyo: United Nations University Press, 1998), 111–113; D. Freestone and A.G. Oude Elferink, "Flexibility and Innovation in the Law of the Sea: Will the LOS Convention Amendment Procedures Ever be Used?" in Oude Elferink, *supra* note 16, 169–221.

34 *Cf.* A.G. Kirton and S.C. Vasciannie, "Deep Seabed Mining under the Law of the Sea Convention and the Implementation Agreement: Developing Country Perspective," *Social and Economic Studies* 51, no. 2 (2002), 63–115 at 113. See also P.B. Payoyo, *Cries of the Sea World Inequality, Sustainable Development and the Common Heritage of Humanity* (The Hague: Martinus Nijhoff, 1997).

on the horizon for decades without ever really reaching the depths.[35] Recent projects have looked into mining on the continental shelf,[36] but deep-sea mining in 'the Area' at depths of up to 4,000 m, as Pardo predicted, has yet to occur. By 2017, although 27 contractors have entered into exploration contracts with the ISA, it still remains uncertain when industrial exploitation of deep sea minerals will actually begin to take place in the Area outside national jurisdiction.[37] Until this happens, there will be no revenue flow to the ISA.[38] The Commission on the Limits of the Continental Shelf is still looking into national borders on the continental shelf, which will then define the Area, while other open questions include how to handle the contiguous zone.[39]

Conclusion

In 1967, idealists like Arvid Pardo and Elisabeth Mann Borgese, saw a chance to secure a 'more just world order' by allocating resources that were outside national jurisdiction to the benefit of all mankind. The promising economic potential John L. Mero saw in the polymetallic nodule in 1958 was the engine for this development. In 1967, the time seemed right. Maritime boundaries were still flexible, a potential source of wealth was discovered in 'uncharted territory,' and former colonies entered the international arena as developing states with the chance to shape international treaties in a way that could be beneficial for them. Much has changed since the 1970s, and it remains to be seen how much of the common heritage of mankind concept will be left once mining activity starts in the Area, the sea floor outside national jurisdiction.

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35 See J. Harrison, *Making the Law of the Sea: A Study in the Development of International Law* (Cambridge: Cambridge University Press, 2011), 115–153.

36 See, e.g., "World's First Success in Continuous Ore Lifting Test for Seafloor Polymetallic Sulphides," Japan Ministry of Economy, Trade and Industry, 26 September 2017, http://www.meti.go.jp/english/press/2017/0926_004.html; SRK Consulting, "PNG, Tonga, Fiji, Solomon Islands, New Zealand, Vanuatu and the ISA," NI 43-101 Technical Report 2011, prepared for Nautilus Minerals Incorporated (March 2012), http://www.nautilusminerals.com/irm/PDF/1054_0/TechnicalReport2011PNGotherSouthPacificnationsandtheISA; "Exploration 2007–2013," Nautilus Minerals Incorporated, http://www.nautilusminerals.com/IRM/Company/ShowPage.aspx?CategoryId=190&CPID=1553&EID=99064433.

37 See "Deep Seabed Minerals Contractors," ISA, last accessed 2 February 2018, https://www.isa.org.jm/deep-seabed-minerals-contractors.

38 With regards to the controversy concerning the common heritage of mankind, see *K.M.W. Owolabi,* "The Principle of the Common Heritage of Mankind," *Nnamdi Azikiwe University Journal of International Law and Jurisprudence* 4 (2013): 51–56.

39 With regards to future challenges, see D. Vidas ed., *Law, Technology and Science for Ocean in Globalisation: IUU Fishing, Oil Pollution, Bioprospecting, Outer Continental Shelf* (Leiden/Boston: Martinus Nijhoff, 2011).

Article 82 of UNCLOS: A Clear Outcome of the 'Package Deal' Approach of the Convention Negotiation

Frida M. Armas-Pfirter
University of Buenos Aires, Buenos Aires, Argentina

Introduction

Article 82 of the 1982 United Nations Convention on the Law of the Sea (UNCLOS)[1] is one of the new additions to the international law of the sea. Article 82, paragraph 1, provides, *inter alia*,

> The coastal State shall make payments or contributions in kind in respect of the exploitation of the non-living resources of the continental shelf beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured.

Its implementation is not an easy task and raises many problems.[2] But, seeing the glass as half full, we also need to acknowledge that there are some important elements that have already been defined, e.g., the rate and grace period of the payments and contributions, the institution through which the payments shall be made, and the basic criteria to distribute the funds collected.

This positive approach to the problem does not imply minimizing several complex issues whose resolution is still pending. Undoubtedly, it is necessary to solve them to provide greater certainty to the offshore industry and to the work of the International Seabed Authority (ISA). This essay briefly considers the origin and rationale of Article 82, but cannot attempt to solve all the problems. Rather it tries to provide useful elements for their solution and, in particular, it identifies various problems with respect to the three actors involved in implementation of Article 82: the coastal state, the ISA, and the beneficiary states.

1 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3. The 1958 Geneva Convention (*infra* note 3) did not have a provision similar to Art. 82.

2 International Seabed Authority (ISA), *Issues Associated with the Implementation of Article 82 of the United Nations Convention on the Law of the Sea*, ISA Technical Study No. 4 (Kingston: ISA, 2009). This study was a revised version of a legal study prepared by Aldo Chircop for the ISA seminar that discussed this issue.

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The Rights of Coastal States over the Continental Shelf and Article 82

As dealt with in Part VI of UNCLOS, the continental shelf, as a natural prolongation of the coastal state's land territory, comprises the seabed and subsoil of the submarine areas that extend beyond the territorial sea to the outer edge of the continental margin or to a distance of 200 nautical miles (M) from the baselines, where the outer edge of the continental margin does not extend up to that distance. The entitlement to the continental shelf has always been based on the right of the coastal state over the land, although its formulation has evolved. The 1958 Geneva Convention on the Continental Shelf[3] linked the right of the coastal state over the continental shelf to 'adjacency', and ten years later, the International Court of Justice added the concept of 'natural prolongation' to that of adjacency:

> the rights of the coastal State in respect of the area of continental shelf that constitutes a natural prolongation of its land territory into and under the sea exist *ipso facto* and *ab initio*, by virtue of its sovereignty over the land, and as an extension of it in an exercise of sovereign rights for the purpose of exploring the seabed and exploiting its natural resources.[4]

Natural prolongation as a basis for rights over the continental shelf is set out in Article 76, paragraph 1 of UNCLOS, and is also considered customary international law. This right applies to the entire shelf as "there is in law only a single continental shelf rather than an inner continental shelf and a separate extended or outer continental shelf."[5]

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3 Geneva, 29 April 1958, 499 *U.N.T.S.* 311 [1958 Geneva Convention], art. 1: "The term 'continental shelf' is used as referring (*a*) to the seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 meters or, beyond that limit, to where the depth of the superjacent waters admits the exploitation of the natural resources of the said areas."

4 *North Sea Continental Shelf Cases*, 1969 *I.C.J. Reports*, para. 19. See also F.M. Armas-Pfirter, "Working paper on Potential Options on Equitable Distribution of Payments and Contributions," in ISA, *Implementation of Article 82 of the United Nations Convention on the Law of the Sea*, ISA Technical Study No. 12 (Kingston: ISA, 2013), Annex 6, 83–97, 83–88.

5 Arbitral Tribunal, *Barbados v. Trinidad and Tobago*, 2006, para. 213 *in fine*, 66. This statement by the Arbitral Tribunal has been, according to Shabtai Rosenne, "a useful and important clarification." See S. Rosenne, "Arbitrations under Annex VII of the United Nations Convention on the Law of the Sea," in *Law of the Sea, Environmental Law, and Settlement of Disputes: Liber Amicorum Judge Thomas A. Mensah*, eds., T.M. Ndiaye and R. Wolfrum (Leiden: Brill

Article 77 further defines the rights of the coastal state over the shelf as exclusive, not dependent on occupation or an express proclamation.[6] Despite this concept of single shelf, it is clear that the Article treats the exploitation of non-living resources differently whether within or beyond 200 M. This difference needs to be understood in the historical context of the decade of negotiations during the Third United Nations Conference on the Law of the Sea. When the Conference sessions began in 1973, the 1958 Geneva Convention was in force for more than fifty states and, therefore, the exclusive right of a coastal state over the resources of the continental shelf adjacent to its coast, up to 200 meters depth or up to where exploitation was feasible, was widely accepted. This reference to the possibility of exploitation to determine the limit made it indefinite and subject to technological advances. Bearing in mind that one of the driving forces of the Conference was the need to establish a new international legal regime ('the Area'[7]) for the seabed and its resources beyond national jurisdiction, the 'common heritage of mankind', it was necessary to clearly establish the limits to coastal states' continental shelves.

A group of states, known as the broad-margin states or margineers,[8] acted jointly with a clear goal: to consolidate their claim to rights over the shelf following the criterion of natural prolongation, without being constrained by the 200-M exclusive economic zone (EEZ).[9] As a result of the negotiations, the concept of continental shelf as the natural prolongation of a coastal state's territory was consecrated. Therefore, the continental shelf, whether it is inside or outside 200 M, is not part of the Area. But the margineers had to make some concessions:

- The outer limit of the continental shelf had to be determined according to the criteria and restrictions established in Article 76, with the intervention of the Commission on the Limits of the Continental Shelf.
- The coastal state has the obligation to make payments or contributions in kind, not exceeding 7 per cent, with respect to the exploitation of non-living resources beyond 200 M, and provided it is not a net importer of

Nijhoff, 2007), 1004. See also later cases: *Bangladesh v. Myanmar* (ITLOS, 2012); *Bangladesh v. India* (Arbitral Tribunal, 2014); *Nicaragua v. Colombia*, Preliminary Objections (ICJ, 2016).

6 1958 Geneva Convention, *supra* note 3, art. 2(2–3); UNCLOS *supra* note 1, art. 77(2–3).

7 UNCLOS, id., Part XI. For a discussion of the regime of the Area and its importance, see other essays in this section of this volume.

8 Broad-margin states include Argentina, Australia, Canada, India, Ireland, New Zealand, Norway, the United States, and Uruguay.

9 See UNCLOS, *supra* note 1, Part V.

the mineral resource produced.[10] This concept arose as the only viable compromise for an extension of the continental shelf beyond 200 M. It was a *quid pro quo* in the 'package deal' approach adopted in the negotiation of the Convention. The final outcome was that the whole continental shelf and its resources are subject to the coastal states' sovereign rights and they are separate from the Area and the 'common heritage' principle. Further, the exploitation of non-living resources is subject to a form of 'servitude',[11] which is established in Part VI (continental shelf). In Part XI (the Area), it is only mentioned in relation to the powers of the ISA.

There are dissimilar conceptions of the essence of this rule, and consequently, the extent of the coastal state's rights over the continental shelf beyond 200 M. According to one interpretation, the limit of the continental shelf beyond 200 M is an 'encroachment' on the Area, a sort of "transitional zone between the areas within the limits of national jurisdiction and the area beyond the limits of national jurisdiction."[12] For those who take this view, the payments and contributions of the coastal state are resources that are the common heritage of mankind and, as such, must be distributed by the ISA.

Others, on the contrary, focus on the fact that by definition, the natural prolongation of the state's territory—the continental shelf—cannot be part of the Area, which is "the seabed and ocean floor and subsoil thereof, *beyond* the limits of national jurisdiction." For this reason, during the negotiation of UNCLOS, several of the margineer states maintained their opposition to the concept of 'revenue sharing' until the end, not only due to its economic aspect, but also because it implied establishing a dual regime for the continental shelf.[13]

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10 See D.H. Anderson, "The Status Under International Law of the Maritime Areas Around Svalbard," *Ocean Development & International Law* 40 (2009): 373–384; T. Koivurova, "The Actions of the Arctic States Respecting the Continental Shelf: A Reflective Essay," *Ocean Development & International Law*, 42, no. 3 (2011): 211–226, 215; T.L. McDorman, "The Continental Shelf Regime in the Law of the Sea Convention: A Reflection on the First Thirty Years," *The International Journal of Marine and Coastal Law* 27 (2012): 743–751.

11 See A. Chircop, "Development of Guidelines for the Implementation of Article 82," in ISA Technical Study No. 12, *supra* note 4, Annex 4, 35–68.

12 *Cf.* E.D. Brown, *The International Law of the Sea, Volume I, Introductory Manual* (London: Dartmouth Publishing Company Limited, 1994), 262–263. See also R.R. Churchill and A.V. Lowe, *The Law of the Sea*, 3rd ed. (Manchester: Manchester University Press, 1999), 156–157.

13 *Cf.* A.L. Daverede, *La plataforma continental—Los intereses argentinos en el nuevo derecho del mar* (Buenos Aires: Editorial Universitaria de Buenos Aires, Colección Instituto del Servicio Exterior de la Nación 2, 1983), 89, 94–95; J.A. Yturriaga Barberan De, *Ámbitos de Jurisdicción en la Convención de las Naciones Unidas sobre el Derecho del Mar* (Madrid: Ministerio de Asuntos Exteriores, 1996), 280–281.

The concession of Article 82 is considered by this position as a result of the negotiation of all the issues as a 'package deal'.[14]

Role of the International Seabed Authority in Relation to Article 82

As noted above, Article 82 provides the ISA with a limited, yet essential, role as the 'channel' through which payments and contributions go from the coastal state to the developing state beneficiaries.[15] The ISA was established under UNCLOS as the autonomous body through which states parties "shall … organize and control activities in the Area, particularly with a view to administering the resources of the Area."[16] According to UNCLOS and the Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (1994 Agreement),[17] the ISA's functions are fulfilled by its three main organs, namely, the Assembly, the Council and the Secretariat, and by two subsidiary ones, the Legal and Technical Commission and the Finance Committee.[18]

The 1994 Agreement specifies the role that each organ of the ISA has in the distribution of benefits and development of the equitable sharing criteria. The Legal and Technical Commission is in charge of formulating and submitting to the Council the rules, regulations, and procedures related to the distribution of benefits, to keep them under review, and to recommend, from time to time, such amendments thereto as it may deem necessary or desirable.[19]

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14 See, e.g., the US delegation's report noting: "Revenue sharing for exploitation of the continental shelf beyond 200 M from the coast is part of a package that establishes with clarity and legal certainty the control of coastal States over the full extent of their geological continental margins." Quoted by A. Roach and R. Smith, *Excessive Maritime Claims*, 3rd ed. (Leiden/Boston: Martinus Nijhoff, 2012), 192.

15 McDorman, *supra* note 10, 751. It is worth considering that during the negotiations, there were proposals to designate other UN bodies or regional economic organizations as recipients, so that contributions were not confused with the resources that are the common heritage of mankind.

16 UNCLOS, *supra* note 1, art. 157; Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December, 1982, 28 July 1994, 33 *I.L.M.* 1309 (1994) [1994 Agreement], Annex, s. 1.1.

17 1994 Agreement, id.

18 The Finance Committee was not established by UNCLOS but in the 1994 Agreement, with the task to oversee the financing and financial management of the Authority, and has a central role in the administration of the Authority's financial and budgetary arrangements.

19 1994 Agreement, *supra* note 16, art. 165, para. 2 (a), (f) and (g).

In turn, the Council's functions include, specifically, recommending to the Assembly rules, regulations, and procedures on the equitable sharing of the payments and contributions made by coastal states pursuant to Article 82.[20] For its part, the Assembly has to consider and approve them.[21]

The Finance Committee has a role regarding all activities that could have financial implications for the ISA. The 1994 Agreement establishes that the Assembly and the Council should consider its recommendations, as regards, among others, "rules, regulations and procedures on the equitable sharing of financial and other economic benefits derived from activities in the Area and the decisions to be made thereon."[22] Although the payments and contributions in Article 82 are not related to the 'activities in the Area', a recommendation by the Finance Committee might be worthwhile regarding the equitable sharing criteria. In any event, the importance of the ISA in the framework of Article 82 and the problems of fulfilling its mandate are undeniable. There is no doubt that the ISA must somehow provide for and have in place the means to be able to collect and distribute the payments and contributions, and to be able to organize the workload that this task will imply.

State Beneficiaries

The beneficiaries of payments or contributions are the 'states parties' to UNCLOS. However, the payments or contributions are not going to be distributed evenly. Article 82, paragraph 4, establishes that this will be done "on the basis of equitable sharing criteria, taking into account the interests and needs of developing States, particularly the least developed and the land-locked among them." The list of least developed countries is reviewed every three years by the United Nations Economic and Social Council, and there are currently 47 states on the list.[23] The land-locked states, which were, to a great

20 Id., art. 162, para. 2(o) and (i). These recommendations need to be adopted by consensus, in accordance with Article 161, paragraph 8(d): "Decisions on questions of substance arising under the following provisions shall be taken by consensus: Article 162, paragraph 2 (m) and (o)."

21 Id., Article 160, paragraph 2 (f), (i), and subparagraph (g), also grants the Assembly the power "to decide upon the equitable sharing of financial and other economic benefits derived from activities in the Area," but it must be borne in mind that the funds of Article 82 are not benefits derived from activities in the Area.

22 Id., Annex, s. 9(7). See also Rule 11 (f) of the Rules of Procedure of the Finance Committee.

23 See "LDC List," United Nations, Department of Economic and Social Affairs (June 2017), https://www.un.org/development/desa/dpad/least-developed-country-category/ldcs-at-a-glance.html.

extent, the driving force behind the adoption of Article 82, must also be privileged. Some states have both characteristics and others have only one of the two. These and other considerations show that Article 82, paragraph 4, opens many options for the implementation of payments and contributions.[24]

Conclusion

It is clear that the need to operationalize Article 82 is becoming increasingly pressing in the face of the technological advances making it possible to exploit hydrocarbons at greater depths. The media has already referred to a real possibility that Canada may be the first country to make payments and contributions, and also to the demand made by companies for a clear regulation on the manner in which that international obligation will affect royalties.[25]

In addition, a good working relationship with the states parties to UNCLOS is essential for the work of the ISA, as the implementation of Article 82 will have consequences in its functioning and the costs involved. It is also necessary for the ISA to develop the equitable sharing criteria in advance, to avoid problems when the time comes, and to provide for the necessary infrastructure or personnel requirements. But UNCLOS carefully avoided including powers either of the ISA or other states that may restrain coastal states when complying with the obligation imposed by Article 82, even though Article 82 must be fulfilled in good faith as with all the other obligations set forth in the Convention.[26] Compliance with Article 82 may potentially be subject to the dispute settlement procedures in the Convention, however, and this poses a number of challenges.[27]

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24 See a detailed analysis of the beneficiaries and criteria in Armas-Pfirter, *supra* note 4.

25 Canada has a number of offshore licenses in the continental shelf beyond 200 M. See, among others, W. Spicer, “Canada, the Law of the Sea Treaty and International Payments: Where Will the Money Come From?” The School of Public Policy, University of Calgary, SPP Research Papers, 8, no. 31 (September 2015), https://www.policyschool.ca/wp-content/uploads/2016/03/final-law-sea-spicer.pdf.

26 UNCLOS, *supra* note 1, art. 300.

27 As noted in ISA, *supra* note 2, at 67, “The challenges associated with the resolution of Article 82 disputes highlight the need for close cooperation between the concerned OCS States and the Authority to resolve differences before they degenerate into disputes.”

There have been proposals for an agreement or guidelines in the workshops organized by the ISA and in its published papers.[28] But not much progress has been made thus far. Perhaps an option to move faster without generating resistance among coastal states would be to encourage negotiations among states in relation to implementation of Article 82. These negotiations may take place, although not exclusively, within the ISA's sphere, but avoiding granting the organization the role of control over the coastal states' activity.

At the same time, the ISA is not precluded from moving forward specifically in the tasks assigned indisputably to it by UNCLOS, that is, defining the equitable sharing criteria that best take into account the interests and needs of developing states, particularly the least developed and land-locked among them, and analyzing the options of administrative, accounting, and personnel organization that it may deem necessary to receive and distribute the payments.

28 Several have already been referred to, see Technical Study No. 4, *supra* note 2; No. 5: "Non-living Resources of the Continental Shelf Beyond 200 Nautical Miles: Speculations on the Implementation of Article 82 of the United Nations Convention on the Law of the Sea" (2010); No. 12, *supra* note 4; No. 15: "A Study of Key Terms in Article 82 of the Nations Convention on the Law of the Sea" (2016).

The Common Heritage of Mankind: Expanding the Oceanic Circle

Prue Taylor
School of Architecture and Planning, University of Auckland, Auckland, New Zealand

> Like life itself, the new order started in the deep ocean, which has been declared the 'common heritage of mankind' and it is expanding over the seas and oceans to the coastal zones until it embraces the whole biosphere in 'the majesty of the oceanic circle'.[1]

Mother of the Oceans, Father of the Law of the Sea

Elisabeth Mann Borgese became known as the 'Mother of the Oceans'. This title embraced both her deep love and respect for the oceans and her enormous contribution to oceans governance, including development of the 1982 United Nations Convention on the Law of the Sea (UNCLOS).[2] In this task, she worked closely with her friend and colleague, Arvid Pardo, former Maltese ambassador to the United Nations (UN). Appropriately, his contributions to the international law of the sea earned him the title: 'Father of the law of the sea'. From 1967 onwards, they worked as a team advocating for adoption of the ethical and legal concept 'common heritage of mankind' (CHM) in UNCLOS.

Central to their work was a shared understanding of the oceans as a complex integrated ecological system, sometimes expressed as the 'whole of ocean space' or the 'marine environment'. Their objective was to ensure that ocean's plenitude continued to sustain present and future generations and that its uses contributed to peace, security, and the equitable development of peoples. To achieve this, a new legal principle was required; one which claimed all ocean space as a commons (belonging to all humankind), and placed it under an

1 E. Mann Borgese, "The Oceanic Circle," *Ocean Yearbook* 14 (2000): 1.
2 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3.

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international commons management regime, for the benefit of all. Pardo summed up CHM in these words:

> In ocean space, … the time has come to recognise as a basic principle of international law the overriding common interest of mankind in the preservation of the quality of the marine environment and in the rational and equitable development of resources lying beyond national jurisdiction.[3]

This created a new legal regime. States become charged with a legal responsibility to prioritize and act consistently with the common interests of all humanity. They are no longer free to act solely in their individual national or collective self-interests. CHM creates a kind of trust:

> [S]tates suspend or do not assert rights or claims, or in some cases exercise such jurisdiction only within set limits, for the benefit of the whole human community, without any immediate return, and conserve and if necessary manage areas in conformity with the common interest for the benefit of all mankind.[4]

CHM posed a radical challenge for traditional international law, in particular the centrality of state sovereignty, the cornerstone of international law, and the prioritization of national self-interests. Elisabeth and Arvid were required to stanchly defend CHM against claims of 'utopianism'. The existing international legal regime, the 'freedom of the high seas', was an open access regime that left the oceans vulnerable to degradation and therefore had to change. What began as a doctrine suited to the needs of traditional maritime empires had become a right to overfish and a license to pollute.[5] Despite the difficulties, they argued that *necessity* required a new principle of law given the grave risks arising from competition for and exploitation of ocean resources, together with the inadequacy of traditional international law principles. Critically, CHM did not disregard the individual interests of states, but rather placed them in the longer term collective context of the 'common good'.[6] In 1971, Arvid drafted an

3 A. Pardo, *The Common Heritage; Selected Papers on Oceans and World Order 1967–1974* (Valletta: Malta University Press, 1975), 176.

4 A. Kiss, "The Common Heritage of Mankind: Utopia or Reality?" *Law in the International Community* 40, no. 3 (1985): 423–441, 427.

5 A. Beesley, "Grotius and the New Law," *Ocean Yearbook* 18 (2004): 98–116, 105.

6 Pardo, *supra* note 3.

Ocean Space Treaty to "show how [CHM] could be implemented in the marine environment as [an integrated] whole."[7]

Elisabeth and Arvid worked tirelessly to champion CHM and its legal implementation in the law of the sea and, ultimately, UNCLOS. Where they perhaps differed was in their response to the outcome of the negotiations. A combination of political and economic factors greatly restricted the scope of CHM to mineral resources on the deep seabed and ocean floor in areas outside of national jurisdiction.[8] UNCLOS did not apply CHM to the entire ocean environment as a complex and interconnected ecological whole. This created 'ecological nonsense' that left much of the oceans vulnerable to traditional notions of state sovereignty (including creeping claims of sovereign jurisdiction), common property, and freedom of the high seas. Arvid expressed grave disappointment with this outcome.[9]

In contrast, Elisabeth remained wholly committed to the larger vision of CHM. She saw the use of CHM in UNCLOS as a seed, from which a more expansive regime would eventually grow. For Elisabeth (and others) CHM embraced a moral force that unifies humanity and is *capable* of generating an integrated or coherent "view of ourselves in our environment that is both new and old" and "attempts to blend Western scientific values with Eastern philosophical values."[10] That this vision has not yet come to fruition was not a disappointment but an indication that the 'philosophical setting' for CHM is not yet in place.[11] To this day, the ethical and moral foundation of the International Oceans Institute remains upholding and *expanding* CHM.[12]

7 A. Pardo, "The Origins of the 1967 Malta Initiative," *International Insights* 9, no. 2 (1993): 65–69, 67.

8 UNCLOS, *supra* note 2, art. 136 provides that the 'Area' and its resources are the common heritage of mankind (CHM). 'Area' is defined in Article 1(1) as "the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction." Resources are defined in Article 133.

9 E. Mann Borgese, "Arvid Pardo (1914–1999): In Memoriam," *Ocean Yearbook* 14 (2000): xix–xxxviii. Note however the relevance of CHM to the role of the International Seabed Authority (ISA) and law relating to outer space, the moon, natural and cultural heritage, and Antarctica. See P. Taylor, "The Concept of the Common Heritage of Mankind," in *Research Handbook on Fundamental Concepts of Environmental Law*, ed., D. Fisher (Cheltenham: Edward Elgar, 2016), 306–333, 313–316.

10 E. Mann Borgese, *The Future of the Oceans: A Report to the Club of Rome* (Montreal: Harvest House, 1986), 131.

11 Id., 125–134.

12 See "IOI Vision, Mission and Goals," International Ocean Institute (IOI), https://www.ioinst.org/about-1/vision-mission-and-goals/.

Today—A New Dawn for the Original Vision

Where are we today—50 years on from Pardo's 1967 UN speech (which launched CHM and led to UNCLOS negotiations) and 35 years on from UNCLOS? Sadly, the oceans are in a far more dire state than 50 years ago. The cumulative impact of multiple interconnected threats to the health of the oceans now imperils its regenerative capacity.[13] We also have a more comprehensive understanding of the oceans as a complex interconnected ecological system *and* an integral part of the Earth's climate system.[14]

The paradox of recent scientific discoveries (e.g., seamounts and thermal vents) is that we both know more while also appreciating how little we know. The magnitude of the unknown calls into serious question our ability to judge the ecological impact of human activities.[15] Alongside scientific knowledge comes a better appreciation of the multidimensional failures of international environmental law (including the law of the sea) to halt or turn back the continuing trajectory of large-scale cumulative ocean degradation. A recent analysis described international environmental law as immature, underdeveloped, and ineffective.[16] It is a legal system that does not yet adequately serve the "greater interests of humanity and planetary welfare."[17] Taken together, the *need for radical change* foreseen by Arvid and Elisabeth, articulated as the principle of CHM, is now much more urgent than ever before.

Where then, is the new dawn or opportunity for CHM? It comes in the form of UN discussions on another implementing agreement to UNCLOS.[18] This

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13 See Group of Experts of the Regular Process, "First Global Integrated Marine Assessment: World Ocean Assessment 1," United Nations (2016), http://www.un.org/depts/los/global_reporting/WOA_RPROC/WOACompilation.pdf.

14 The ocean and cryosphere are the subject of a special report to the Intergovernmental Panel on Climate Change, due in 2019 (https://www.ipcc.ch/report/srocc/). Earth system science establishes what we have long known: the oceans are both the giver and sustainer of all life on Earth. See W. Steffen, "The Planetary Boundaries Framework: Defining a Safe Operating Space for Humanity," in *The Safe Operating Space Treaty: A New Approach to Managing the Earth's System Use*, eds., P. Magalhães et al. (Newcastle upon Tyne: Cambridge Scholars Publishing, 2016), 23–47.

15 C.L. Van Dover et al., "Biodiversity Loss from Deep-seabed Mining," *Nature Geoscience* 10 (June 2017): 464–465, doi.org/10.1038/ngeo2983.

16 F. Francioni, "International Common Goods: An Epilogue," in *International Law for Common Goods: Normative Perspectives on Human Rights, Culture and Nature*, eds., A.F. Vrdoljak and F. Lenzerini (Oxford: Hart Publishing, 2014), 443–448.

17 *Case Concerning the Gabcikovo-Nagymaros Project* (*Hungary v. Slovakia*), [1997] ICJ Reports 7, separate opinion of Vice-President Weeramantry, at C(c).

18 United Nations General Assembly (UNGA), Report of the Preparatory Committee established by General Assembly resolution 69/292, UN Doc. A/AC.287/2017/PC.4/2 (2017).

is currently framed as a regime for the 'conservation and sustainable use of marine biological diversity'. Could CHM be used as the normative basis for this new regime, in a manner consistent with the original vision of Arvid and Elisabeth?

Before outlining how this could occur, it must be noted that the scope of this future regime is currently limited to marine biological diversity in 'areas beyond national jurisdiction' (ABNJ), i.e., the high seas. This is so despite the fact that it makes no sense from an ecological perspective as it perpetuates the problem of a lack of legal and practical co-ordination between the management of areas within *and* areas beyond national jurisdiction, and can undermine ecological outcomes. In the view of jurist Tullio Treves, the reasons are ideological and historical. "State sovereignty is seen as a supreme value: any idea that could question recently obtained and hard-fought extensions of it are considered with suspicion and rejected off hand by a substantial number of States."[19] In his view, despite persuasive arguments for a different approach, and the growing awareness of the problems, change will only come slowly and "it is a political requirement" to proceed on this limited basis.[20]

This essay argues for a very different approach: the magnitude and urgency of the problems faced no longer affords us the time for slow incremental change! Drawing from the vision of Elisabeth and Arvid, CHM can—and must—be used as the overarching normative concept for a whole of ocean space regime; encompassing the seabed, the water column, surface and space above, as an interconnected ecological whole. In this way, CHM extends across and co-ordinates priorities and interaction within and between all pre-existing ocean jurisdictions.

This approach does not deny state sovereignty. When applied *within* national jurisdiction, states retain the legal power to control and regulate activities. But this sovereign authority is subject to limitations (or ecological responsibilities) specifically designed to protect the interests of all, by serving the well-being of the whole. In this way, CHM rejects unfettered sovereignty, but does not replace it with an international common or joint property regime.[21] Given the diverse capacities, approaches, and results obtained from the exercise of sovereign rights in national jurisdiction, a period and process for co-ordinating

19 T. Treves, "Principles and Objectives of the Legal Regime Governing Areas Beyond National Jurisdiction," in *The International Legal Region of Areas Beyond National Jurisdiction: Current and Future Developments,* eds., E.J. Molenaar and A.G. Oude Elferink (Leiden: Martinus Nijhoff, 2010), 7–25, 12.

20 Id.

21 This misunderstanding of CHM caused its rejection by developing states in the context of the UN Convention on Biological Diversity. Taylor, *supra* note 9, 316.

ecological responsibilities would be required, together with a more expansive understanding of benefit and burden sharing. As Peter Sand's research demonstrates, precedents exist within international biodiversity policy and law. States are already beginning to act as global environmental trustees, in a manner that strengthens (not weakens) their sovereign legitimacy.[22]

As applied to ABNJ, an additional key element of CHM would be that of non-appropriation—preventing states from claiming or exercising sovereignty/sovereign rights over ABNJ. The objective is to halt continued and new forms of creeping sovereignty, thereby protecting ABNJ as a global ecological commons; belonging to all but owned by none. This will require better delimitation of existing and extended claims to national jurisdiction,[23] in addition to halting claims to parts of ABNJ. CHM fundamentally changes the existing 'freedom of the high seas' regime. It constrains the exercise of those freedoms (e.g., fishing, navigation, pipe and cable laying)[24] by the fulfilment of ecological responsibilities that prioritize and meet the interests of all. This is very different from the current understanding according to which these freedoms or rights are constrained only by the rule of 'due regard' to the interests of other states exercising those rights.[25] In short, CHM places 'use rights' within the overarching prior context of ecological responsibilities. States are required to act as global environmental trustees.

By using CHM as an overarching normative concept, in the manner outlined above, we create a very important opportunity; to strengthen and commit in moral solidarity (and legal form) to the objective of protecting and restoring the oceans as an integrated ecological system. This requires us to clarify the relationship between protection/restoration and human use. As ecological integrity is clearly the precondition for long-term well-being of all life, of which humans are a part, its protection/restoration must be the clearly articulated objective.[26] To achieve this, we can no longer employ the techniques of a weak, 'do no harm' approach. These approaches, especially in the context of biodiversity protection, use vague obligations that leave space for a 'balancing of interests'. This enables governments to sacrifice (or trade off) the integrity of

22 P.H. Sand, "The Concept of Public Trusteeship in the Transboundary Governance of Biodiversity," in *Transboundary Governance of Biodiversity*, eds., L. Kotzé and T. Marauhn (Leiden: Brill, 2014), 34–64.

23 A.G. Oude Elferink, "The Regime of the Area: Delineating the Scope of Application of the Common Heritage Principle and Freedom of the High Seas," *International Journal of Maritime and Coastal Law* 22, no. 1(2007): 143–176.

24 UNCLOS, *supra* note 2, art. 87(1).

25 Id., art. 87(2).

26 K. Bosselmann, *The Principle of Sustainability* (New York: Routledge, 2017), 40–45.

ecological systems for economic benefit, without this being a clear violation of the law.[27] As Francioni observes, the cumulative effect of this approach is that "most environmental damage is caused by lawful acts that have had adverse effects on the environment."[28]

The use of CHM, as described above, creates a new 'default position' for the law as it applies to the oceans. This gives the law a new overarching objective or purpose.[29] The function of a new default position is to define the start point for what is acceptable human activity, in the absence of specific law.[30] It also provides a guiding concept for more specific law thereby defining the spirit or intention, according to which law is written, interpreted, and applied (and when necessary amended). Thus, CHM can provide a critical co-ordinating role, mitigating against the current fragmentation of ocean regimes, *and* creating coherence for new topic specific ocean regimes.

The current ABNJ discussions illustrate the potential risks of fragmentation in the creation of new issue specific regimes. This work could be viewed as largely 'technical' in nature because the primary focus is on one form of resource use, with economic potential (marine genetic resources). Discussions are proceeding on the basis that only sampling is required, with the most important issues being benefit-sharing of scientific research and outcomes, capacity building, and technology transfer.[31] In contrast, civil society has advocated for comprehensive protection of marine biological diversity via a governance regime to remedy the multiple gaps and weaknesses in existing law.[32] This objective has become confined to discussions on 'area based conservation measures' (e.g., marine protected areas) for ABNJ only. This approach (*on its own*) risks creating a dichotomy between special areas (worth saving) and non-special areas (which are not worth saving). If we are to protect and restore the whole marine environment, then such distinctions (when used alone) are untenable.[33] Furthermore, the 'relationship' between these two specific regimes

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27 K. Bastmeijer, "Ecological Restoration in International Biodiversity Law: A Promising Strategy to Address Our Failure to Prevent?" in *Research Handbook on Biodiversity Law*, eds., M. Bowman, P. Davies and E. Goodwin (Cheltenham: Edward Elgar, 2016), 387–413, 400.

28 Quoted in Bastmeijer, id., 402.

29 Bosselmann, *supra* note 26. Contra Treves who suggests that a revised 'freedom of the high seas' principle should be the default position for ABNJ regimes, *supra* note 19, 21–25.

30 A. Jóhannsdóttir, *The Significance of Default* (Jur. dr. dissertation, Uppsala Universitet, Sweden 2009), http://www.diva-portal.org/smash/get/diva2:173192/FULLTEXT01.pdf.

31 Treves, *supra* note 19, 16–20.

32 Id., 20–21.

33 Bastmeijer, *supra* note 27, 403.

is yet to be defined, as is the applicability of 'freedom of the high seas' and/or CHM as guiding concepts.[34]

This brief discussion of CHM does not answer many critical questions, including how to bring about its acceptance by states, and how to implement it in a broader governance and institutional context, including progressively applying it to existing regimes. These matters are critically intertwined and pose difficult challenges. Nevertheless, several important trends and developments are emerging in international law to address similar issues in related contexts. These include cosmopolitanism, global environmental constitutionalism, states as environmental trustees, and ecological approaches to law.[35] More specifically, despite its terminology it is not inherently an anthropocentric concept. However, it needs to be better articulated as the 'common heritage of *all life*' embracing an understanding of intrinsic value and humanity as part of ecological systems.[36] In addition, the social equity aspect of CHM needs to be better understood and applied within the overarching framework of 'strong' sustainable development, and not confined to regimes for resource use.[37]

Conclusion

The ABNJ discussions, despite their limited framing, present a critical opportunity to return Elisabeth and Arvid's original vision for CHM. Measured against the current state of negotiations, how realistic is this?

To date, there are few, if any, signs of states advocating for CHM, as outlined here.

State sovereignty dominates as the supreme value.[38] Despite years of discussions, many states may not be in a hurry to negotiate at all, reasoning that *their sovereign interests* are best protected by the freedom of the high seas principle.[39] Much of the discussion on CHM has reduced it to the status of a

34 UNGA, *supra* note 18, para. 38(b) at p. 17/19: "further discussions are required." Another problem is how marine protected areas will restrict traditional high seas freedoms in order to protect ecological systems.

35 K. Bosselmann and P. Taylor, eds., *Ecological Approaches to Environmental Law* (Cheltenham: Edward Elgar, 2017).

36 P. Taylor, *An Ecological Approach to International Law* (London and New York: Routledge, 1998), c. 6. See also E. Mann Borgese, *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: UNU Press, 1998), 198.

37 Mann Borgese, id.

38 Treves, *supra* note 19.

39 Id.

polarizing ideological tool, limited to conflicts over marine genetic resources in ABNJ. References to its broader ethical and ecological responsibility elements are vague. Efforts to keep the work progressing has led to a 'pragmatic' 'package deal approach' which may (it is feared) see CHM dropped altogether.[40]

However, when measured against a different reality, the prospects for CHM change. The ecological need is becoming ever more urgent and apparent and the limited scope and trajectory of the current discussions (into marine genetic resources and 'area based conservation measures') for ABNJ only, re-enforce Elisabeth and Arvid's concerns about the deficiencies of traditional international law. The future they foresaw is the reality we now confront, and it is one that requires urgent solutions.

Fifty years ago, the Mother of the Oceans and the Father of the Law of the Sea, led the way. It is now our task to advance strategies of 'realistic' utopianism,[41] and to remain alert to regressive trends. As Arvid Pardo reminded us: "It will be up to all of us to frustrate [designs to thwart CHM] and to open deeper and wider cracks in traditional international law until, in the eternal cycle, a new global order emerges from the ruins of the old, better to serve all humanity."[42]

40 D. Tladi, "Pursuing a Brave New World for the Oceans: The Place of Common Heritage in a Proposed Law of the Sea Treaty," in *The Pursuit of a Brave New World in International Law: Essays in Honour of John Dugard*, eds., T. Maluwa, M. du Plessis and D. Tladi (Leiden: Brill, 2017), 87–113.

41 A. Peters, "Realizing Utopia as a Scholarly Endeavour," *The European Journal of International Law*, 24, no. 2 (2013): 533–552; P. Taylor and L. Stroud, *Common Heritage of Mankind: A Bibliography of Legal Writing* (Malta: Foundation de Malte, 2013).

42 Pardo, *supra* note 7, 69.

Marine Biodiversity in Areas Beyond National Jurisdiction

*David Freestone**
George Washington University Law School and Sargasso Sea Commission, Washington, DC, United States

The 1982 United Nations Convention on the Law of the Sea (UNCLOS) provides a detailed and generally comprehensive coverage of key issues relating to the regime of the ocean. It was famously compared by Tommy Koh, Chair of the final session of the Third Conference on the Law of the Sea in 1982 with a 'constitution for the oceans'.[1] However there are some gaps or 'unfinished agendas' in UNCLOS and as our understanding of the importance of high seas and deep sea ecosystems has increased it has become increasingly clear that the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction (or ABNJ) is one such unfinished agenda.[2]

In 2004, the United Nations General Assembly (UNGA) agreed to the recommendation of the United Nations Informal Consultative Process on the Oceans and the Law of the Sea (UNICPOLOS) to establish a process to look further into the question. To address the full range of issues related to the conservation of biodiversity in areas beyond national jurisdiction, it established the cumbrously named 'Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction'.[3] This Working Group, which soon

* The author has drawn on his previous writings, see, e.g., "Problems of High Seas Governance," in *The World Ocean in Globalisation: Challenges and Responses*, eds., D. Vidas and P. Schei (Leiden: Brill Nijhoff, 2011), 99–130; "Governing the Blue: Governance of Areas beyond National Jurisdiction in the Twenty-first Century," in *The Limits of Maritime Jurisdiction*, ed., Clive Schofield et al. (Leiden: Brill Nijhoff, 2014), 729–751; "Governance of Areas beyond National Jurisdiction: An Unfinished Agenda?" in *Law of the Sea: UNCLOS as a Living Treaty*, eds. J. Barrett and R. Barnes (London: British Institute of International and Comparative Law, 2016), 231–266 ['Governance of ABNJ'].

1 T.T.B. Koh, "A Constitution for the Oceans," *The Law of the Sea—Official Text of the United Nations Convention on the Law of the Sea*, UN Pub. Sales No. E.83.V.5 (New York: United Nations, 1983), http://www.un.org/depts/los/convention_agreements/texts/koh_english.pdf.

2 See Freestone, "Governance of ABNJ," *supra* note 1.

3 Further meetings were held in 2008, 2010, 2011, 2012, 2013, and 2014, with a final meeting in January 2015. See the BBNJ Working Group website, http://www.un.org/Depts/los/biodiversity workinggroup/biodiversityworkinggroup.htm.

became known as the BBNJ Working Group, held its first meeting in 2006, its second in 2008, and a third in 2010. Initial progress was slow. Matters highlighted in the discussions included the absence of a global legal instrument regulating the establishment and monitoring of marine protected areas (MPAs) in ABNJ, even though protected areas have proven to be extremely effective in maintaining biodiversity in coastal contexts, the absence of comprehensive environmental impact assessments (EIAs) for new activities in ABNJ, as well as the lack of co-ordination between those international organizations that are charged with regulating specific sectoral activities. However, a significant number of delegations expressed doubt as to whether a further legal instrument was necessary and suggested strongly that improved implementation of existing regimes should be the first priority. A part of the discussion also focused on whether the United Nations (UN) was the most appropriate forum for this discussion and whether the Convention on Biological Diversity (CBD) might provide both a more appropriate forum and perhaps a better basis for action on this issue than UNCLOS. In particular, delegates were aware of the discussions in various CBD Conference of the Parties (COP) meetings leading up to the 2010 Aichi Target 11 which envisaged that

> [b]y 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape.[4]

Even before the development of the Aichi targets, the CBD COP established that the comparative advantage of the CBD was in providing scientific advice and guidance on this matter and as a result, in October 2007 the Government of Portugal hosted in the Azores a CBD Expert Workshop on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection. In 2008, the CBD COP 9 Decision IX/20 on "Marine and coastal biodiversity" adopted the scientific criteria recommended by the Azores Workshop for identifying ecologically or biologically significant marine areas (or EBSAS) in

4 See Convention on Biological Diversity (CBD), COP 7, Decision VII/30, Strategic Plan: Future Evaluation of Progress (2004), Annex II, Goal 1.1; K. Scott, "Conservation on the High Seas: Developing the Concept of the High Seas Marine Protected Areas," *International Journal of Marine and Coastal Law* 27 (2012): 849–850.

need of protection in open-ocean waters and deep-sea habitats.[5] Annex I sets out the seven criteria in detail, but simply stated they are: (1) uniqueness or rarity; (2) special importance for life history stages of species; (3) importance for threatened, endangered or declining species and/or habitats; (4) vulnerability, fragility, sensitivity, or slow recovery; (5) biological productivity; (6) biological diversity; and (7) naturalness.

Decision IX/20 also set out in Annex II, “Scientific Guidance for Selecting Areas to Establish a Representative Network of Marine Protected Areas, Including in Open Ocean Waters and Deep-sea Habitats,” and accepted the offer of the Governments of Canada and Germany to organize and host another workshop to “provide scientific and technical guidance on the use and further development of biogeographic classification systems, and guidance on the identification of areas beyond the national jurisdiction, which meet the scientific criteria in annex I to the present decision.”[6] That workshop was held in Ottawa, Canada, in September/October 2009 and was able to report back to COP 10 in Nagoya, Japan, that same year.

At COP 10, the parties decided to initiate a science-driven process to describe EBSAs.[7] To that end, by Decision X/29, the COP requested its executive secretary to work with parties and competent organizations at international, regional, and sub-regional levels, to convene a series of regional workshops to facilitate the description of EBSAs.

This was the origin of the series of regional and sub-regional scientific workshops convened by the CBD Secretariat team to describe EBSAs. It was never intended that EBSAs would have any legal status *per se*. The process of identifying them was to be a science-led process and the adoption of appropriate measures for the conservation and sustainable use of areas identified as EBSAs would be left to the relevant competent international organizations in accordance with international law. In other words, while the CBD does not have competence to designate marine protected areas, information shared through the EBSA identification process may help strengthen the scientific basis for protective measures to be taken by other sectorial organizations. To date, more than 15 workshops have been held[8] and more than 150 sites identified by the workshops. Although the sites are identified by an ostensibly non-political,

5 CBD, COP 9, Decision IX/20, Marine and Coastal Biodiversity (2008).
6 Id., para. 19.
7 CBD, COP 10, Decision X/29, Marine and Coastal Biodiversity (2010), para. 36.
8 For a full list see “Background on the EBSA Process,” CBD Secretariat, https://www.cbd.int/ebsa/about.

scientific process, to date international organizations have not been willing to rely on this process to adopt their own protection measures.[9]

In the meantime the BBNJ Working Group had continued its debates in the UN. However, the lively debates on improved governance became overshadowed by controversy over the future regime for exploitation of marine genetic resources beyond national jurisdiction.[10] The G-77[11] and China argued that the common heritage of mankind concept in UNCLOS, which applies to deep seabed minerals,[12] should also apply to the living resources of the deep ocean floor, many of which may have important industrial and pharmaceutical potential. They argued that, rather than being subject to the open access regime of the high seas water column as advocated by some states, if the drafters of UNCLOS had been aware of these unique living resources—rather than simply being aware of the famous 'manganese nodules'—they would doubtless have specifically included these within the deep sea bed regime of common heritage.[13] These polarized positions produced a stalemate in the discussions at the BBNJ Working Group. However, at the May 2011 meeting there was a breakthrough. It was agreed that the issues of protection of biodiversity through conservation and management tools such as EIAs and MPAs should be linked with issues relating to access and benefit sharing of marine genetic resources.[14] This was discussed further at the 2012 BBNJ Working Group meeting and at the UN Conference on Sustainable Development (Rio+20) in June 2012. The outcome document of the Rio Conference, entitled "The future we want,"[15] contained the commitment "to address, on an urgent basis, the issue of the conservation and sustainable use of marine biological diversity of areas beyond national juris-

9 See D. Freestone et al., "Can Existing Institutions Protect Biodiversity in Areas Beyond National Jurisdiction? Experiences from Two On-going Processes," *Marine Policy* 42 (2014): 167–175. And note the recent award of a seabed mining exploration licence by the ISA to Poland regarding a site on the Mid-Atlantic Ridge which covers the unique "Lost City" EBSA.

10 See David Leary et al., "Marine Genetic Resources: A Review of the Scientific and Commercial Interest," *Marine Policy* 33 (2009): 183.

11 The Group of 77 or G-77 is an important voting bloc of the developing countries within the UN system.

12 See United Nations Convention on the Law of the Sea, Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3, art. 138: "The Area and its resources are the common heritage of mankind." Article 133 further provides that 'resources' means "all solid liquid or gaseous mineral resources in situ in the Area at or beneath the seabed, including polymetallic nodules."

13 For records of these discussions see BBNJ Work Group, *supra* note 3.

14 UNGA, UN Doc. A/66/119 (2011), Annex 1: Recommendations of the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction and Co-Chairs' summary of discussions.

15 UNGA Res. 66/288 (2012), Annex.

diction, including by taking a decision on the development of an international instrument under the United Nations Convention on the Law of the Sea."[16]

To address this commitment, the UNGA, in Resolution 68/70, asked the Secretary-General to convene three more meetings of the BBNJ Working Group.[17] These took place 1–5 April and 16–19 June 2014 and 20–23 January 2015. At its 2015 meeting, the BBNJ Working Group decided, after protracted debate, to recommend to the UNGA that it "[d]ecide to develop an international legally binding instrument [ILBI] under the Convention on the conservation and sustainable use of marine biological diversity of areas of areas beyond national jurisdiction …."

In 2015 the UNGA accepted the BBNJ Working Group's recommendation for the establishment of a Preparatory Commission, to begin work in 2016 and to report to the UNGA in 2017 with specific text recommendations for an ILBI.[18] Four sessions of the Preparatory Commission were held; in March and August of 2016 and in March and July of 2017. Early in the morning of the day after its final session was due to end, on 21 July 2017, after a protracted and contentious session, the Preparatory Commission, despite having been unable to reach consensus on all of the proposed elements of an ILBI, did reach consensus to recommend that the UNGA

> take a decision, as soon as possible, on the convening of an intergovernmental conference, under the auspices of the United Nations, to consider the recommendations of the Preparatory Committee on the elements and to elaborate the text of an international legally binding instrument under the Convention.[19]

The UNGA is expected to take such a decision in the near future, but in the light of the complexity of the issues to be addressed, the negotiations at the international conference seem likely to take a number of years. It remains to be seen whether the new ILBI when concluded will indeed fully complete this unfinished agenda of the 'constitution for the oceans'.

16 Id., para. 162; UNGA Res. 68/70, Oceans and law of the sea (2013), para. 197.

17 UNGA Res. 68/70, id., para. 200.

18 Topics to be included were identified in the package agreed by the BBNJ Working Group in 2011, namely, the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction, in particular, together and as a whole; marine genetic resources, including questions on the sharing of benefits; measures such as area-based management tools, including marine protected areas; environmental impact assessments, as well as capacity-building and transfer of marine technology.

19 UNGA, Report of the Preparatory Committee established by General Assembly resolution 69/292, UN Doc. A/AC.287/2017/PC.4/2 (2017), para. 38(b).

The Evolution of Scientific and Technical Methodologies in the Delimitation of Maritime Spaces

Galo Carrera
Marine Affairs Program, Dalhousie University,
Halifax, Nova Scotia, Canada

Introduction

The most important modern theoretical contribution made to ocean boundary-making is the recognition that establishing maritime boundaries and outer limits of national maritime spaces has a functional role.[1] Under this theory, boundaries and limits are not regarded as separate jurisdictional or geometric entities, but rather they are important elements for sustainable development of the oceans. The theory of ocean boundary-making has been the subject of intense interdisciplinary research.[2] The value of the contributions made by any particular discipline towards the delimitation of a maritime boundary is largely measured by its ability to support more effective ocean governance.

Contemporary international practice recognizes the fundamentally interdisciplinary nature of the delimitation of maritime spaces. The roles of technical and scientific experts has evolved from simple technical tasks of depicting a geometric line or area on a nautical chart to developing a wide set of creative boundary scenarios and proposals. The boundary scenarios are developed in view of all the legal, historic, economic, strategic, technical, and scientific data and information available for the particular maritime region and are depicted in a variety of formats. Flexibility to accommodate any intrinsically special and relevant circumstances of each maritime boundary seems to be one of the key factors for success.

This essay cannot provide a full description of the evolution of ocean boundary-making methodologies. Instead it highlights the evolution of the scientific methodology employed in the delimitation of international maritime spaces, which comprises two components: the determination of the outer limits of

1 D.M. Johnston, *The Theory and History of Ocean Boundary-Making* (Kingston: McGill-Queen's University Press, 1988).
2 United Nations, *Handbook on the Delimitation of Maritime Boundaries* (New York, 2000).

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maritime spaces under national jurisdiction and the delimitation of international maritime boundaries.

Whereas the outer limits of maritime spaces under national jurisdiction are determined by states as a result of unilateral actions by the coastal state, international maritime boundaries between claimant states are either created as a result of (i) international legal agreements reached through bilateral or multilateral negotiations and diplomacy, or (ii) third-party interventions such as enquiry, mediation, conciliation, arbitration, judicial settlement, resort to regional agencies or arrangements, or other peaceful means in accordance with Article 33 of the Charter of the United Nations.[3]

Some of the methodologies described here are applied by national organizations worldwide in support of routine operations. Other methods, however, are the result of analyses of boundaries determined by international courts and tribunals. For example, one of the most important recent developments in the delimitation of the outer limits of the continental shelf are presented in the Scientific and Technical Guidelines produced by the Commission on the Limits of the Continental Shelf (CLCS).[4]

Early Methods and Pioneers

A review of the evolution of methodology in the delimitation of maritime spaces must consider both national legislation and the work of international law conferences and the resulting conventions. The League of Nations Codification Conference of 1930 and the First and Third United Nations Conferences on the Law of the Sea are as much a *tour de force* as the corpus of *codified international law* produced by the latter two conferences, such as the 1958 Geneva Conventions on the Territorial Sea and the Contiguous Zone[5] and the Continental Shelf,[6] and the 1982 United Nations Convention on the Law of the Sea (UNCLOS).[7]

Various scientific and technical scholars have made important contributions to the discussion of the delimitation of maritime spaces in the context

3 The Charter of the United Nations was signed, in San Francisco, on 26 June 1945, at the conclusion of the United Nations Conference on International Organization, and came into force on 24 October 1945. The Statute of the International Court of Justice is an integral part of the Charter. See Part XV of the United Nations Convention on the Law of the Sea.

4 Commission on the Limits of the Continental Shelf (CLCS), Doc. CLCS/11 (13 May 1999); Doc. CLCS/11/Add.1 (3 September 1999).

5 Geneva, 29 April 1958, 516 *U.N.T.S.* 205.

6 Geneva, 29 April 1958, 499 *U.N.T.S.* 311.

7 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3.

of national legislation and international law conferences and conventions. For example, Shalowitz's study provides an excellent example of the evolution and development of methods and techniques for the delimitation of maritime spaces in the influential national legislation of the United States.[8] Similarly, Boggs has described the seminal contributions made on scientific and technical aspects relating to the determination of the outer limit of the territorial sea and the determination of international maritime boundaries during the 1930 Codification Conference.[9] The technique used to determine the offshore limits of the territorial sea from a selection of points along baselines was originally defined by Boggs as the method of envelopes of arcs first introduced as a proposal for codification in international law by the US delegation at the 1930 Hague Conference. This method provides an offshore limit every point of which is located at a prescribed distance from the nearest point on the coast. Shalowitz advanced a more elegant definition of this method where the offshore limit "is the locus of the centre of a circle the circumference of which is always in contact with the coastline, that is, with the low water line or the seaward limits of inland waters."[10]

The legal evolution of the determination of outer limits from straight lines has been reviewed elsewhere.[11] From the technical standpoint, the difficult task of determining offshore limits from straight or archipelagic baselines is compounded by the fact that neither of these has ever been rigorously defined in the legal literature from a geodetic perspective. The existing literature only speculates as to what the nature of these lines might be.[12]

The vast body of work by Alexander[13] and many others describes methods for the determination of all baselines, the delimitation of maritime spaces,

8 A.L. Shalowitz, *Shore and Sea Boundaries: With Special Reference to the Interpretation and Use of Coast and Geodetic Survey Data, Volume 1, Boundary Problems Associated with the Submerged Lands Cases and the Submerged Lands Acts* (Washington, DC: US Department of Commerce, Coast and Geodetic Survey, 1962).

9 S.W. Boggs, "Delimitation of the Territorial Sea: The Method of Delimitation Proposed by the Delegation of the United States at the Hague Conference for the Codification of International Law," *American Journal of International Law* 24, no. 3 (1930): 541–555: S.W. Boggs, "Problems of Water Boundary Definition: Median Line and International Boundaries through Territorial Waters," *Geographical Review* 27, no. 3 (1937): 445–456.

10 Shalowitz, *supra* note 8, 171.

11 For example, T. Gihl, "The Baseline of the Territorial Sea," *Scandinavian Studies in Law* 11 (1967): 119–174.

12 R.D. Hodgson and E.J. Cooper, "The Technical Delimitation of a Modern Equidistant Boundary," *Ocean Development and International Law* 3, no. 4 (1976): 361–388. When applied in a rigorous geodetic fashion, the method of trace parallel can implement the legal provisions contained in the *Anglo-Norwegian Fisheries Case*, Judgment [1951] ICJ 3.

13 See L.M. Alexander, "Baseline Delimitations and Maritime Boundaries," *Virginia Journal of International Law* 23, no. 3 (1983): 503–526; L.M. Alexander, "Equidistance and Maritime

and their evolving breadth over time, and the interpretation of a wide range of scientific and technical provisions and terms discussed during the Third Conference on the Law of the Sea and codified in UNCLOS. The development and analyses of international maritime boundary delimitation methods in state practice and judicial settlements has been extensively studied and scrutinized in international scientific and legal literature.[14] The description of equidistance, simplified or modified equidistance, half- or partial-effect, bisectors, equi-ratio, parallel and meridian, and enclave methods[15] for the delimitation of international maritime boundaries in the exclusive economic zone and the continental shelf in order to achieve an equitable solution are beyond the space and scope allocated to this essay. In particular, key elements of the modern methodology established by the International Court of Justice, the International Tribunal for the Law of the Sea, and other tribunals in case law, are important.[16] However, a number of objective and subjective factors, which underlie this methodology, remain to be discussed and clarified.

As a corollary to this section, it will suffice to quote Alexander in order to gain an appreciation of the enormous progress and advancement made in the introduction of science and technology in the delimitation of maritime spaces and the ability to develop and present perceptual information to courts and tribunals since 1985:

> The third point is that we had with us at The Hague what I felt was a spectacular display of specially prepared maps, illustrating graphically the injustice which would be wrought on the people of Guinea, should the Court rule in favor of Guinea-Bissau's boundary claim. Many of the maps were transparent overlays and I personally believe that our cartographic materials, some of which we managed to leave on display even after our

Boundary Delimitation," in *International Boundaries and Boundary Conflict Resolution*, ed., C. Grundy-Warr (Durham: IBRU Press, 1990), pp. 1–7; L.M. Alexander, *Alternative Interpretations of Geographic Articles in the 1982 LOS Convention* (Kingston, RI: Center for Ocean Management Studies (COMS), University of Rhode Island (URI), 1990).

14 For example, C. Lathrop, ed., *International Maritime Boundaries*, Vol. 1–VII (Brill Nijhoff and the American Society of International Law).

15 For example, United Nations, *supra* note 2.

16 Various decisions from these tribunals propose a three-step methodology to implement the equitable principles/relevant circumstances approach for delimiting the exclusive economic zone and the continental shelf: (i) draw provisional delimitation line; (ii) consider whether the line should be adjusted by the consideration of relevant circumstances; and (iii) apply a proportionality test.

> presentations, may have helped our cause considerably. Guinea-Bissau, I might note, had no special maps whatever.[17]

The Impact of New Technologies on Ocean Boundary-making

Developments in data gathering and processing technologies have in turn significantly impacted the development and application of methodologies for the delimitation of maritime spaces. For example, the availability of global navigation satellite systems (GNSS) in geodesy, multi-beam echo-sounding, and light detection and ranging (LIDAR) in coastal hydrography, satellite imagery and remote sensing designed to detect and classify vast amounts of information in cartography, and marine, land, air, and space techniques in geophysics, provide high-quality data in volumes unprecedented in the history of science.

Modern GNSS in geodesy such as global positioning systems (GPS)[18] and its augmentation systems, the Russian Global Navigation Satellite System (GLONASS),[19] and the soon to be operational Galileo[20] and BeiDou-2[21] systems, allow not only for highly accurate positioning of baselines from which the breadth of the territorial sea is measured, but also monitoring of changes over time. These positioning systems provide worldwide kinematic positioning of vessels at sea and their spatial relationships with respect to outer limits and international maritime boundaries. Further, they are accurate enough to describe the attitude (heave, roll, and pitch rotations) and deformations of vessels in real-time.

The challenges posed by the need to process and derive useful information from large amounts of high-quality data have, in turn, been met by exponential developments in computer hardware and software technologies. While the availability of geographic information systems and large database storage architectures[22] have become standard tools for technical experts, specialized

17 L.M. Alexander, "Guinea/Guinea-Bissau Case Study: Maritime Boundary Maps," in *The Continental Shelf: Resources, Boundaries and Management*, eds., T.A. Grigalunas and L.C. Hanson (Kingston, RI: COMS, URI, 1986), 74.

18 See, "GPS Advanced Control Segment (OCX)," Los Angeles Air Force Base (25 October 2011), http://www.losangeles.af.mil/About-Us/Fact-Sheets/Article/343736/gps-advanced-control-segment-ocx/.

19 See GLONASS website, https://www.glonass-iac.ru/en/.

20 See "Galileo Status: Fact Sheet," European Space Agency (last updated July 2017), https://esamultimedia.esa.int/docs/galileo/GalileoFactsheet2017.pdf.

21 See "China will make BeiDou Navigation Satellite System available to global users by 2020," Next Big Future (28 June 2016), https://www.nextbigfuture.com/2016/06/china-will-make-beidou-navigation.html.

22 Multi-user relational geodatabases of unlimited size.

software has also been developed to address specific needs in the delimitation of maritime spaces. Some of these maritime delimitation software products are available as commercial products. The ability to process big data[23] is now, for example, explored as a user-behavior analytics tool in various applications relating to worldwide legal and illegal fisheries monitoring.[24]

Important advances in the production and visualization of large digital elevation models,[25] large amounts of high- and super-resolution air and satellite imagery, and digital charts and maps have been achieved over the last two decades. Multi-media technologies used to display such information are part of the current practice in international maritime boundary diplomatic negotiations and any other third-party intervention dispute settlement processes, including the preparation of materials in judicial processes, particularly oral hearings. These technologies have become evident in the preparation of submissions to the CLCS and presentations that states make in the process of their consideration.

Special mention must be made of the nautical technology that makes use of all national maritime limits and international maritime boundaries for modern marine navigation purposes: the Electronic Chart Display and Information System (ECDIS).[26] ECDIS is an operational navigation display, an interpreter of sensors, and a source of real-time information designed for route planning, positioning, and collision and grounding avoidance. It is an important tool in maritime transportation, marine natural resources exploration and exploitation, and the enforcement of maritime boundaries and limits. New standards for the depiction and deposit of limits of maritime spaces and maritime boundaries in digital format are currently being developed.[27]

The development of these new technologies interact with the process of delimiting maritime spaces in a symbiotic manner: Technology provides indispensable information for the determination of outer limits and international boundaries. In turn, new technologies may impose requirements on the methodology employed in the delimitation of international maritime spaces.

23 Volumes of data so large and complex that are impossible to process with common hardware and software tools.

24 See, for example, the Global Fishing Watch website, http://globalfishingwatch.org/.

25 W.B.F. Ryan et al., "Global Multi-Resolution Topography Synthesis," *Geochemistry, Geophysics, Geosystems* 10, no. 3 (2009), doi.org/ 10.1029/2008GC002332.

26 The International Hydrographic Organization maintains a set of standards related to ECDIS in the form of Special Publications, see their website at http://iho.int.

27 See "Main Page (S-121)," International Hydrographic Organization (last updated 16 March 2018), http://www.s-121.com/w/index.php/Main_Page.

Settling Maritime Boundaries: Why Some Countries Find It Easy, and Others Do Not

Michael Byers
Department of Political Science, University of British Columbia, Vancouver, British Columbia, Canada

Andreas Østhagen
Fridtjof Nansen Institute, Oslo, Norway

Introduction

Previously neglected maritime boundary disputes are acquiring newfound economic, political, and academic significance. Rising sea levels, changing distributions of marine natural resources, and growing demand for those resources have combined to create a 'perfect storm' for policy-making, diplomacy, and research. When surveying the world's maritime boundaries, it becomes clear that hundreds of disputes have been resolved. However, why states resolve their disputes, and with what motivation, is often unclear. Most studies describe the process as a matter of legal technicalities, driven by economic interests. As Douglas Johnston argues, boundary-making in the ocean is functionalist: done with an eye towards the functional usage of the maritime space itself.[1]

Yet hundreds of maritime disputes remain unresolved. The existence of a dispute can hinder the economic exploitation of offshore resources such as oil and gas and complicate the management of transboundary fish stocks. In other instances, maritime boundary disputes contribute to larger international tensions and conflicts. States do not necessarily resolve boundary disputes for functional purposes whenever it is convenient to do so. Instead, a number of factors may hinder or facilitate dispute resolution.

Maritime Boundaries

Maritime boundaries define the geographic spaces within which states, companies and individuals operate. An international legal regime for the oceans

1 D.M. Johnston, *The Theory and History of Ocean Boundary-Making* (Montreal: McGill-Queen's University Press, 1988).

came into being through the 1958 Geneva Conventions, the 1982 United Nations Convention on the Law of the Sea (UNCLOS), and parallel developments in customary international law. As a result, many states implemented 200 nautical mile exclusive economic zones (EEZ) in offshore waters, and a number of boundary disputes arose or became more significant between the maritime zones of 'adjacent' or 'opposing' coastal states. Some of these boundaries were immediately settled, but a large number remain disputed.

To understand the international law of maritime boundaries, it is essential to understand the difference between land and maritime space. While the concept of occupation is essential in establishing title to land territory, it does not hold relevance in the maritime domain. Contrary to the customary international law rules on sovereignty over land territory, occupation of the continental shelf cannot in itself lead to acquisition of sovereign rights. Thus, a marked separation between land and maritime space has emerged, with rights to the latter deriving from the former. Delimitation of territory on land rests on the principle that the territory belongs to *one* state, and the central point is to establish which state has the most valid claim. In the maritime domain, however, international law accepts that *both* states can have valid legal titles to a given area, in which case it becomes a matter of "reasonable sacrifice such as would make possible a division of the area of overlap."[2]

How to Settle a Boundary

Over the course of the twentieth century, principles of maritime boundary delimitation developed through a combination of treaties and customary international law, with the most important of these being 'equidistance'. The principle of equidistance entails a boundary that is an equal distance, at every point, from the two states' adjoining or opposing coastlines. This principle was codified in Article 6(2) of the 1958 Geneva Convention on the Continental Shelf.[3]

However, the International Court of Justice (ICJ) soon took the view that 'relevant' or 'special' circumstances should also be relevant to the delimitation of a maritime boundary, with such circumstances including—at times—not just coastal length and other geographical variables but also security interests and natural resources. This has been deemed *equity,* a principle different from

2 P. Weil, *The Law of Maritime Delimitation—Reflections* (London: Grotius Publications Limited, 1989), 91–92.

3 499 UNTS 311. See also: T.M. Franck, *Fairness in International Law and Institutions* (New York: Oxford University Press, 1995), 62.

equidistance. Indeed, as far back as 1969 the ICJ explained that "[e]quity does not necessarily imply equality."[4] Since 1982, the ICJ has provided greater specificity on the principle of equity, with a focus on geographic rather than societal and political factors.

The ICJ currently makes use of three-stage approach to maritime boundary disputes, which it outlined in the *Black Sea Case* between Romania and Ukraine in 2009. First, a 'provisional delimitation line' between disputing countries is established based on equidistance.[5] Second, there is a consideration of 'relevant circumstances' that might require an adjustment of this line to achieve an 'equitable result'.[6] Third, the Court evaluates whether the provisional line leads to any 'marked disproportion' taking the coastal lengths of the states into consideration.[7] Yet the development of the international law on maritime boundaries is not complete; it will undoubtedly adapt and evolve as new physical, political, technological, and economic developments emerge. Notions of equity and special circumstances also render the question of 'who gets what' more political than some international lawyers might admit.

Currently there are changes that are making the settlement of maritime boundary disputes—most of which arose in the 1970s and 1980s as the result of the development of rights over the continental shelf and the EEZ—more salient. Settlement of disputes continues to take place, though quite a number remain. Disputes range from active and conflictual, to dormant and cooperative. Prescott and Schofield highlight that "out of 427 potential maritime boundaries, only about 168 (39%) have been formally agreed, and many of these only partially."[8] The decisions of international courts and tribunals have shaped the law of maritime boundary delimitation, but the actual number of these decisions is quite limited. States usually rely on UNCLOS and customary international law as basis for settling their disputes, though this process is sometimes complicated by historic claims, treaties or arbitration decisions, as well as domestic politics and law. Moreover, UNCLOS does not specify *how* states are to settle their maritime boundary disputes, calling only for 'an

4 *North Sea Continental Shelf Cases* (*Federal Republic of Germany v. Denmark; Federal Republic of Germany* v. *Netherlands*) [1969] International Court of Justice (ICJ), "Judgment of 20 February 1969," para. 91.

5 *Maritime Delimitation in the Black Sea* (*Romania* v. *Ukraine*) [2009] ICJ, "Judgment of 3 February 2009," para. 116.

6 Id., paras. 118–120.

7 Id., para. 122.

8 V. Prescott and C. Schofield, *Maritime Political Boundaries of the World* (Leiden: Martinus Nijhoff, 2004), 218.

equitable solution'.[9] Most maritime disputes are settled bilaterally between the disputing parties, giving them the freedom to choose whichever result they both find comfortable.

Canada the Laggard?

A comparison of Canada and Norway provides an excellent example of the complexity of these processes. On 21 September 2010, the Russian and Norwegian foreign ministers surprised the Canadian government with an opinion piece in *The Globe and Mail* newspaper. In their co-authored article, Sergei Lavrov and Jonas Gahr Støre celebrated the conclusion of a Russia–Norway boundary treaty in the Barents Sea. However, they also expressed "hope that the agreement will inspire other countries in their attempts to resolve their maritime disputes, in the High North and elsewhere."[10]

Given their choice of venue, the message was clearly directed at Canada, which has five disputed maritime boundaries. That is a high number of disputes for a country with only three neighbors—the United States, Denmark (Greenland), and France (St. Pierre and Miquelon). Lavrov and Støre assumed that Canada had not tried hard enough to negotiate solutions and, by writing in a Canadian national newspaper, they were criticizing Canadian diplomats in a public forum. The problem is that Lavrov and Støre's assumption was wrong. We know this because of research we carried out comparing and contrasting Canada's maritime boundaries to Norway's, with the resulting detailed article published in the *Canadian Yearbook of International Law*.[11]

In that article, we examined the history of Canada's unresolved or only-partially-resolved boundaries in the Gulf of Maine, Beaufort Sea, Lincoln Sea, Dixon Entrance, and seaward of Juan de Fuca Strait. We also looked at Canada's two fully resolved boundaries between Baffin Island and Greenland and around St. Pierre and Miquelon. We compared the situation with that of Norway, which has successfully negotiated treaties for all seven of its maritime boundaries, including with Russia. We sought to understand whether the two

9 United Nations Convention on the Law of the Sea, Montego Bay, 10 December 1982, 10 December 1982, 1833 *U.N.T.S.* 3, art. 74.

10 S. Lavrov and J. Gahr Støre, "Canada, Take Note: Here's How to Resolve Maritime Disputes," *The Globe and Mail*, 21 September 2010, http://www.theglobeandmail.com/opinion/canada-take-note-heres-how-to-resolve-maritime-disputes/article4326372/.

11 M. Byers and A. Østhagen, "Why Does Canada Have So Many Unresolved Maritime Boundary Disputes?" *Canadian Yearbook of International Law* 54 (August 2017), doi.org/10.1017/cyl.2017.14.

countries' different records of boundary settlement are a result of different policy approaches, or whether they are a result of specific factors in each dispute, such as its geography, legal history, political context, or the existence of natural resources. In essence, we sought to understand whether Canada really is a diplomatic laggard. As a case study of the complexity of maritime boundary settlement the situations of both countries are instructive.

Comparing Canada and Norway

Our research revealed some similarities between the two countries' experiences with maritime boundary disputes. Both Norway and Canada actively sought to resolve their disputes in the mid-twentieth century, after international law gave coastal states exclusive rights to resources on the continental shelf. Norway quickly resolved a number of significant disputes in the North Sea and the Norwegian Sea. Canada settled its boundary with Greenland in 1973 and sought to resolve all four of its disputes with the United States by proposing a 'package deal'. When the offer was rejected, Canada and the United States sent part of the Gulf of Maine dispute to the ICJ. Also, beginning in 2005, Norway and Canada began paying more attention to the Arctic. Norway settled a small dispute near Greenland in 2006 and its major dispute with Russia in 2010. Canada initiated negotiations with the United States on the Beaufort Sea in 2010 and announced a tentative agreement with Denmark on the Lincoln Sea in 2012.

The similarities end here. Norway's ability to resolve the Barents Sea dispute was contingent on the preferences of its more powerful neighbor. Russia became willing to make concessions on the boundary because of its desire for legal certainty with regard to offshore oil and gas, as well as a desire to affirm the primacy of the UNCLOS regime in the Arctic.[12] The United States has shown no comparable willingness to compromise in the Beaufort Sea, presumably because the costs of oil and gas development in that remote and seasonally ice-bound region are prohibitively high.

Canada's unresolved disputes are also related to concerns about creating legal precedents. In both the Beaufort Sea and Dixon Entrance cases, Canada's legal position is based on a historical treaty or arbitration decision that prevents easy compromises. In contrast, Norway had no old treaties, decisions or judgments complicating its disputes and was able to consistently support the

12 A. Moe, D. Fjærtoft and I. Øverland, "Space and Timing: Why Was the Barents Sea Delimitation Dispute Resolved in 2010?" *Polar Geography* 34(3) (2011): 145–162.

win-win principle of 'equidistance'. Norway and Canada also have different approaches to uncertainty and risk. Norway exhibited a relatively high tolerance for economic risk and was prepared to conclude boundary agreements without knowing the exact location of oil and gas reserves. At the same time, it has shown a low tolerance of risk with regards to its relations with Russia, as the unresolved boundary was seen as a potential flashpoint for conflict.

Canada is more concerned about certainty with regards to natural resources, as was demonstrated in 2011 when it pulled back from negotiations on the Beaufort Sea because of uncertainty about the location of hydrocarbons. It is less concerned about international political risk, because all Canadian boundaries are with North Atlantic Treaty Organization allies. At the same time, Canadian politicians are very concerned about domestic political risk and will avoid making any moves that could be portrayed as 'selling out' on sovereignty. Ironically, Canadian politicians are only able to take this approach because of Canada's mostly amicable relationship with the United States, which makes the 'management' of ongoing disputes a viable option. Lastly, Canada is a federal country, and several of its boundary disputes are complicated by provincial claims. The provincial level British Columbia government will not stand quietly by while the Canadian federal government negotiates over Dixon Entrance. When it comes to boundary negotiations, Norway benefits from being a unitary state.

In short, Norway had a collection of boundary disputes that were of a very different character from Canada's disputes, which are more complicated and difficult to resolve. This does not mean that they are unsolvable. But instead of making assumptions on the basis of a country's record of settled versus unsettled disputes, policy-makers, diplomats and academics need to delve deep into the specific reasons why particular disputes remain unresolved—and why 'managing' a dispute might, in some situations, be the best option available.

The Complexities of Maritime Boundary Disputes

The foregoing case study illustrates the specificity and complexity of maritime boundary dispute negotiation and resolution. Treaty provisions, customary international law, and judicial or arbitral decisions can all play a role in the resolution of a maritime boundary dispute. But while the question 'who gets what' is sometimes answered—and is almost always guided—by international law, the question is also political. In this short essay, we have highlighted how diverse factors can influence maritime boundary negotiations and the chances of a settlement. It is at the nexus of international law, international relations, and domestic politics where the outcomes to disputes are made. Reducing maritime boundary disputes to simple dichotomous options does little to advance our knowledge of *how* and *why* states come to an agreement.

At the same time, there are some factors that we might expect to be present, and were certainly present in the cases of both Canada and Norway. The historic origin of a dispute sets its parameters. The engagement, or lack thereof, of interest groups determines the amount of pressure on national governments for-or-against an effort at dispute resolution. These groups are sometimes motivated by the potential for resource development in the disputed area. And historic patterns of enmity or amity can determine the security relevance of the dispute, which in turn might deem a dispute manageable without immediate impetus for a resolution, or demand an immediate resolution.

These insights will hopefully provide starting points for further enquiry, as unsettled maritime boundaries and related disputes are likely to become more salient in the future, including as a result of the recognition of sovereign rights over extended continental shelves and the consequent need (in some instances) to draw boundaries beyond 200 nautical miles. Additional studies of how other states have approached their maritime boundaries will provide further insight into the motivations and complexities of dispute resolution. They will also enable us to address the question of whether agreed maritime boundaries are always needed, or whether some disputes can be successfully ‘managed’ through informal arrangements or resource sharing regimes.

Legal Aspects of Climate Change

Karen N. Scott
School of Law, University of Canterbury,
Christchurch, New Zealand

Introduction

Climate change constitutes the greatest global long-term threat to the health of the planet. States have however, been slow to recognize the implications of climate change for the oceans—in contrast to the atmosphere and biosphere. The subordinate status of the oceans in the climate regime complex is perpetuated by the 1992 United Nations Framework Convention on Climate Change (UNFCCC)[1] itself, which pays scant attention to both the impacts of climate change on the oceans and the capacity of the ocean to mitigate climate change through its function as a sink for carbon dioxide (CO_2). Scientific research now underpins an improved public and indeed policy understanding of the impacts climate change on the oceans: increased water temperature and its impact on ecosystems and species including coral reefs; sea level rise; and, ironically, a reduction in the capacity of the oceans to absorb CO_2.[2] An excess of CO_2 in the oceans also leads to a distinct but connected challenge: ocean acidification, the lowering of ocean pH,[3] which poses a particular risk to calcifying organisms and reef ecosystems.[4] However, the development of regulatory responses has thus far been fragmented, with a strong emphasis on soft targets and obligations designed to fill and bridge the gaps between instruments with a mandate to address climate change and ocean acidification. Moreover, as the largest natural sink for CO_2 the oceans also represent a potential or at least a partial solution for climate change. Mediating this tension between protection and exploitation, and the moral complexity underpinning actions designed to mitigate and adapt to climate change, will be one of the greatest challenges for the law of the sea in the twenty-first century. This

1 New York, 9 May 1992, 1771 *U.N.T.S.* 107 [UNFCCC].
2 See M. Rhein et al., "Observations: Ocean," in *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, T.F. Stocker et al. (Cambridge: Cambridge University Press 2013), 255–315.
3 R. Zeebe et al., "Carbon Emissions and Acidification," *Science*, 321, no. 5885 (2008): 51–52.
4 J. Orr et al., "Anthropogenic Ocean Acidification Over the Twenty-first Century and Its Impact on Calcifying Organisms," *Nature* 437 (2005): 681–686.

essay will briefly explore the regime complex[5] that applies to climate change and the oceans, and focuses on issues relating to mitigation, adaptation, and exploitation. It will highlight the disconnect between these regimes and the lack of a co-ordinated and integrated approach to oceans climate policy and conclude with selected recommendations to support the development of an overall legal and policy framework.

Mitigation

Although the 1982 United Nations Convention on the Law of the Sea (UNCLOS)[6] purports to provide a constitution for the oceans, comprehensive in regulatory scope, it is not the primary regime for climate change mitigation. Its obligations on states to protect and preserve the marine environment[7] and to prevent and mitigate all sources of marine pollution,[8] whilst undoubtedly broad enough to encompass anthropogenic climate change and ocean acidification, are very general and arguably add little to existing external obligations relating to climate change. Articles 207 and 212 of UNCLOS, which set out obligations relating to land-based and atmospheric pollution respectively, neither establish global standards nor require states to comply with any such standards adopted. The one source of greenhouse gas emissions that is subject to specific regulation is ship-based greenhouse gas emissions, which since 1997, has been subject to regulation under Annex VI of the 1973/78 International Convention for the Prevention of Pollution from Ships.[9] Under Article 211, paragraph 2, of UNCLOS these standards are applicable to all UNCLOS parties.

The overarching obligation underpinning the climate change regime is the stabilization of greenhouse gas concentrations in the atmosphere at a level that prevents dangerous interference with the climate system.[10] The 'climate system' includes the oceans, but the focus of the UNFCCC is on the atmosphere,

5 A regime complex may be defined as "a loosely coupled set of specific regimes" which "pertain to the same issue domain or spatially defined area … and interaction with one another in the sense that the operation of each affects the performance of the others." See O.R. Young, "Building an International Regime Complex for the Arctic: Current Status and Next Steps," *The Polar Journal* 2, no. 2 (2012): 391–407, 394.

6 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3 [UNCLOS].

7 Id., arts 192, 193, 194(5). See also *Chagos Marine Protected Area Arbitration* (*Mauritius v. UK*), Annex VII Tribunal, 2015 [538]; *The South China Sea Arbitration* (*Philippines v. China*), Annex VII Tribunal, 2016 [992–993].

8 UNCLOS, id., art. 194.

9 London, 2 November 1973, 1340 *U.N.T.S.* 184, as amended.

10 UNFCCC, *supra* note 1, art. 2.

and this is demonstrated by the definition of climate change in the Convention itself as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the *global atmosphere*…"[11] Targets to mitigate climate change are established under the 1997 Kyoto Protocol[12] (and 2012 Doha Amendment[13]) and, most recently, by the 2015 Paris Agreement,[14] which establishes a global average temperature increase target of "well below 2°C above pre-industrial levels" with the aim of limiting the increase to 1.5°C.[15] Notably, however, there has been minimal discussion as to the implications of a 2ºC rise for the oceans, and there is no comparable target relating to ocean pH change and there are no specific commitments in relation to the rise in the production of CO_2, which is the primary cause of ocean acidification.[16]

In an effort to bridge and indeed fill the gaps between the oceans and climate regimes a number of soft goals have been developed, particularly in relation to ocean acidification and the related problem of climate change. For example, Aichi Biodiversity Target 10 adopted under the auspices of the 1992 Convention on Biological Diversity calls upon parties to minimize the impacts of climate change or ocean acidification on coral reefs and other vulnerable ecosystems so as to maintain their integrity and ecosystem function by 2015.[17] The UN General Assembly (UNGA) 2012 resolution adopting 'The future we want' called for collective action to prevent further ocean acidification and to take steps to promote ecosystem resilience.[18] Most recently, Sustainable Development Goal 14.3, adopted by the UNGA in 2015, urges states to "minimize and address the impacts of ocean acidification, including through enhanced scientific co-operation at all levels."[19] Soft targets and calls for action have been made by regional organizations such as the Arctic Council,[20] as well as by non-governmental and scientific organizations. Nevertheless, these initiatives fall

11 Id., art. 1(2) (emphasis added).

12 Protocol to the UNFCC, 11 December 1997, 2303 *U.N.T.S.* 214 [Kyoto Protocol].

13 UNFCC, Decision 1/CMP.8 (2012), Amendment to the Kyoto Protocol pursuant to its Article 3, paragraph 9 (the Doha Amendment).

14 Paris Agreement, 12 December 2015 (2016) 55 *I.L.M.* 743 (2016).

15 Id., art. 2(1)(a).

16 See the essay by Kumiko Azetsu-Scott in this volume.

17 Convention on Biological Diversity, COP Decision X/2, Strategic Plan for Biodiversity 2011–2020 (2010), Annex.

18 United Nations General Assembly (UNGA) Res. 66/288, The Future We Want (2012), para. 166.

19 UNGA Res. 70/1, Transforming Our World: The 2030 Agenda for Sustainable Development (2015).

20 See the 2013 Kiruna Declaration of the Eighth Ministerial Meeting of the Arctic Council.

short of binding and meaningful commitments relating to the mitigation of climate change and acidification as they relate to the oceans.

Adaptation

The second regulatory and policy intersection between climate change and the law of the sea lies in the area of adaptation. In contrast to mitigation, adaptation to climate change is an important theme within national, regional, and global instruments with oceans governance mandates. Adaptation, for example, is strongly endorsed within integrated approaches to oceans management, particularly in the context of integrated coastal zone management in regions such as the Mediterranean.[21] The need to promote ecosystem resilience designed to withstand multiple pressures, including climate change, underpins the designation of modern marine protected areas (MPAs). For example, the Ross Sea MPA, established in 2016 by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)[22] in the Southern Ocean—and the largest MPA in international waters to date—is designed to conserve ecosystem function and establish reference areas for monitoring natural variability and long-term change "to better gauge the ecosystem effects of climate change and fishing."[23] More generally, the impacts of climate change and ocean acidification on fish stocks is beginning to be considered as part of fisheries management by regional fisheries management organizations and states. CCAMLR, a leader in this area, is now required to consider climate change and ocean acidification when adopting conservation measures (including catch limits)[24] and, in 2016 anticipating the need to take precautionary action to protect areas newly exposed by ice retreat, the Commission adopted a measure permitting those areas to be designated scientific special areas.[25] Perhaps the most fundamental area of adaptation arises in the context of determining

21 See, for example, the 2008 Protocol on Integrated Coastal Zone Management to the 1976 Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (amended and renamed in 1995) (2009), OJ L34/19; Regional Climate Change Adaptation Framework for the Mediterranean Marine and Coastal Areas, adopted at the 19th COP of the Barcelona Convention in February 2016 (Decision IG.22/6, Regional Climate Change Adaptation Framework for the Mediterranean Marine and Coastal Areas (2016)).

22 Established under the Convention on the Conservation of Antarctic Marine Living Resources, 20 May 1980, 1329 *U.N.T.S.* 47 [CCAMLR].

23 CCAMLR Conservation Measure 91-05 (2016), para. 3(i)–(iii).

24 CCAMLR Resolution XXVIII, Climate Change (2009), preamble and para. 1.

25 CCAMLR Conservation Measure 24-04 (2016).

baselines and maritime boundaries which change or disappear altogether with sea level rise. The question of whether the traditional rules of maritime delimitation continue to apply, or whether new solutions such as fixed baselines and outer limits by global agreement or otherwise will be developed, has yet to be determined.[26]

Exploitation

As the largest natural sink for CO_2 and as a source of renewable energy, the ocean provides clear potential for exploitation in order to mitigate or otherwise address the impacts of climate change. At the forefront of regulating such exploitation is the dumping regime, in particular, the 1996 Protocol to the 1972 London Convention.[27] In particular, in 2006, the Protocol was amended in order to expressly permit and create a legal basis for the disposal of CO_2 into sub-seabed geological formations.[28] More controversially, in 2013, the Protocol was amended to create an explicit mandate for the regulation of ocean fertilization, a technique designed to draw down CO_2 from the atmosphere into the oceans, and, in the future, potentially other forms of marine geoengineering.[29]

Currently only ocean fertilization for scientific purposes is permitted under the Protocol provided that it is carried out consistently with the conditions of the Protocol, including the risk assessment framework.[30] The relationship between the Protocol and UNCLOS with respect to ocean fertilization is complex and, furthermore, whether the Protocol has a mandate to address marine geoengineering more generally is debatable.[31] Currently, the emerging regime for ocean fertilization—and possibly marine geoengineering more generally—is disconnected from the climate change regime. Linking the regimes in order to develop a consistent and coherent approach to ocean climate governance constitutes a significant challenge to twenty-first century law of the sea.

26 In 2012 the International Law Association established a committee on International Law and Sea Level Rise.

27 Protocol to the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 7 November 1996 (1997) 35 ILM 1 [1996 Protocol].

28 Id., Annex I, paras. 1.8, 4.

29 International Maritime Organization, Resolution LP.4(8) on the Amendment of the London Protocol to Regulate the Placement of Matter for Ocean Fertilization and other Marine Geoengineering Activities (18 October 2013).

30 1996 Protocol, *supra* note 27, Annexes 4 and 5.

31 See K. Scott, "Geoengineering and the Law of the Sea" in *Research Handbook on International Marine Environmental Law*, ed. R. Rayfuse (Cheltenham: Edward Elgar, 2015) 451.

Concluding Remarks

Currently the law of the sea lacks an overall framework to manage the oceans–climate regime complex. The absence of binding targets relating to ocean pH and CO_2 emissions and the development of rules relating to marine geoengineering outside of broader climate policy considerations demonstrates the limits of the law of the sea to address this important issue. The development of a coherent and integrated policy framework is essential going forward and could be adopted as an accord under the 1992 UNFCCC or as a UNGA resolution. Such a framework could provide the basis for ocean-climate related targets, including the development of nationally determined contributions[32] of specific application to the oceans. The framework could also establish principles relating to the development of policy and rules around exploiting the oceans for climate change mitigation, including geoengineering. And finally, such a framework could provide a basis for linking regimes and institutions, navigating the regime complex governing the oceans–climate nexus.

32 Paris Agreement, *supra* note 14, art. 4.

Elisabeth Mann Borgese, UNCLOS, and the Arctic: The Power of Normative Thinking and Her Legacy

Rob Huebert
Department of Political Science and Centre for Military, Strategic and Security Studies, University of Calgary, Calgary, Alberta, Canada

In a volume dedicated to the memory Elisabeth Mann Borgese, it is it is fitting to reflect upon the impact that the focus of her life's work has had on the international system. Those who have had the privilege of knowing her can attest to the power of her ideals and her vision for the future. Coming out of the ravages of the Second World War, she dedicated her life to making the world a better place. To that end, she concentrated on the study and promotion of the 1982 United Nations Convention of the Law of the Sea (UNCLOS). It was her core belief that the facilitation of an equitable sharing and sustainable utilization the world's oceans would be a fundamental component of international co-operation and peace. Her commitment and drive in supporting the development of the Third United Nations Conference on the Law of the Sea and the implementation of UNCLOS was an important element of the treaty's ultimate success. She is rightly referred to by many as the 'mother' of the Convention (alongside its 'father', Arvid Pardo, her good friend and colleague).

I had the privilege of being both her Ph.D. student and, for a time, her dog-sitter. (Throughout her life she was an avid dog lover and usually had at least five dogs in her household at any one time.) This gave me the unique opportunity to spend extensive time with her discussing and debating her thoughts and plans regarding ocean governance. As both her writings and our conversations made clear, she believed that the true value of UNCLOS was in its development as a 'constitution' of the ocean which established a set of rules and procedures that would ensure the sustainable and orderly use of the oceans.[1] But equally important, Elisabeth believed that it provided for the development of an international set of norms promoting international co-operation that went beyond its specific provisions. In effect, she understood that the development of a robust and comprehensive set of rules established by UNCLOS

1 Elisabeth Mann Borgese was very prolific in her writings. Two of my favorites are *The Future of the Oceans: Report to the Club of Rome* (Montreal: Harvest House, 1986) and *Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations Press, 1998).

would have ramifications well beyond ocean governance and would ultimately promote greater co-operation on both land and sea. And she was right!

As important as UNCLOS was in the improvements in the world's ocean governance system, its significance went beyond marine matters. This has become abundantly clear in regards to the developing governance of the Arctic. While the Arctic is essentially an ocean with five coastal state regions that encircle it, it was a frozen ocean that remained largely inaccessible.[2] With the exception of the so-called Canadian clause in UNCLOS, Article 234 on 'ice-covered waters', there was little attention given to the Arctic during the negotiation of the Convention because few thought of the international nature of the region. However as the impacts of climate change now opens the region in ways previously thought impossible,[3] it is clear that the strength of UNCLOS both in terms of its substance and its normative framework allows for the peaceful and co-operative development of a system of rules, organizations, and practices in the Arctic region.

In the late 1990s and early 2000s, many began to fear that the opening of the Arctic waters would unleash a rush to claim and exploit its resources in a lawless 'new' international region.[4] Several commentators—myself included—suggested that there was a need to create a new international treaty specific to the Arctic that would replicate the benefits of UNCLOS.[5] But by the end of the first decade of the 2000s, it became clear that this would have been redundant

2 Regardless of the challenges faced to reach this location, there are several international disputes in the region. The United States disagrees with Russia and Canada over the international status of the Northeast Passage and the Northwest Passage (internal waters versus international strait). Canada and Denmark disagree over the ownership of Hans Island. The United States and Canada disagree over the delimitation of the maritime boundary of the Beaufort Sea.

3 There is a huge literature on this, see, e.g., A. Anderson, *After the Ice: Life, Death, and Geopolitics in the New Arctic* (New York: Smithsonian Books, 2009); M. Byers, *International Law and the Arctic* (Cambridge: Cambridge University Press, 2013); C. Emmerson, *The Future History of the Arctic* (London: The Bodley Head, 2010).

4 Among the academic literature, see R. Howard, *The Arctic Gold Rush: The New Race for Tomorrow's Natural Resources* (London and New York: Continuum, 2009); R. Sale and E. Potapov, *The Scramble for the Arctic: Ownership, Exploitation and Conflict in the Far North* (London: Frances Lincoln, 2010). In the media, see "The Arctic: Gold Rush Under the Ice," *The Economist* (3 August 2007); W. Underhill, "The North Pole Heats Up," *Newsweek International* 42 (5 December 2005).

5 R. Huebert and B. Yeager, *A New Sea: The Need for a Regional Agreement on Management and Conservation of the Arctic Marine Environment* (Oslo: WWF International Arctic Programme, October 2006); T. Koivurova, "Alternatives for an Arctic Treaty: Evaluation and a New Proposal," *Review of European, Comparative & International Environmental Law* 17, no. 1 (2008): 14–26, doi.org/10.1111/j.1467-9388.2008.00580.x.

and potentially resulted in fragmentation and legal uncertainty. The terms of UNCLOS are as applicable to the Arctic as they are to any other region. The framework of ocean governance on specific issues such as the determination of the outer limits of the continental shelf is the same for the Arctic coastal states as they would be for any other region. More importantly, the normative strengths of having established international rules has created a determination by the Arctic states and other members of the international community to build on the existing framework and go beyond UNCLOS on specific issues on a co-operative basis.

UNCLOS has provided the backbone of much of the international governance system emerging for the Arctic in three ways. First, there has been a direct application of the rules established by the Convention to the region. The Arctic may have been frozen, but it still is an ocean. Secondly, articles of UNCLOS have shaped further rules and agreements governing activities in the region. Third, the norms established for international co-operation have allowed the region to develop in a peaceful and collaborative manner even as the most powerful Arctic coastal states have faced disagreements and conflicts elsewhere. Space does not allow for a comprehensive and detailed consideration of these three major impacts, but it is possible to note the most important elements of these three forces.

The best example of the direct application of UNCLOS to the Arctic is demonstrated by the efforts of the coastal Arctic states to determine the outer limit of their continental shelves under Part VI, the continental shelf. Russia was in fact the first country to submit co-ordinates to the Commission of the Outer Limits of the Continental Shelf in 2001 (the Commission).[6] When the submission was returned to them with a request for additional research, Russia accepted this request and further developed and strengthened its original submission.[7] Canada, Denmark, Norway, and the United States have also dedicated extensive resources to this task.[8] Meeting in Ilulissat, Greenland, in May 2008, they agreed in the final declaration to follow the terms of UNCLOS regarding

6 United Nations, "Commission on Limits of Continental Shelf Receives it first Submission: Russian Federation First to Move to Establish Outer Limits of Its Extended Continental Shelf," Meetings Coverage and Press Releases SEA/1729 (21 December 2001), http://www.un.org/press/en/2001/sea1729.doc.htm.

7 M. Webber, "Defining the Outer Limits of the Continental Shelf across the Arctic Basin: The Russian Submission, States' Rights, Boundary Delimitation and Arctic Regional Cooperation," *The International Journal of Marine and Coastal Law* 24 (2009): 659–665.

8 Even though the United States is not a party to UNCLOS. T.L. McDorman, "The Continental Shelf Beyond 200 NM: Law and Politics in the Arctic Ocean," *Journal of Transnational Law & Policy* 18, no. 2 (Spring 2009): 155–194.

the determination of their respective continental shelves. The importance of this meeting lies in two factors.[9] First, even though the United States is not party to UNCLOS, it still agreed to attend the meeting and signed the final declaration. The declaration let the rest of the world know that the Arctic was not an ungoverned zone and that the international ocean governance regime applied there as in any other location.

Further, UNCLOS has been applied to domestic policies adopted by the Arctic states. One of the best known examples is the use of Arctic 234 by Canada and Russia. It was introduced by the Canadian government during the negotiations to gain better protection and control over international navigation in the Northwest Passage.[10] Both governments have utilized this article to support their regulatory regime in their Arctic waters. Admittedly, there is a considerable debate over whether or not each or both state are exceeding its provisions. Nevertheless, Article 234 has been instrumental in how these states have approached navigation in their northern waters.[11]

It is also becoming evident that the Arctic coastal states, along with other states with Arctic interests such as China, are applying many of the core cooperative norms established by UNCLOS to emerging issues. The best example of this is potential commercial fishing in their respective exclusive economic zones (EEZ) and the high seas areas of the Arctic. The five Arctic coastal states have readily agreed to accept the norm of protecting living resources within their EEZ and to apply the precautionary principle to any possible emerging commercial fisheries.[12] There has been a willingness of certain non-Arctic states to enter into negotiations to provide for a cautious and scientifically informed approached to the exploitation of any new fisheries that may develop in the Arctic high seas area as the ice cover retreats. Even more impressive was the subsequent agreement reached in December 2017 to forbid commercial

9 K. Dodds, "The Ilulissat Declaration (2008): The Arctic States, 'Law of the Sea,' and Arctic Ocean," *SAIS Review of International Affairs* 33, no. 2 (2013): 45–55, doi.org/10.1353/sais.2013.0018.

10 D. McRae, "The Negotiations of Article 234," in *Politics of the Northwest Passage*, ed., F. Griffiths (Montreal: McGill-Queen's University Press, 1987), 98–114.

11 See A. Chircop et al., "Course Convergence? Comparative Perspectives on the Governance of Navigation and Shipping in Canadian and Russian Arctic Waters," *Ocean Yearbook* 28 (2014): 291–327.

12 E.J. Molenaar, "The Oslo Declaration on High Seas Fishing in the Central Arctic Ocean," in *Arctic Yearbook 2015*, eds. L. Heininen, H. Exner-Pirot and J. Plouffe (Akureyri: Northern Research Forum, 2015), 426–431; G. Dickie, "International Accord Bans Fishing in Central Arctic Ocean, Spurs Science," *Oceans Deeply* (4 December 2017), https://www.newsdeeply.com/oceans/articles/2017/12/04/international-accord-bans-fishing-in-central-arctic-ocean-spurs-science.

fishing in the central Arctic for the next 16 years.[13] Countries such as Russia, the United States, and China were able to put aside their differences elsewhere to reach this agreement. This clearly indicates the desire on the part of all actors to deal with this difficult issue in a co-operative and sustainable manner.

It is important to note that the fishing ban initiative was ultimately led by the United States, because it is not party to UNCLOS. One of the greatest challenges of the application of UNCLOS within the Arctic remains the United States' refusal and/or inability to accede to the treaty. While the United States invested extensively in the negotiations of UNCLOS[14] and played a major role in its creation, the administration under President Ronald Reagan refused to sign the treaty until elements of Part XI dealing with the deep-sea mining provisions were changed.[15] The United States' demands were subsequently met through the negotiations of a supplementary arrangement.[16] However, this did not lead to the United States agreeing to be bound by UNCLOS and there remain significant domestic political challenges to consideration of the treaty.[17]

As a result, the United States is unable to participate in any of the bodies created by UNCLOS.[18] However the strength and normative power of the treaty as international law has been demonstrated by the extent to which the United States has continued to use both the terms and the norms established by UNCLOS in their consideration of Arctic issues. Specifically, as described above, the United States led the efforts to develop a precautionary approach to the possibility of commercial fishing in the Arctic. It has also proceeded with the scientific determination of the outer limits of its Arctic continental shelf even though it will not be able to submit the findings to the Commission. Nevertheless, they have co-operated extensively with Canada to determine their co-ordinates.[19]

13 US Department of State, *Meeting on High Seas Fisheries in the Central Arctic Ocean, 28–30 November 2017: Chairman's Statement*, Washington, DC, 30 November 2017, https://www.state.gov/e/oes/ocns/opa/rls/276136.htm.

14 J. Norton Moore, "UNCLOS Key to Increasing Navigational Freedom," *Texas Review of Law & Politics* 12, no. 2 (Spring 2008): 459–468.

15 E.L. Richardson, "The Politics of the Law of the Sea," *Ocean Development and International Law* 11, no. 1–2 (1982): 9–24.

16 Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, 16 November 1994, 1836 *U.N.T.S.* 3.

17 P. Bonner, "Neo-isolationists Scuttle UNCLOS," *The SAIS Review of International Affairs* 33, no. 2 (2013): 135–146.

18 S.G. Borgerson, *The National Interest and the Law of the Sea* (Washington, DC: Council on Foreign Relations, May 2009).

19 J. Verhoef, D. Mosher, and S. Forbes, "Defining Canada's Extended Continental Shelves," *Geoscience Canada* 38, no. 2 (2011): 92.

The ability to proceed on all of these fronts, even though relations on a geopolitical level have deteriorated between the key Arctic coastal and other states since 2014 is notable. The Russian intervention in Ukraine has seriously hurt relations between it and the five Arctic coastal states as well as Sweden and Finland.[20] There has been a significant movement towards the expansion of military capabilities in the region, and relations between the eight Arctic states are difficult.[21] Yet, this did not prevent the five Arctic coastal states from developing the 2017 agreement to limit fishing in the region. It has also not prevented the five coastal states from further developing their respective continental shelf submissions on a peaceful and co-operative basis under Article 76 of UNCLOS.[22]

These initiatives in the Arctic point back one of the core principles that Elisabeth firmly believed. Even though she dedicated her entire life in the pursuit of what many characterized as utopian dreams, she always retained a clear understanding of power and a realistic understanding of the international system. She understood that the major powers will have significantly different interests at different times. However, she also understood that with the creation of a fair and equitable system of governance, even enemies can come together when it suits their interests. Furthermore, she understood that the more these states behaved in a co-operative fashion, the more they would find it in their interests to continue to behave co-operatively. Thus it would not be surprising to her that both Russia and the United States and the other Arctic coastal and other states are continuing to co-operate in the Arctic. That was precisely, why she was such a visionary in truly understanding and promoting the constitutional power of UNCLOS and why it has been so important to the Arctic.

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20 See J. Rahbek-Clemmensen, "The Ukraine Crisis Move North. Is Arctic Conflict Spill-over Driven by Material Interests?" *Polar Record* 53, no. 1 (January 2017): 1–15.

21 R. Gramer, "Here's What Russia's Military Build-Up in the Arctic Looks Like," *Foreign Policy* (25 January 2017), http://foreignpolicy.com/2017/01/25/heres-what-russias-military-build-up-in-the-arctic-looks-like-trump-oil-military-high-north-infographic-map/.

22 A. Sergunin, "Is Russia Going Hard or Soft in the Arctic?" *The Wilson Quarterly* (Summer/Fall 2017), https://wilsonquarterly.com/quarterly/into-the-arctic/is-russia-going-hard-or-soft-in-the-arctic/.

The ITLOS Experience in Dispute Resolution

Philippe Gautier
Catholic University of Louvain, Louvain-la-Neuve, Belgium, and
International Tribunal for the Law of the Sea, Hamburg, Germany

After 20 years of existence,[1] the International Tribunal for the Law of the Sea ('the Tribunal' or ITLOS) has established itself as a judicial institution for the settlement of sea-related disputes. This is evidenced by international practice. So far, 23 contentious cases and two advisory cases have been submitted to it,[2] compared to 26 contentious cases also relating to the law of the sea, during the

* The opinions expressed in this essay are solely those of the author.

1 The first election of judges of the Tribunal took place on 1 August 1996. The Tribunal was officially inaugurated on 18 October 1996.

2 ITLOS: **Contentious cases**: *M/V "SAIGA"* (*Saint Vincent and the Grenadines v. Guinea*); *M/V "SAIGA"* (*No. 2*) *Case* (*Saint Vincent and the Grenadines v. Guinea*)*; Southern Bluefin Tuna* (*New Zealand v. Japan; Australia v. Japan*); *"Camouco"* (*Panama v. France*); *"Monte Confurco"* (*Seychelles v. France*)*; Conservation and Sustainable Exploitation of Swordfish Stocks* (*Chile/European Union*); *"Grand Prince"* (*Belize v. France*); *"Chaisiri Reefer 2"* (*Panama v. Yemen*); *MOX Plant* (*Ireland v. United Kingdom*); *"Volga"*(*Russian Federation v. Australia*); *Land Reclamation in and around the Straits of Johor* (*Malaysia v. Singapore*); *"Juno Trader"* (*Saint Vincent and the Grenadines v. Guinea-Bissau*); *"Hoshinmaru"* (*Japan v. Russian Federation*); *"Tomimaru"* (*Japan v. Russian Federation*); *Delimitation of the maritime boundary in the Bay of Bengal* (*Bangladesh/Myanmar*); *M/V "Louisa"* (*Saint Vincent and the Grenadines v. Kingdom of Spain*); *M/V "VIRGINIA G" Case* (*Panama/Guinea-Bissau*)*; "ARA Libertad"* (*Argentina v. Ghana*)*; "Arctic Sunrise"* (*Kingdom of the Netherlands v. Russian Federation*)*; Dispute Concerning Delimitation of the Maritime Boundary between the Republic of Ghana and the Republic of Côte d'Ivoire in the Atlantic Ocean* (*Ghana/Côte d'Ivoire*)*; "Enrica Lexie" Incident* (*Italy v. India*)*; M/V "Norstar" Case* (*Panama v. Italy*). **Advisory cases**: *Responsibilities and obligations of States sponsoring persons and entities with respect to activities in the Area; Request for an Advisory Opinion submitted by the Sub-Regional Fisheries Commission* (*SRFC*). **Arbitration under Annex VII of the Convention**: *Southern Bluefin Tuna* (*New Zealand-Japan, Australia-Japan*); *MOX Plant* (*Ireland v. United Kingdom*); *Delimitation of the exclusive economic zone and the continental shelf between Barbados and Trinidad and Tobago; Delimitation of the maritime boundary between Guyana and Suriname*; *Land Reclamation by Singapore in and around the Straits of Johor* (*Malaysia v. Singapore*); *Delimitation in the Bay of Bengal* (*Bangladesh v. India*); *"Marine Protected Area" related to the Chagos Archipelago* (*Mauritius v. United Kingdom*)*; ARA Libertad* (*Argentina v. Ghana*)*; South China Sea* (*Philippines v. China*); *Atlanto-Scandian Herring* (*Denmark in respect of Faroe Islands v. European Union*)*; Arctic Sunrise* (*Netherlands v. Russia*)*; Duzgit Integrity* (*Malta v. São Tomé and Príncipe*)*; Enrica Lexie Incident* (*Italy v. India*)*; Coastal state rights in the Black Sea, Sea of Azov, and Kerch Strait* (*Ukraine v. Russian Federation*). *ICJ: Fisheries Jurisdiction* (*Spain v. Canada*)*; Sovereignty over Pulau Ligitan und Pulau Sipadan* (*Indonesia/Malaysia*); *Territorial and Maritime Dispute in the Caribbean Sea*

same period of time, submitted either to arbitration (14 cases) under Annex VII to the 1982 United Nations Convention on the Law of the Sea ('the Convention' or UNCLOS), or to the International Court of Justice (ICJ) (12 cases) on the basis of jurisdictional links other than Part XV of the UNCLOS (e.g., declarations made under Article 36 of the ICJ's Statute, special agreements, and compulsory clauses included in other international agreements).

That said, the purpose of this contribution to this book in honor of Elisabeth Mann Borgese is not to give an overview of the extent of judicial work of ITLOS, but rather to examine whether its practice reveals anything about new trends in the field of international dispute-settlement and the challenges facing the international community in law of the sea matters. These were both topics of great importance to Elisabeth Mann Borgese. They will be considered successively.

Settlement of International Disputes

It may first be observed that the system put in place by UNCLOS seems to function in a satisfactory manner. This is largely due to the compulsory mechanism provided for under Part XV, Section 2, of the Convention. As an illustration, it may be noted that the 23 contentious cases submitted to the Tribunal were all introduced either on the basis of the compulsory jurisdiction[3] of the Tribunal (19 cases), or pursuant to an agreement transferring to ITLOS a dispute originally submitted to compulsory arbitration under Annex VII to the Convention (4 cases).

In this context, it should be recalled that, of the four means for settling disputes (ITLOS, ICJ, arbitration and special arbitration) made available to the states parties to the Convention, a certain preference is given to arbitral proceedings by the Convention. Arbitration is the compulsory mechanism by

(*Nicaragua v. Honduras*); *Territorial and Maritime Dispute* (*Nicaragua v. Colombia*); *Sovereignty over Pedra Branca/Pulau Batu Puteh, Middle Rocks and South Ledge* (*Malaysia/Singapore*); *Maritime Delimitation in the Black Sea* (*Romania v. Ukraine*); *Maritime Dispute* (*Peru v. Chile*); *Whaling in the Antarctic* (*Australia v. Japan: New Zealand intervening*); *Obligation to Negotiate Access to the Pacific Ocean* (*Bolivia v. Chile*); *Question of the Delimitation of the Continental Shelf beyond 200 nautical miles from the Nicaraguan Coast* (*Nicaragua v. Colombia*); *Alleged Violations of Sovereign Rights and Maritime Spaces in the Caribbean Sea* (*Nicaragua v. Colombia*); *Maritime Delimitation in the Caribbean Sea and the Pacific Ocean* (*Costa Rica v. Nicaragua*); *Maritime Delimitation in the Indian Ocean* (*Somalia v. Kenya*).

3 United Nations Convention on the Law of the Sea, Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3 [UNCLOS]. See provisional measures proceedings pending the constitution of an arbitral tribunal (art. 290, para. 5, UNCLOS) and prompt release proceedings (art. 292, UNCLOS).

default pursuant to Article 287 of the Convention. The Tribunal may only deal with cases that are submitted to it on the basis of the consent of the parties to a dispute (through declarations made under Article 287 of the Convention or special agreements) or on the basis of its compulsory jurisdiction. This is the paradox of 'the Montreux formula' contained in Article 287 of the Convention: the Convention establishes the Tribunal as a new specialized court for the settlement of sea-related disputes although, pursuant to Article 287, states parties are deemed to have chosen arbitration, except if they agree otherwise. In addition, arbitral proceedings, which are rather costly, have to be financed entirely by the parties to the dispute concerned, while the expenses of the Tribunal are borne by the states parties and its use is free of charge for them. This may raise some questions at a time when the use of public funds is under scrutiny. In any event, it is possible for states parties to make fuller use of the Tribunal by making declarations under Article 287 of the Convention or by concluding special agreements, even after the institution of arbitral proceedings, to submit a particular dispute to it.

After this introductory comment, it is useful to briefly enumerate some of the new features introduced by the Tribunal's jurisprudence:

- The Tribunal has had the opportunity to deal with a number of urgent proceedings (prompt release proceedings and provisional measures proceedings), i.e., cases which have to be completed within a period of approximately one month, from the day of the submission of the request to the date of the delivery of the decision. The swift handling of these cases has demonstrated that international proceedings do not necessarily have to be long and costly.
- Provisional measures proceedings pending the constitution of an arbitral tribunal, which constitute part of the compulsory jurisdiction of the Tribunal under Article 290, paragraph 5, of the Convention, represent a new and distinct feature of ITLOS's jurisprudence. In a number of instances, states parties have had recourse to the Tribunal to obtain an interim decision in a situation of urgency, in order to preserve their rights (e.g., as flag state of a detained vessel) or to prevent serious damage to the marine environment, including fish stocks. Provisional measures prescribed by the Tribunal are binding and the parties are obliged to inform the Tribunal of action taken to comply with them. This certainly reinforces the usefulness of these proceedings and, furthermore, in some instances, measures of a procedural nature ordered by the Tribunal have contributed to the successful solution of a dispute.[4]

4 See, e.g., Permanent Court of Arbitration, Press Release, 14 January 2005, *Case Concerning Land Reclamation by Singapore In and Around the Straits of Johor* (*Malaysia v. Singapore*).

– Although the Convention only refers expressly to advisory proceedings before the Seabed Disputes Chamber of ITLOS,[5] the Tribunal, in its advisory opinion of 2 April 2015, decided that it could also render advisory opinions pursuant to Article 21 of its Statute, which states that its jurisdiction comprises "all matters specifically provided for in any other agreement which confers jurisdiction on the Tribunal."[6] This therefore introduces a new tool available to states parties to the Convention. Whenever there is a dispute between them, they do not necessarily have to resort to contentious proceedings, but may prefer to submit a request for a non-binding advisory opinion on a particular legal question. They would then have the possibility of negotiating to find a solution on the basis of an authoritative legal opinion. It remains to be seen to what extent states will, in the future, make further use of the opportunity to seek advisory opinions from the Tribunal.

The settlement of disputes under the Convention is, however, not immune from crisis. Two states parties, which are permanent members of the United Nations Security Council, did not participate in proceedings instituted against them pursuant to the compulsory procedures under Section 2 of Part XV of the Convention.[7] Incidentally, it may be noted that the reasons invoked for the non-participation in those two instances were that the arbitral tribunal constituted under Annex VII had no jurisdiction over the dispute and that they were based on declarations made under Article 298 of the Convention, which entitles states parties to exclude some matters from the compulsory procedure contained in Section 2 of Part XV. Pursuant to the principle of *compétence de la compétence*, included in Article 288, paragraph 4, of the Convention, any objection to the jurisdiction of a court or tribunal is to be settled by decision of that court or tribunal. Although this principle is the cornerstone of international dispute settlement, it is sometimes fragile,[8] underlining that the peaceful settlement of international disputes—and this applies equally to the action

5 See UNCLOS, *supra* note 3, art. 191.

6 Statute of the Tribunal, *supra* note 3, art. 21. See *Request for an Advisory Opinion Submitted by the Sub-regional Fisheries Commission* (*SRFC*), ITLOS Case No. 21, Advisory Opinion of 2 April 2015, paras. 38 and 48.

7 See *South China Sea Arbitration* (*Republic of the Philippines v. People's Republic of China*), PCA Case No. 2013–19; *"Arctic Sunrise"* (*Kingdom of the Netherlands v. Russian Federation*), Provisional Measures, Order of 22 November 2013, ITLOS Reports 2013, p. 230; *Arctic Sunrise Arbitration* (*Netherlands v. Russia*), PCA Case No. 2014-02.

8 In this context, it is perhaps fitting that we recall that, in the Alabama Arbitration, a case often quoted as an early assertion of the power of arbitrators to determine their jurisdiction, the statement that there was "no disagreement between the two governments as to the competency of the tribunal to decide" on the claims for damages was in fact wording agreed to by the parties as a result of negotiations on the sensitive issue of indirect damages. See, e.g.,

of the Tribunal—should not be taken for granted. It depends ultimately on the conduct of states and needs constantly to be defended and preserved.

Challenges in the Law of the Sea

An examination of the practice of courts and tribunal over the past 20 years should give us some indication of the main issues arising in law of the sea matters. These cases may be divided into three broad categories: delimitation of maritime areas (including disputed sovereignty over islands and the exercise of rights and obligations in disputed area); arrest and detention of ships (including claims for compensation); and environmental disputes.

Delimitation disputes constitute a stable business for international courts and tribunals. In the future, they are likely to address new issues relating to the delimitation of the continental shelf beyond 200 nautical miles, such as the delimitation of the outer continental shelf in the absence of a recommendation from the Commission on the Limits of the Continental Shelf or where scientific data are disputed by the parties. In light of the increased use of marine areas, cases relating to the exercise of rights in disputed areas or relating to the competing uses of the seas (fishing, marine protected areas, cables and pipelines, etc.) should also emerge.

As mentioned above, several disputes relating to the arrest and detention of vessels have been submitted to ITLOS. These cases may include claims for damage caused to private persons (seafarers and cargo or shipowners) of various nationalities. Owing to the rule of exhaustion of local remedies, private individuals—who have suffered damage as a result of an alleged violation of international law—have first to exhaust local remedies available to them, before a claim is brought to an international court by their national state. Thus, recourse to interstate litigation is not always perceived as an efficient tool by the shipping community. This may change in the future on the basis of ITLOS' jurisprudence, which has facilitated access to an international court in cases of disputes involving damage to private entities. This is so for two reasons. First, the Tribunal has clarified that the rule that local remedies have to be exhausted by private claimants before their national state is entitled to exercise diplomatic protection is not applicable to cases where the flag state seeks reparation of a prejudice caused to its own rights, such as the freedom

I. Shihata, *The Power of the International Court to Determine its Own Jurisdiction* (The Hague: Martinus Nijhoff, 1965), 17–19.

of navigation.[9] Second, in affirming the principle of the unity of the ship, the Tribunal found that the flag state whose direct rights have been violated is also entitled to claim reparation for the prejudice suffered by private claimants, independently of their nationalities. It may be added that cases involving arrest of vessels may also be submitted to the Tribunal as urgent proceedings under its compulsory jurisdiction. There is thus reason to believe that flag states will continue to make frequent use of ITLOS in the case of arrest and detention of vessels.

The preservation of the marine environment is certainly one of the major challenges facing the international community. ITLOS has been seized of several environmental cases, *inter alia*, disputes concerning the obligation of states parties to preserve the marine environment, including fish stocks. In light of the current issues relating to illegal, unreported and unregulated fishing, it may reasonably be expected that such issues will become the source of new disputes. In addition, the two advisory opinions rendered by the Seabed Disputes Chamber and the Tribunal, in 2011 and 2015 respectively, have clarified the notion of international responsibility which attaches to the state sponsoring activities conducted by entities in the Area, or flag states of vessels engaged in illegal fishing activities.

The exploitation of mineral resources of the Area, when it becomes a reality, will trigger a number of disputes involving states parties, contractors, and the International Seabed Authority. The Seabed Disputes Chamber of ITLOS is well-equipped to deal with these new categories of claims. In this context, the main difficulty will probably be to put in place a viable commercial exploitation while ensuring the preservation of the fragile marine environment of the deep seabed area.

The core function of international courts and tribunals is to settle disputes relating to specific situations. Judges are not law-makers and solutions to environmental issues such as land-based pollution, sea level rise and ocean acidification, require co-ordinated action on the part of the international community. Nevertheless, legal actions submitted to international courts may clarify the obligations and responsibility of states parties. To that extent, pronouncements of international courts may contribute to more efficient implementation of the international norms. In this respect, it may be underlined that, under the Convention, states parties have a broad *locus standi*. Article 286 of UNCLOS provides that "any dispute concerning the interpretation or application of this Convention shall … be submitted at the request of any party

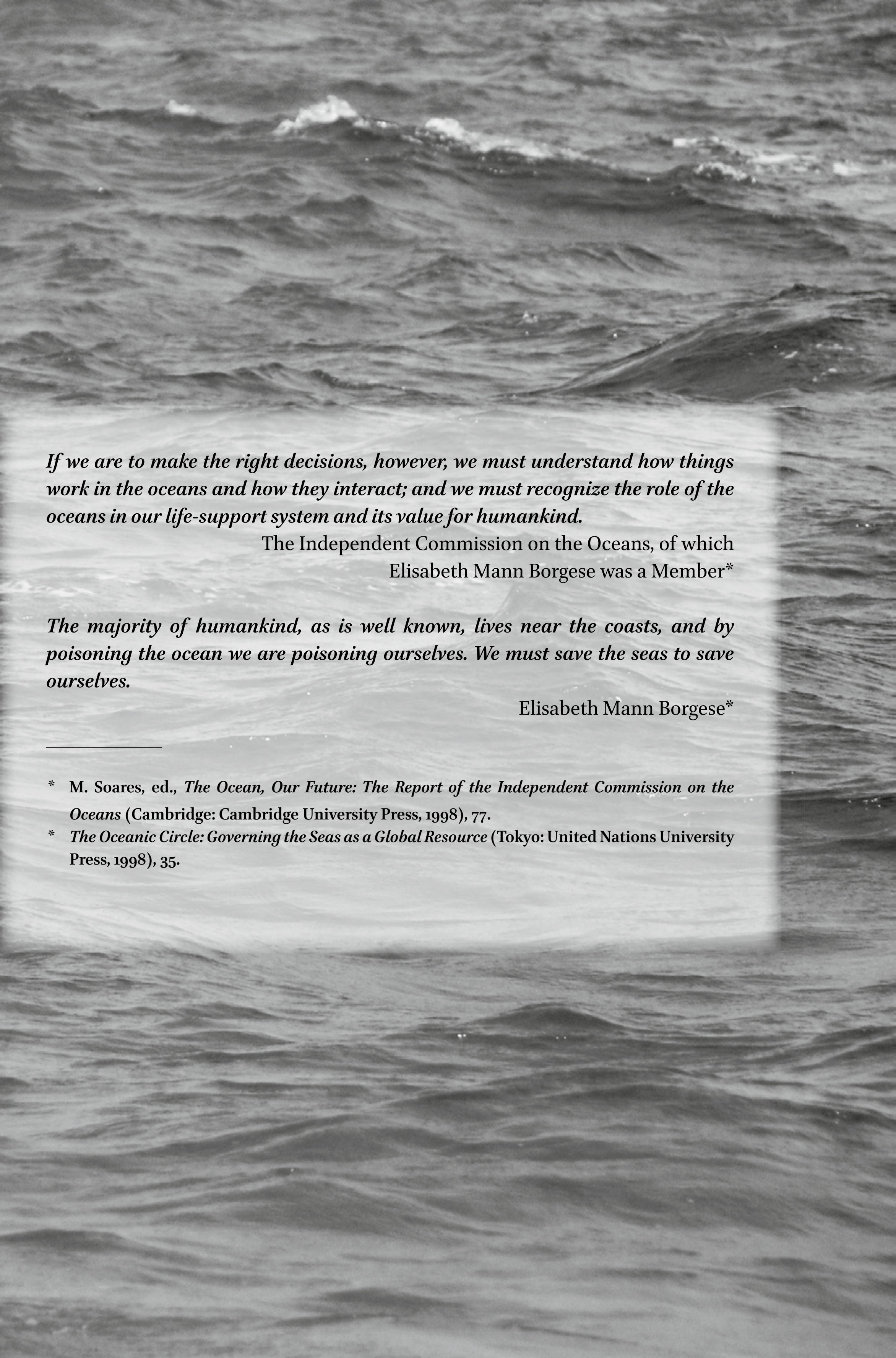
9 See, e.g., UNCLOS, *supra* note 3, art. 90: "Every State, whether coastal or land-locked, has the right to sail ships flying its flag on the high seas."

to the dispute to the court or tribunal having jurisdiction under this section." Accordingly, states parties are entitled to make use of Part XV of the Convention whenever it is alleged that provisions of the Convention have not been complied with, as regards the preservation of the marine environment, including the global commons.

As the discussion of this essay shows, the Tribunal's jurisprudence illustrates trends in the field of international dispute settlement. They concern in particular issues relating to delimitation of continental shelf beyond 200 nautical miles, arrest and detention of ships, and environmental disputes. It may be considered that they represent the new challenges facing the international community in law of the sea matters.

PART 4

Ocean Sciences



If we are to make the right decisions, however, we must understand how things work in the oceans and how they interact; and we must recognize the role of the oceans in our life-support system and its value for humankind.

The Independent Commission on the Oceans, of which
Elisabeth Mann Borgese was a Member*

The majority of humankind, as is well known, lives near the coasts, and by poisoning the ocean we are poisoning ourselves. We must save the seas to save ourselves.

Elisabeth Mann Borgese*

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* M. Soares, ed., *The Ocean, Our Future: The Report of the Independent Commission on the Oceans* (Cambridge: Cambridge University Press, 1998), 77.

* *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 35.

Introduction

Editor: Peter G. Wells

Elisabeth Mann Borgese stated in *The Oceanic Circle* that "the ocean sciences, or science in general, cannot be considered in isolation. They are part of the whole system" of ocean governance.[1] The essays that follow in this section cover a number of topics representing our current understanding of the physical, chemical, and biological makeup of the ocean. They show how the impact of an ever-growing humanity needs to be understood and controlled in the interests and health of future coastal populations, and the conservation of the ocean's valuable and irreplaceable biodiversity. The essays are personal overviews by ocean experts. Collectively, they provide a snapshot of current knowledge and underlie the importance of the relevant science to effective ocean governance and management. Ultimately, a comprehensive understanding of the whole oceanic system is required—from the watersheds and shorelines to the abyssal plains, from surface waters to the depths. However, all of the contributing authors, as did Elisabeth, understand that "our knowledge of ocean processes and life in the oceans will remain forever incomplete."[2] This fact alone, on the backdrop of growing evidence of overuse and abuse, and global climate change, suggests the wisdom of practicing a precautionary approach in our relationship with the oceans—to conserve their species, habitats, and finite resources. The essays should reinvigorate interest in what Elisabeth called 'the majesty of the oceanic circle' and the pivotal role of ocean science in the governance and sustainability of our blue planet.

1 E. Mann Borgese, *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 43.
2 Id., 23.

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Health of the Ocean

Peter G. Wells
International Ocean Institute-Canada, Halifax, Nova Scotia, Canada

Addressing the Problem

Serious attention to ocean health started after the Second World War, as an era of economic recovery, industrial growth, and prosperity began in many developed countries. Large oil tankers plied the sea. Occasional but severe accidents caused huge, highly visible spills. The impact of oil pollution along coastlines and on fishery species appeared on the radar of politicians and coastal inhabitants. Ocean health showed signs of being compromised and awareness for the welfare of both people and ocean dwelling species began to surface. The newly formed United Nations reacted with conventions and regulations to curb such pollution. In the 1960s and early 1970s, as environmentalism blossomed, concerns about the oceans expanded to include many industrial effluents and chemicals, ocean dredging materials, land-based pollution of many other kinds (e.g., riverine sediments), and radioactivity. Elisabeth Mann Borgese, to whom this essay is dedicated, recognized the need for ocean protection in her various writings and diplomatic initiatives. Endorsed in 1982, the United Nations Convention on the Law of the Sea (UNCLOS) Part XII emphasized marine environmental protection.[1] Many countries continued to enact environmental legislation, addressing marine pollution, especially from shipping and land-based activities.[2]

During this early era of environmentalism, the governmental and intergovernmental response to marine pollution was significant.[3] It was accepted that an understanding of ocean health is a critical underpinning of effective ocean governance and sustainability. The science of marine ecotoxicology

1 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3.

2 See Agenda 21, prepared for the 1992 United Nations Conference on Environment and Development, https://www.sustainabledevelopment.un.org/content/documents/Agenda21.pdf. Agenda 21 highlighted the need to control marine pollution from land-based activities (LBAS), formerly called land-based pollution.

3 See GESAMP (the United Nations Joint Group of Experts on Scientific Aspects of Marine Environmental Protection (formerly … of Marine Pollution) (www.gesamp.org); the Scientific Committee on Problems of the Environment (SCOPE) (www.scopenvironment.org); the Scientific Committee on Oceanic Research (SCOR) (www.scor-int.org); Brundtland Commission, *Our Common Future* (Oxford: Oxford University Press, 1987).

evolved rapidly, providing the tools to assess and control marine pollution to acceptable levels. The terms ocean health, ecosystem health, marine environmental quality, contamination, pollution, and others were precisely defined.[4] One achievement was clarity and general acceptance of the concept of ocean health—it involves both knowing effects of stressors on ocean ecologies as well as ocean impacts on human health.[5] Understanding both topics under the umbrella of UNCLOS Part XII is essential for encouraging and achieving ocean protection and conservation, i.e., sustaining ocean health for all species.

Progress on Core Ocean Health Issues

There are numerous, albeit incomplete, information sources on the state of our oceans,[6] as ocean ecologies are complex and not yet fully understood. Discoveries of new species and habitats are ongoing; recent finds include species of deep-sea crustaceans, jellyfish, Arctic zooplankton, and microbes.[7] A more comprehensive knowledge of marine biological diversity, vulnerable species, and critical habitats is needed to ensure adequate protection.[8]

Many years of research and discussion have led to a consensus on the primary threats to ocean health. They include a legacy of fishing and overfishing, with its impact on biodiversity and various ecosystems; land-based pollution from untreated or partially treated sewage, chemicals of emerging concern such

4 A. O'Brien et al., "How is Ecosystem Health Defined and Measured? A Critical Review of Freshwater and Estuarine Studies," *Ecological Indicators* 69 (2016): 722–729; The UN-GESAMP defines marine pollution as follows: "pollution means the introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of seawater, and reduction of amenities." GESAMP, *The State of the Marine Environment* (Oxford: Blackwell Scientific, 1990).

5 See the essay by Michael Depledge in this volume; see also R.E. Bowen et al., *Oceans and Human Health: Implications for Society and Well-Being* (Wiley-Blackwell, 2014).

6 See GESAMP, *Pollution in the Open Oceans: A Review of Assessments and Related Studies*, GESAMP Reports and Studies No. 79 (UNEP, 2009); United Nations, *The First Global Integrated Ocean Assessment: World Ocean Assessment 1* (Cambridge: Cambridge University Press, 2017); Global Ocean Commission, *The Future of Our Ocean: Next Steps and Priorities* (Oxford: Global Ocean Commission, Somerville College, 2016), http://www.some.ox.ac.uk/research/global-ocean-commission/.

7 See essay by Paul V.R. Snelgrove and Anna Metaxas in this volume; P.V.R. Snelgrove, *Discoveries of the Census of Marine Life. Making Ocean Life Coun*t (Cambridge: Cambridge University Press, 2010).

8 E.O. Wilson, *Half-Earth: Our Planet's Fight for Life* (New York: Liveright Publishing, 2016).

as pharmaceuticals and plasticizers, pesticides, metals such as mercury, lead, copper, cadmium and chromium, and nutrients; oil pollution, natural and accidental; sediment loading into estuaries from land-clearing; noise from shipping and oil exploration; and climate change resulting in ocean acidification,[9] shifting water temperatures, and enhanced coastal erosion. Fishing has had the greatest impact on ocean biodiversity, and the ecologies of many areas, such as the North Atlantic. Trophic levels and food chains have been impacted, e.g., overfishing the northern cod. The impacts of legacy contaminants such as PCBs and DDT[10] are still not fully understood; these substances persist for decades in sediments. Noise from shipping and seismic exploration is being intensely studied at present, with concerns for marine mammals being paramount.[11] Plastics and micro-plastics, in enormous quantities, are commonly found along coasts and in extensive patches in ocean gyres.[12] Oxygen-free dead zones near the mouths of large rivers are increasingly common.

Hence, the list of stressors is long. The organization Living Oceans (United States)[13] has named four pillars of ocean health assessment: climate change; changes in and loss of biodiversity (referred to as marine defaunation); habitat change (transition from harvest to habitat degradation); and chemical and solid pollution. There are also many smaller, perhaps less important, stressors from land-based activities causing cumulative change to the ecosystem.[14]

The public and governments in different parts of the world are focused on a plethora of current ocean health issues. These include the plight of North Atlantic right whales; the bleaching and dying off of large swaths of the Great Barrier Reef; mortalities of birds and sea turtles caused by plastics; effects of noise on whales and porpoises; the global implications to land and sea of an Arctic Ocean free of annual and multi-year ice; the impacts of severe storms and hurricanes on coastal erosion; increased occurrences of toxic algal blooms in coastal waters, e.g., the Gulf of Maine; potential impacts of deep-sea mining;

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9 See essay by Kumiko Azetsu-Scott in this volume.

10 Polychlorinated biphenyls; dichloro-diphenyl-trichloroethane.

11 K. Moore, "Evidence-informed Conservation Policies: Mitigating Vessel Noise within Gray Whale (*Eschrichtius robustus*) Foraging Habitat in British Columbia, Canada," Master of Marine Management Paper, Dalhousie University, 2016.

12 UNEP, *Marine Plastic Debris and Microplastics: Global Lessons and Research to Inspire Action and Guide Policy Change* (Nairobi: UNEP, 2016), http://apps.unep.org/publications/index.php?option=com_pub&task=download&file=012194_en.

13 "Four Pillars of Ocean Health," Living Oceans, last accessed 8 February 2018, http://www.livingoceans.org/initiatives/ocean-ecosystems/issues/four-pillars-ocean-health; see also the essay by Boris Worm in this volume.

14 B.S. Halpern et al., "Spatial and Temporal Changes in Cumulative Human Impacts on the World's Ocean," *Nature Communications* 6, no. 7615 (2015), doi.org/10.1038/ncomms8615.

increasing numbers of coastal dead zones; and threats to biodiversity from invasive species. Ocean health is also being considered with a broader framework of ecosystem-based, coastal, and fisheries management, and global ecosystem services.[15] Understanding ocean health and supporting the fields of ecology, ecotoxicology, and ocean management have become key to achieving the goals of UNCLOS and related international conventions and agreements. This will ultimately achieve Elisabeth Mann Borgese's goal of an ocean effectively governed and protected for all humankind.

Reporting on Ocean Health

A conceptual framework behind periodic comprehensive reports on ocean health, underpinning marine environmental protection, has seven key elements and recognizes key science–policy linkages, as follows:

1. Ongoing relevant marine science
2. Monitoring, using appropriate indicators[16]
3. Data and information management
4. Development of indices of ocean health[17]
5. Development of guidelines and regulations
6. Reporting on the state of the marine environment and communicating to decision-makers
7. Action by decision-makers, politicians and regulators, with industry and community involvement

New approaches to monitoring and reporting on ocean health have been implemented.[18] Various programs have enlarged our knowledge of marine species, their movements, and their living conditions.[19] The field of restoration ecology has emerged, for heavily impacted coastal ecosystems such as mangrove forests, salt marshes, and seagrass beds. There have been many successful efforts

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15 K.K. Arkema and J.F. Samhouri, "Linking Ecosystem Health and Services to Inform Marine Ecosystem-based Management," *American Fisheries Society Symposium* 79 (2012): 9–25; see also the essay by Kenneth Sherman in this volume.

16 See essay by Kenneth Sherman in this volume.

17 B.S. Halpern et al., "An Index to Assess the Health and Benefits of the Global Ocean," *Nature* 488 (2012): 615–622.; B.S. Halpern et al., "Patterns and Emerging Trends in Global Ocean Health," *PLOS One* 10, no. 3 (2015), e0117863, doi.org/10.1371/journal.pone.0117863.

18 See footnotes 6 and 17.

19 See the Census of Marine Life (www.coml.org), the Ocean Tracking Network (oceantrackingnetwork.org), the Global Ocean Observing System (www.goosocean.org), and the North-East Regional Association for Coastal Ocean Observing Systems (www.neracoos.org/).

to create more marine protected areas for conservation and the reduction of defaunation. Technology is rapidly producing many new ways to search for and access information. Led by Conservation International, the Ocean Health Index program pursues ten goals, multiple indicators, and a normalized scoring system that permits comparisons of ocean health between countries on an annual basis.[20] Finally, the United Nations Environment Programme (UNEP, now UN Environment) supports improvements at the science-policy interface in governmental efforts to protect and conserve ocean health within the framework of ocean management.

Wicked Problems: The Challenges of Protecting Ocean Health

A *wicked problem* is "a *problem* that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize"[21] and "for which there is no simple method of solution."[22] Appraising ocean health and finding workable solutions for ocean protection is filled with wicked problems.

Population growth is clearly 'the elephant in the room'. Besides continuous land development, expanding coastal population centers emit untreated or partially treated sewage and municipal wastes. Sewage directly impacts marine species and their habitats, threatens human health, and contaminates fisheries species.[23] Given that global population numbers will likely exceed nine billion people by mid-century, controlling sewage pollution will remain a major wicked problem.

Understanding the complexity of marine ecosystems, in both their natural unaltered states and under the stress of human activities and wastes, is perhaps the most wicked problem. Many changes are cumulative and long term, and some are irreversible. Ecosystems also have negative and positive feedback loops, little understood for the majority of trophic levels and species; research such as on puffins in the Northwest Atlantic is beginning to unravel

20 See Halpern et al. 2012, *supra* note 17.

21 "Wicked Problem," Wikipedia, last accessed 8 February 2018, https://en.wikipedia.org/wiki/Wicked_problem.

22 "Definition of Wicked Problem," Financial Times Lexicon, last accessed 8 February 2018, http://lexicon.ft.com/Term?term=wicked-problem.

23 GESAMP, *Protecting the Oceans from Land-based Activities*, GESAMP Reports and Studies No. 71 (UNEP, 2001).

the complexity of such loops.[24] Maintaining monitoring programs is key to understanding such ecological dynamics and identifying new problems all over the globe, some of which are mentioned above. Reliable and uninterrupted data collection over long periods of time ensures descriptions of current ocean health and predictions of change.[25]

Finally, there is the wicked problem at the institutional and societal level to co-ordinate global ocean protection. Too many organizations are involved, complicating responsibilities and effective action; UNEP tries to co-ordinate, but not every country listens. The ecological implications of the open ocean having no owners (the tragedy of the commons in the open sea) is clear—fisheries species in many areas outside the EEZs are being severely overexploited,[26] and industrial-scale ocean mining is just beginning.

Prognosis for Maintaining Healthy Oceans

Upon countering these wicked problems, one encouraging sign is the resilience of ecological systems. Some can rebound if stressors are removed (e.g., North Sea fisheries during the Second World War). Yet, little is known about the tipping points of natural marine ecosystems. What are the various thresholds for recovery? One clear example of apparent non-recovery is the cod fishery in the North Atlantic—the population remains small and may be incapable of sufficient recruitment for significantly rebuilding the populations.[27]

Much is at stake if humanity fails to protect ocean species and ecosystems. The consequences of inaction are becoming all too apparent. Despite many successful efforts to control marine pollution and to manage coastal and ocean areas, more fisheries are becoming unsustainable, people continue to be sickened by algal toxins and industrial chemicals, marine species and key ecosystems are diminished, and economies of coastal countries suffer from declining ocean health. Action to counter climate change, overfishing, pollution, and over development of coastlines has often been delayed or turned out to be ineffective. For some countries, these problems are overwhelming; they lack capacity to tackle them successfully.

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24 A. Diamond, University of New Brunswick, Fredericton, New Brunswick, Canada, personal communication.

25 For example, programs at the Bedford Institute of Oceanography, Canada (www.bio.gc.ca) and the Bermuda Institute of Ocean Sciences (www.bios.edu).

26 See essay by Boris Worm in this volume.

27 J. Hutchings, Dalhousie University, Halifax, Nova Scotia, Canada, various papers and recent lecture, November 2017.

Much more needs to be done to maintain healthy oceans. Recognizing this, large international efforts continue to address the big issues and find solutions. The Paris Agreement on climate change in 2015 and other climate meetings have been essential steps to protect ocean health from this global stressor. The UN Ocean Conference in June 2017, laid out a framework for the oceans and an agenda to 2030.[28] Efforts on marine protected areas and marine spatial planning (ocean zoning[29]) are increasing, especially in offshore regions with sensitive habitats, e.g., around seamount ecosystems. Importantly, the linkage of ocean health with human health is much more prominent.[30] Ultimately, concerns for local economies and human health will sway the efforts to protect natural marine ecosystems and their inhabitants.

Conclusion

The international sense of urgency to address ocean health must be maintained. Collectively, we must speed up the political, managerial, industrial, and scientific responses to the unfolding crisis in parts of the ocean, and especially to predicted climate change impacts on the global ocean, its ecosystems, and its living resources. With a planet predicted to have two to three billion more people by mid-century, mostly living in coastal cities and all under the threat of climate change (e.g., sea level rise), strong international political will and action are needed now and over the long term. The ocean will survive as it has for the past four billion years, but its health and ours will continue to be compromised unless we are successful addressing the core issues and threats.

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28 See the UN Ocean Conference, 5–9 June 2017, website, https://oceanconference.un.org/about; see also World Ocean Council, "Sustainable Ocean Summit 2017: The Ocean Sustainable Development Goal (SDG 14): Business Leadership and Business Opportunities, Official Program," 29 November–1 December 2017, Halifax, Nova Scotia, Canada, https://www.oceancouncil.org/event/sustainable-ocean-summit-2017/.

29 D.J. McCauley et al., "Marine Defaunation: Animal Loss in the Global Ocean," *Science* 347, no. 6219 (16 January 2015), 1255641, doi.org/10.1126/science.1255641.

30 See footnote 5.

Oceans, Health, and Well-Being

*Michael H. Depledge**
European Centre for Environment and Human Health, University of Exeter Medical School, Exeter, Devon, United Kingdom

On 7 December 1972 the crew of the spaceship Apollo 17 took a color photograph of the Earth from 18,000 miles out in space. The 'Blue Marble' image they sent back not only raised public awareness that most of the planet's surface is covered by water, but reminded us of the deep connection humans have with our seas and oceans. Close scrutiny of this and other images of the Earth from space reveal a human preference for settlements close to the sea coast and vividly illustrate the worldwide use of the oceans for transport and trade. Dependence on marine resources is clear from the ceaseless activity of the myriad fishing fleets and container ships roaming both coastal and open waters, and in the hundreds of towering oil rigs endlessly feeding off undersea petroleum reserves.

Back on *terra firma*, human connections with the sea are even plainer to see. From seaside holiday resorts and marinas to major ports and industrial complexes, over 370,000 miles (592,000 km) of the coastline of the continents are adorned with our artefacts. Over a third of the human population (ca. 2.5 billion people) now lives within 60 miles (96 km) of the coast, with many thousands more joining them every year. In this essay, ways of living sustainably and in harmony with marine ecosystems are discussed.

Although coastal areas are deemed desirable locations in which to reside or visit, we often fail to grasp the extent of risks to our health and well-being. For example, globally, there were ca. 1,562 flood disasters from 1994 to 2004 that killed ca. 120,000 people and affected two million more overall. Most of these events were played out in low elevation coastal zones. One hundred and eighty countries have populations located in such areas, mainly in large urban settlements. Twenty-one of the world's 33 megacities (> 8 million people) are coastal. When extreme events hit, the lives of enormous numbers of people are

* This essay brings together points raised in discussions on numerous occasions with friends and colleagues at the European Centre for Environment and Human Health at the University of Exeter Medical School. I am particularly indebted to Dr. Mat White, Dr. Becca Lovell, Dr. Ben Wheeler, Dr. Tim Taylor, Dr. Karyn Morrissey, Dr. Sabine Pahl and Professor Lora Fleming for sharing their knowledge and expertise. Any errors in the essay are entirely my responsibility.

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put in jeopardy and demands on healthcare systems escalate sharply. When Hurricane Mitch hit Honduras in October 1998, it caused 18,000 deaths, mainly in the coastal zone. Similarly, in the United States, when Hurricane Katrina made landfall in New Orleans in August 2005, 1,800 deaths ensued. The level of economic development of a community tends to modulate the severity of impacts. When Hurricane Sandy hit wealthy New York in 2012, 285 people died, while Typhoon Haiyan striking the less prosperous Philippines in November 2008, killed 5,200 people. By the 2000s, millions more people will face storm surges and floods every year as sea level rises. As if to confirm this trend, at the time of writing (summer 2017), Hurricane Irma has passed through the Caribbean and Florida causing utter devastation. The costs in terms of human lives and economic damage await quantification, but will undoubtedly be enormous.

Coastal dwellers are also vulnerable to undersea seismic events. The Asian (Indonesian) earthquake and tsunami of December 2004 killed at least 226,000 people in coastal areas of 13 countries, with over 500,000 people injured. A further ca. 150,000 people died from infectious diseases following the disaster. Up to five million coastal residents lost their homes, or access to food and water and around one million people were left without a means of making a living. The collapse of sewage treatment and land drainage systems resulted in the discharge of pathogens into coastal waters. The public (both locals and visitors) were then exposed to dangerous viruses and bacteria through skin contact and following the consumption of contaminated fish and shellfish. On a daily basis, wastewater and human sewage of a huge portion of the world's population (> 640 million people) are currently discharged daily, directly or indirectly, into coastal seas, mostly without treatment. Past research indicates that this generates ca. 120 million cases of gastrointestinal diseases and more than 50 million cases annually of respiratory disease. Recent data are not available so it is hard to assess current trends. However, we do know that viral and to a lesser extent, bacterial and protozoan pathogens in polluted coastal waters contaminate edible shellfish and fish resulting in ca. four million cases of hepatitis A and E, which cause ca. 40,000 deaths, together with a further ca. 40,000 episodes of disease that lead to long term disability. As seawater temperatures rise with global warming, rates of pathogen infections will increase and their geographic range will extend. Added to this, an estimated 3–5 million cases of cholera result each year in 100,000–120,000 deaths. Harmful algal blooms are also increasing in frequency. Around 60,000 cases annually of gastroenteritis and respiratory irritation are due to consumption of seafood containing algal toxins. Only a small proportion are diagnosed, usually as paralytic shellfish poisoning, amnesic shellfish poisoning, and Ciguatera poisoning.

For many coastal inhabitants in temperate, higher income countries where extreme storms, seismic events, and sewage pollution are less common, the threats mentioned above may seem remote. Nonetheless, those living and working at sea or along coastlines are exposed everywhere to many other hazards. Of note, ca. 372,000 people globally drown each year. Those in fisheries and the offshore oil industry are especially at risk. From 2000 to 2006, the average annual fatality rate in the United States was 115 deaths per 100,000 fishermen. This is three times greater than that of the next most dangerous occupation and more than 25 times that of the US national average for all workers. In offshore oil and gas workers, death rates were 27 per 100,000 in the United States between 2003 and 2010, seven times greater than the national average.

Recreation in coastal areas generates a surprising number of health issues. Worldwide, more than 355,000 people are injured annually in recreational boating accidents, with more than 40 percent of injuries requiring medical treatment beyond simple first aid. Shallow water and open sea recreation brings people into contact with poisonous or aggressive marine animals in many locations. Dangerous species encountered include sharks, barracuda, the blue ringed octopus, lionfish, stingrays, cone shells, and swarms of jellyfish. Despite wide public interest and concern, deaths and injuries due to these creatures are still quite rare.

A less obvious, long-term health threat arising in the sea involves chemical pollutants contaminating seafood. This is perhaps the most underestimated, insidious danger of all those discussed so far. Persistent pollutants such as heavy metals (especially mercury), polyaromatic hydrocarbons, and a wide range of synthetic organic compounds (PCBs, Bisphenol A, brominated flame retardants, dioxins, perfluorinated compounds, etc.) have been linked to clinical disorders including neuropathy, cardiomyopathy, endocrine disruption, vascular disease, and cancers. Body burdens of environmental chemicals are associated with the changing incidence of a wide variety of illnesses worldwide, so much so that they may be influencing global patterns of disease.

This litany of ocean-related health threats is perhaps both surprising and alarming, and clearly warrants much greater attention as ever higher numbers of people move to the coast. However, it is important to consider, with equal diligence, the enormous range of opportunities and health benefits offered by our seas and coastal areas, many of which have previously been under-exploited or simply overlooked. Good health and well-being are intimately linked with economic prosperity and education. In many of the world's poorest countries, marine ecosystems generate employment for millions of people and offer an attractive environment in which to live. Capture fisheries and aquaculture provide jobs for 10 to 12 percent of the world's population. Over two billion people work in the marine energy sector (non-renewable and renewable), mining industries (aggregates and deep sea mining), maritime transport, and tourism. In total, approximately two thirds of the global gross national product (GNP) is generated within 100 km of the sea coast, with over nine billion tonnes of goods being shipped around the world by sea each year. Shipping capacity will more than double by 2030. Many other marine-related jobs contribute to sustaining coastal communities; for example, employment in the extraction of salt, processing and preserving of fish and shellfish, manufacturing refined petroleum products; the building, repairing and maintaining ships, boats and floating structures; coastal engineering; and the construction of flood defenses, ports, coastal towns and cities. All of these activities help people to live healthy fulfilling lives.

Marine and medical scientists are keen to point out the dietary health merits of seafood. Fisheries produce ca. 160 million tons of fish per annum that represent ca. 16 percent of animal protein consumed globally. Fish and shellfish rich in omega-3 fatty acids, when combined in a 'Mediterranean diet', consistently lead to health and well-being improvements, conferring cardioprotective effects and a reduced incidence of mammary and prostate cancers. Benefits for neurological function also seem likely.

Other marine organisms have facilitated the discovery of new pharmaceuticals. For example, Ecteinascidin 743 is a potent anti-cancer drug derived from the Caribbean sea squirt; a series of powerful chemotherapy drugs, the dolastatins, have been extracted from sea hares, *Dolabella auricularia*; and Conotoxin, a potent anti-pain drug, is extracted from marine cone shells. Brevenal from the Florida red tide alga also shows promise in treating cystic fibrosis.

Equally exciting is the renewed interest is the use of our seas and oceans to directly foster improvements in health and well-being. In the eighteenth century, seawater was considered helpful in treating 'glandular' diseases such as scurvy, scrofula, jaundice, and tuberculosis. One of the first seawater health spas, created in Brighton, England, came to prominence when attended by the Royal family, leading to other coastal hospitals being established, including the Royal Seabathing Infirmary at Margate in 1791. These institutions offered so-called 'thalassotherapy' to help the weak and sickly recuperate. With progress in medical science, especially the development of pharmaceuticals, interest moved on from thalassotherapy until around ten years ago when the 'blue gym' concept emerged. This involves a more scientific approach to assessing health and well-being benefits of spending time in and around outdoor blue spaces, such as seashores, coastal paths, and estuaries. In England, an analysis of census data for 48 million people showed that they reported better health if they live at the coast. Effects were especially strong in areas of deprivation, suggesting that coastal living could be used to help tackle health inequalities. Physical activity promotes mental and physiological health so if coastal environments encourage outdoor pursuits, potential public health benefits could be enormous, including reducing the risk of obesity and of developing diabetes, cardiovascular and respiratory diseases as well as various cancers. Further health pathways may be *via* stress reduction and restoration of mental well-being, and direct physiological effects mediated through exposure to biologically active molecules present in sea spray. The contention is that these biochemicals, once inhaled, reduce inflammatory responses and foster better health.

In summary, coastal dwellers represent a growing proportion of the global population at a time when threats to health and well-being from the marine environment are increasing rapidly. More frequent extreme weather events, sea level rise, rising sea temperatures, and ocean acidification associated with climate change are exacerbating dangers posed by harmful algal blooms, microbial pathogens, and chemical pollution. Paradoxically, as we have seen, this is at a time of growing recognition of the health and well-being benefits of coastal living. The medical community shows little awareness of the complex relationship between marine-related threats and opportunities and their relevance to medical practice. Illnesses arising from contact with the sea or sea foods tend to be regarded as being of minor importance compared to health risks associated with, for example, smoking, alcohol consumption, obesity, and other lifestyle factors. This may be true in a day-to-day sense, but over the longer term, developing better ways of interacting with the sea and of living in coastal environments may greatly improve overall public health.

It is therefore timely to re-evaluate the topic of 'oceans and human health' in a global context.[1] This will put us in a position to mitigate, adapt to, or avoid

1 For further reading on this topic, see R.E. Bowen, M.H. Depledge, C.P. Carlarne and L.E. Fleming, eds., *Oceans and Human Health: Implications for Society and Well-Being* (London: Wiley, 2014); M.H. Depledge, R. Lovell, B. Wheeler, K. Morrissey, M. White and L. Fleming, *Future of the Sea: Health and Wellbeing in Coastal Communities* (London: Foresight Programme, Government Office of Science, 2017), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/639432/Health_and_Wellbeing_Final.pdf; K. Krajik, "Medicine from the Sea," Smithsonian.com (30 April 2004), http://www.smithsonianmag.com/science-nature/medicine-from-the-sea-99586066/; M.N. Moore et al., *Linking Oceans and Human Health: A Strategic Research Priority for Europe*, Position Paper 19 (Ostend: European Marine Board, 2015), http://www.marineboard.eu/sites/marineboard.eu/files/public/publication/Oceans%20and%20Human%20Health-214.pdf; and M.P. White, S. Bell, R. Jenkin, B. Wheeler and M. Depledge, "The Benefits of Blue Exercise," in *Green Exercise: Linking Nature, Health and Well-Being*, eds., J. Barton, R. Bragg, C. Wood and J. Pretty (London and New York: Routledge, 2016), 69–78.

threats and relieve ourselves of the sense of gloom and foreboding which marine pollution, climate change, and extreme events generate. By fully recognizing that our seas and oceans can play a role in maintaining or improving health and well-being, we can set course for public health policy interventions that help us to significantly lower the global burden of disease.

The Changing Ocean and the Impact of Technology: The Role of the Ocean Tracking Network

Frederick Whoriskey *
Ocean Tracking Network, Department of Oceanography,
Dalhousie University, Halifax, Nova Scotia, Canada

It's Personal

The historic but false vision of the ocean as being so vast and inexhaustible that it would benefit humankind forever has been destroyed during my lifetime. I lived this change, and watched in dismay as it was documented in scholarly publications. The personal experience started in early childhood where summers were spent on the coast in Scituate, Massachusetts. I passed more time in the water with a mask than I did on land. My earliest ocean memories (I was born in 1954 and by 8 years old was a devoted snorkeler) are of a nearshore zone full of life, and of being able to catch cod (*Gadus morhua*), flounder (*Pseudopleuronectes americanus*), striped bass (*Morone saxatilis*), cunner (*Tautogolabrus adspersus*), American lobster (*Homarus americanus*; duly licensed as a Massachusetts recreational harvester), and dogfish (*Squalus acanthias*) within a few meters of shore. Within ten years, most of these species were gone, and the few that remained were greatly reduced in numbers, most probably falling victim to overharvesting. This left the American lobster as the major resource for the coastal fisheries.[1]

Concomitant with the fish declines, other stressors were also rearing their head. Repeated small-scale oil spills occurred,[2] fouling beaches and having undocumented consequences for the area's ecology. Plastic waste began to pile up on the shore, and the ocean began warming. As temperatures rose, southern

* The Ocean Tracking Network has been supported by Dalhousie University, the Canada Foundation for Innovation, the Natural Sciences and Engineering Research Council of Canada, the Social Sciences and Humanities Research Council, the province of Nova Scotia, and its many global partners.

1 "Living Marine Resources," Government of Massachusetts, last accessed 2 February 2018, http://www.mass.gov/eea/docs/czm/oceans/waves-of-change/tech-lmr.pdf.

2 See, for example, Nuka Research and Planning Group, *Evaluation of Marine Oil Spill Threat to Massachusetts Coastal Communities*, Report prepared for the Commonwealth of Massachusetts, Department of Environmental Protection, December 2009, http://www.mass.gov/eea/docs/dep/cleanup/laws/osthrt.pdf.

species like the lady crab (*Ovalipes ocellatus*) began to make their appearance[3] in what used to be a cold-ocean bastion. The warming of waters immediately adjacent to the coast resulted in the lobsters withdrawing to deeper, colder water.[4] The familiar nearshore lines of buoys marking lobster traps are now gone, reducing the socio-economic benefits that flowed from this dominant commercial species and changing the social nature of the coastal community. New invasive species arrived, displacing the existing, common invasive species that in my ignorance I had assumed were our native fauna. In particular, the green crab (*Carcinus maenas*) that probably made its way to North America from Europe on the bottom of colonial sailing ships and so enjoyed the area that it took over the intertidal and nearshore,[5] has now been displaced by the Asian shore crab (*Hemigrapsus sanguineus*),[6] which most probably arrived as larvae in ballast water of a cargo ship[7] from the massive transport network that keeps the global economy chugging along.

However, the ocean story is not one of total gloom and loss. The environmental movement that developed in the wake of large-scale environmental damage changed public policy and regulatory regimes. Globally, requirements were phased in requiring the conduct of environmental impact assessments to mitigate or eliminate impacts of proposed projects that could harm the environment. The concept of sustainable development, so eloquently expressed in the Brundtland Report,[8] has taken deep international root, and with the arrival of the United Nation's newly crafted Sustainable Development Goals (SDG),[9] the health of the ocean for the first time has been specifically and

3 J.C.A. Burchsted and F. Burchsted, "Lady Crabs, *Ovalipes ocellatus*, in the Gulf of Maine," *Canadian Field-Naturalist* 120, no. 1 (2006): 106–108.

4 E. Greenhalgh, "Climate & Lobsters," US National Oceanographic and Atmospheric Agency (NOAA) (6 October 2016), https://www.climate.gov/news-features/climate-and/climate-lobsters.

5 E.D. Grosholz and G.M. Ruiz, "Predicting the Impact of Introduced Marine Species: Lessons from the Multiple Invasions of the European Green Crab, *Carcinus maenas*," *Biological Conservation* 78, no. 1–2 (1996): 59–66.

6 C.E. Epifanio, "Invasion Biology of the Asian Shore Crab *Hemigrapsus sanguineus*: A Review," *Journal of Experimental Marine Biology and Ecology* 44 (2013): 33–49.

7 For a review of ballast water transfers, see J.T. Carlton, "The Scale and Ecological Consequences of Biological Invasions in the World's Oceans," in *Invasive Species and Biodiversity Management*, eds., O.T. Sandlund, P.J. Schei and Å. Viken (Dordrecht: Kluwer Academic Publishers, 1999), 195–212.

8 World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987), http://www.un-documents.net/our-common-future.pdf.

9 "Sustainable Development Goals," United Nations Development Programme, http://www.undp.org/content/undp/en/home/sustainable-development-goals.html.

unquestionably recognized by the international community as critical to humanity's future (SDG 14).

Looming Challenges: The Impacts and Benefits of Technology

There still are huge challenges looming for the ocean, stemming from its 'open access'. An astonishingly rapid development of technology is totally changing the nature of humanity's relationship with the ocean. There is now no location in the sea that is not accessible should we want to pay a visit (note, for example, film director James Cameron's ability to construct a personal submersible to access the deepest portion of the ocean in the Challenger Deep of the Mariana Trench[10]), or to initiate economic activities. The economic drivers will be the most formidable. The ocean economy is currently estimated to be worth at least US$24 trillion worldwide,[11] and systematic attention is now being focused on developing much more ocean economic activity. 'Blue growth', or the 'Blue Economy', are becoming staples of the economic development plans of ocean nations, and we are poised on the brink of a technology driven 'ocean industrial revolution'.[12] If this economic development is not handled carefully, we stand to lose much of the critical ocean biodiversity on which a great deal of our current ocean economy (fisheries, nature tourism), food security, and valued ecosystem services depend. We also face the possibility of a major extinction pulse, similar to the one that was observed for land animals when the terrestrial industrial revolution occurred in the eighteenth and nineteenth centuries.[13]

The impacts of technology can swing both ways. While next generation technologies may create new problems, they can also help to mitigate or eliminate existing or future problems by providing the information and knowledge needed to plan development that will be truly stable. The latter is the world in which Dalhousie University's Ocean Tracking Network (OTN) operates.

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10 L. Klimas, "What Exactly Did James Cameron Find in the Deepest Ocean Trench?," *The Blaze* (26 March 2012), http://www.theblaze.com/news/2012/03/26/what-exactly-did-james-cameron-find-in-the-deepest-ocean-trench.

11 O. Hoegh-Guldberg et al., *Reviving the Ocean Economy: The Case for Action—2015* (Gland: WWF International, 2015), http://wwfintcampaigns.s3.amazonaws.com/ocean/media/RevivingOceanEconomy-REPORT-lowres.pdf.

12 D.J. McCauley et al., "Marine Defaunation: Animal Loss in the Global Ocean," *Science* 347, no. 6219 (2015): 1–7. doi.org/10.1126/science.1255641.

13 Id.

The Ocean Tracking Network

Many animals are unable to meet all of their life-history needs at a single geographic location. Habitat needs and prey types change as animals grow, requiring changes in geographic location. Seasonal variation in habitat productivity may alter the locations where food is available. The habitats and environmental conditions necessary for successful reproduction may be different from those needed for feeding or sheltering. Any of these may trigger predictable and extensive movements in highly valued species. Should something occur to block these movements, populations can decline, and in the worst cases the species can be extirpated locally or go extinct.[14]

As the future Blue Economy develops, the potential for single or multiple projects (cumulative impacts) to fall across the migration routes of these species is increasingly of concern. If we know what the animal's needs are, and the movement pathways that they follow to meet them, policy and management decisions can be taken to locate projects or conduct operations in ways that minimize the potential impacts. Our problem has been that until relatively recently, we were unable to document the movements and habitat use of aquatic animals. Ocean areas are vast; they cover three dimensions; they include extreme temperatures, depths, pressures and other environmental conditions; and humans are badly adapted to personally follow aquatic animals that are at home in the water. Until recently, all of this made it extremely difficult for scientists to document movements and the preferred habitats of animals in the ocean.

The advent of electronic telemetry since the late 1970s has enabled the observation of local and long distance migrations of aquatic species and their use of particular habitat types.[15] A variety of electronic telemetry systems are available. Some, like radio telemetry or passive integrated transponders (PIT tags), are used primarily in fresh water because they depend on transmission of radio signals, which will not penetrate long distances in salt water. However, data loggers, satellite tags, and acoustic telemetry are available and are widely used to track animals in marine systems.[16]

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14 H. Dingle, *Migration: The Biology of Life on the Move* (New York: Oxford University Press, 1996); R. Nathan et al., "A Movement Ecology Paradigm for Unifying Organismal Movement Research," *Proceedings of the National Academy of Sciences of the United States of America* 105, no, 49 (2008): 10952–10959, doi.org/10.1073/pnas.0800375105.

15 N.E. Hussey et al., "Aquatic Animal Telemetry: A Panoramic Window into the Underwater World," *Science* 348, no. 6240 (2015): 1255642, doi.org/10.1126/science.1255642.

16 M.B. Ogburn et al., "Addressing Challenges in the Application of Animal Movement Ecology to Aquatic Conservation and Management," *Frontiers in Marine Science* 4 (2017): 70, doi.org/10.3389/fmars.2017.00070.

There are common elements to the marine telemetry technology systems, but also big differences among them. Common elements include the need to capture animals, humanely attach the tags, and at some point retrieve detections of the animals from the tags that document the animal's geographic locations over time. Data loggers and satellite tags both incorporate environmental sensors (e.g., light sensors for light-based geolocation, depth, and temperature sensors), allowing scientists to link animal movements to environmental conditions. These tag types store their data on board the tag; however, the way the information is retrieved differs. In the case of the data logger, the tag must be recovered from the animal, which can occur, for example, when the tagged animal is captured in a fishery. By contrast, satellite tags report some or all of their data to orbiting satellites whenever the antenna of the tag pops out at the water surface. This can occur, for example, when the tag is fitted on the dorsal fin of a shark and the shark is swimming at the surface with the fin out of the water, or when the tag is a 'pop-up' model, designed to release itself from the animal on a predetermined set date after the animal was tagged. It then floats to the surface where it broadcasts some or all of the contained data, depending on the model of the tag and its settings. Satellite tags are large and very expensive; hence they tend to be used on big, high-value species such as tuna. Data loggers, whose utility is determined by the probability of the tagged fish being captured in fisheries, tend to be used on species where there is a high exploitation rate, increasing the probability of return of the tag.

The third electronic tagging system, acoustic telemetry, uses sound transmission.[17] Animals are tagged with an acoustic tag (also known as a 'pinger') that has a unique identification signal (ID) assigned to each individual, letting all subsequent detections of that tag be attributed to the original animal. These tags can also carry additional sensors such as depth and temperature. However, to detect the acoustic tags, a network of acoustic receivers needs to be deployed in the ocean at known locations. These typically have omnidirectional detection ranges of about 800 m, record the signals from the tags whenever they are within range, and store detections until the data can be retrieved. Course tracks and residency of animals are determined by linking sequential detections on the various receivers in the network. Data retrieval is done in one of three ways: by bringing the receiver to the surface and connecting it to a computer; in more expensive receiver models, by uploading the data from a moored receiver through an acoustic modem to a surface platform or marine autonomous vehicle; or in the most expensive model, by cabling the receiver

17 F. Whoriskey and M. Hindell, "Developments in Tagging Technology and their Contributions to the Protection of Marine Species at Risk," *Ocean Development & International Law* 47, no. 3 (2016): 221–232, doi.org/10.1080/00908320.2016.1194090.

to a surface buoy or mobile marine autonomous vehicles that have satellite or cellular phone links and can transmit detections in real time. Acoustic telemetry has become the most used form of marine electronic telemetry, due to its relatively inexpensive tag costs, and the availability of a variety of tag sizes that let investigators tag animals as small as 4.5 cm in length or which can last for ten years or more. This makes acoustic telemetry a flexible system that can address many questions and species (or their life stages) of interest.

Canada's Ocean Tracking Network (www.oceantrackingnetwork.com) has become a world leader in the field of acoustic telemetry. OTN is a project and system of the United Nations Intergovernmental Oceanographic Commissions' Global Ocean Observing System. Starting in 2008, the OTN began deploying Canadian state-of-the-art acoustic receivers and oceanographic monitoring equipment in key global ocean locations. These are being used to document the movements and survival of acoustically tagged marine animals and to link both to oceanographic conditions. OTN deployments have occurred in all of the world's five oceans, and frequently complement/enhance existing deployments maintained by OTN partners. The >160 species tracked include marine mammals, sea turtles, squid, and fish, including sharks, sturgeon, eels, tuna, salmon, and cod. Over 400 international researchers from 19 countries are currently participating in the global network. Innovative use of autonomous vehicles and platforms of opportunities (e.g., meteorological buoys and offshore oil infrastructure) to position new receivers is greatly enabling OTN's ability to monitor acoustically tagged animals and to retrieve data from moored receivers via acoustic modems.

A particularly unique element of the OTN is its systematic focus on international networking through its data system. OTN maintains a sophisticated data warehouse and is creating networked international nodes to house regional telemetry data. Half of the OTN staff is devoted to the task of seeing that the data from OTN's 1,600+ acoustic receivers are linked to the data flowing from >20,000 additional acoustic receivers deployed by individuals and telemetry networks throughout the global ocean.[18] OTN has been recognized as an Associate Data Unit of the International Oceanographic Data and Information Exchange. The sharing of data in this manner is technically challenging; there is a need for common or at least exchangeable metadata and data standards, and for QA/QC of large volumes of data. A major challenge has been getting

18 S.J. Cooke et al., "Ocean Tracking Network Canada: A Network Approach to Addressing Critical Issues in Fisheries and Resource Management with Implications for Ocean Governance," *Fisheries* 36, no. 12 (2011): 583–592.

individual investigators to buy into the process of data sharing and making their data available for use by the current and future scientific community. Some investigators who are reluctant to network are concerned about data theft or misuse; however, those investigators who are networking are increasing their productivity.[19]

The Future of Electronic Telemetry

Given the need for the information that electronic telemetry provides, the science community believes that its use for tracking aquatic animals will only grow in the future.[20] Continuing technological development (e.g., addition of oxygen, pH, and other sensors to tags) and expansion of its use will reduce costs and increase its utility by letting it help address the key management and policy questions. As the data grow in volume and especially in complexity, with varied environmental and animal movement variables measured at different time and geographic scales, much of the action in the field will shift to data analytics and visualization. There is a bright future for those with strong skills in data analytics and visualization, and with the communication skills to work with animal telemetrists.

Implications for Ocean Governance

Since coastal communities of ocean nations depend on their fisheries/biological resources for their socio-economic well-being, there is a critical need to inform policy and management systems with the best information possible on the impacts of our management decisions and on the potential consequences of future ocean development. We know that many valued species must move at predictable times to meet their life-history needs. If we want these species to prosper and continue to provide benefits to humans, it is imperative that we not block these movements. OTN researchers are informing policy and management decisions about fisheries, endangered species, the effectiveness of

19 V.M. Nguyen et al., "To Share or Not to Share in the Emerging Era of Big Data: Perspectives from Fish Telemetry Researchers on Data Sharing," *Canadian Journal of Fisheries and Aquatic Sciences* 74, no. 8 (2017): 1260–1274, doi.org/10.1139/cjfas-2016-0261.

20 R.J. Lennox et al., "Envisioning the Future of Aquatic Animal Tracking: Technology, Science, and Application," *BioScience* 67, no. 10 (2017): 884–896, doi.org/10.1093/biosci/bix098.

marine protected areas, and the potential environmental impacts of proposed industrial development in the ocean. They are also linking animal distributions to environmental conditions, which will provide a predictive capacity for changed animal distributions in the face of a changing ocean. As such, the OTN has an important role to play in the quest to maintain the health of the oceans.

Ocean Remote Sensing from Space: A Tale of Three Commons

Dirk Werle
ÆRDE Environmental Research, Halifax, Nova Scotia, Canada

Introduction

The uniqueness of the ocean lies in its vastness, its constant movement, flow, and circulation. This seems to elude graphic illustration on a static map with point markings and line drawings, or image capture of the watery element, particularly when it takes the form of currents, waves, fog or clouds, or when it is precipitating, melting or blowing. Geometric representations and instant snapshots of the ocean are ephemeral and fleeting, subject to interpolation and interpretation. Exploring, representing and articulating the dynamics of ocean space is a challenging endeavor that can be enriched by the view from above—high above—from outer space, via the pathways of cyberspace.[1]

The View from Above

Viewing the ocean from outer space is an unusual, formidable perspective. It differs profoundly from that of the traditional lookout in the mast of a sailing vessel or present-day, ship-based radar instruments, horizontally scanning their immediate surroundings and committing important observations and positions to a log. By contrast, modern satellite-based sensors are pointed downward. The vertical perspective permits map-like arrangements of data collections. These are scalable and in effect comparable with other geospatial information as it relates to marine surveillance, mapping, and synoptic views of environmental conditions. Moreover, while confined by Kepler's Laws to orbital motion several hundred kilometers high above the rotating Earth, optical and radar remote sensing systems can effortlessly repeat their measurement

1 P. Meyer, "Outer Space and Cyberspace: A Tale of Two Security Realms," in, *International Cyber Norms: Legal, Policy & Industry Perspectives*, eds., A.-M. Osula and H. Rõigas (Tallinn: NATO CCD COE Publications, 2016), 155–169, https://ccdcoe.org/sites/default/files/multimedia/pdf/InternationalCyberNorms_Ch8.pdf.

cycle, covering vast swaths of ocean surface and eventually the entire globe on a regular basis.

In a typical scenario, satellite-based sensors transform the radiation or backscatter response to a stream of electrons. Data streams are rapidly transmitted to a ground-based facility and processed by algorithms that record them as ocean color, temperature, sea surface elevation, or sea ice, as the case may be. Over the past decades, scientists and mariners have learned to utilize and interpret wide-area coverage of ocean remote sensing data, often in conjunction with in situ validation data from a buoy or Argo float network. They study spatial and temporal dimensions of biophysical and chemical processes, measure trends of global sea level rise, and monitor oscillations, such as El Niño and La Niña events (Figure 1). They routinely assess the risk of operating in remote and harsh marine environments by integrating up-to-date satellite data into mapping, modeling, and forecasting activities.[2]

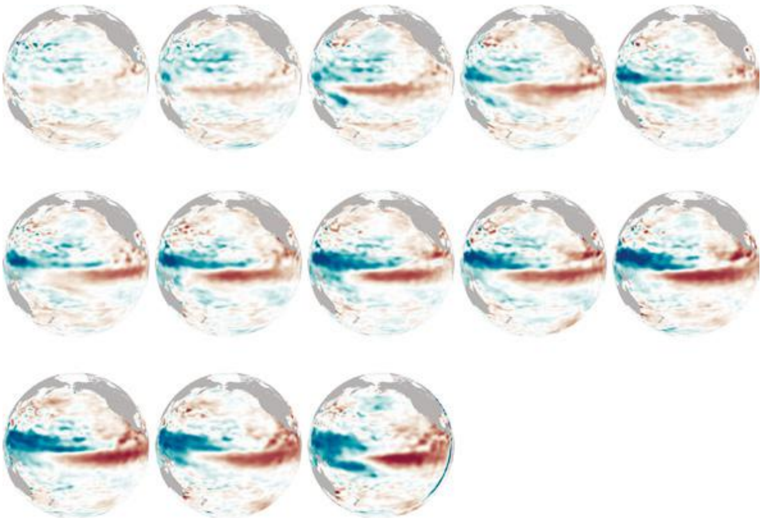

FIGURE 1 Time series of altimeter measurements from the Jason-2 satellite showing averaged sea surface height anomalies in the Pacific Ocean during the development of an intense El Niño event in 2015. Darker shades of red indicate where the ocean stood higher than the normal sea level, as warmer water expands to fill more volume. Darker shades of blue reveal where sea level and temperatures were lower than average, resulting from water contraction. Normal sea level conditions appear in white; continental landmasses appear in grey.
SOURCE: NASA EARTH OBSERVATORY; NASA EARTH OBSERVATORY MAPS BY JOSHUA STEVENS, USING JASON-2 DATA PROVIDED BY AKIKO KAYASHI AND BILL PATZERT, NASA/JPL OCEAN SURFACE TOPOGRAPHY TEAM.

2 I.S. Robinson, *Discovering the Ocean from Space: The Unique Applications of Satellite Oceanography* (Heidelberg: Springer, 2010).

Advanced satellite technologies and constellations of high-precision sensor systems are revolutionizing the way we can observe the ocean surface on a daily basis at spatial resolutions that range from a few hundred meters to several kilometers. Microwave scatterometers provide detailed global data on near-surface wind fields and on sea ice distribution. Altimeters observe ocean circulation patterns, measure significant wave height, and monitor sea levels at centimeter accuracy. Synthetic aperture radars are similar 'weather-independent' instruments generating detailed imagery of coastal wind fields, waves, frontal currents, surface oil pollution, and sea ice. Along-track scanning radiometers provide accurate sea surface temperature maps. Ocean color radiometry is essential in coastal regions for measuring parameters such as chlorophyll-*a* concentration, primary productivity, and suspended matter. Many of these 'surficial' data sets and time series are used for validating multi-dimensional marine ecosystem models of ocean space.[3]

Over the coming years, public and private sector investments in Earth observation technology and geospatial infrastructure will amount to billions of dollars, supporting the scenarios and applications mentioned above. They hold promise for more capable sensors, more frequent and detailed observations, and more timely delivery of related products and services originating from the increasingly crowded precinct of low Earth orbits. Going beyond the view from above and rapid development of space technology, how will policy-makers, managers, and the public-at-large receive and react to scientific evidence of ocean change? What societal benefits might be gained, given the coveted view from above?[4] And, conversely, can Earth observation technologies help to sustain the health of the ocean, given open and reliable access to online data streams and scientific research into essential ocean variables?[5]

Digital Pathways across the Global Commons

One might address the concerns related to ocean science policy, societal benefits, and ocean health from a global commons point-of-view by following the pathways of digital data and image representations of *ocean space*, as they

3 Task Team for an Integrated Framework for Sustained Ocean Observing, *A Framework for Ocean Observing*, IOC/INF-1284 rev. (Paris: UNESCO, 2012), doi: 10.5270/OceanObs09-FOO, http://unesdoc.unesco.org/images/0021/002112/211260e.pdf.

4 S. Djavidnia, V. Cheung, M. Ott and S. Seeyave, eds., *Oceans and Society: Blue Planet* (Newcastle upon Tyne: Cambridge Scholar Press, 2014).

5 P.F. Uhlir, *The Value of Open Data Sharing* (Geneva: Group on Earth Observations/CODATA, 2015), https://www.earthobservations.org/documents/dsp/20151130_the_value_of_open_data_sharing.pdf.

accumulate from sensors based in *outer space* and enter a third domain of the global commons, namely, *cyberspace*. Cyberspace has rapidly emerged as the main vector for transmitting electronic signals, processing data, and accessing information. Satellite oceanography worldwide is thriving in this man-made domain; scientists and fast-growing users groups by and large depend on open access to it.

One of the essential infrastructure elements of cyberspace is the intercontinental fiber-optic cable network. It shuttles more than 90 percent of the worldwide Internet traffic across the ocean floor; the remaining traffic is handled by high-speed data links via communication satellites.[6] Once more, the cybernetic pathways of Earth observation data—this time processed data to end users—transects the global commons of ocean space and outer space. While both of these domains are governed by international treaties, cyberspace is not, at least not yet. A significant challenge to the viability of the emerging cyber-common is inadequate security, insufficient norms and regulations, and ineffective mechanisms of enforcement.[7] Restriction or outright disruption of access to Earth observation data would significantly blindside our ability to monitor vast areas of ocean space.

Meanwhile, satellite remote sensing is accumulating enormous data sets, filling archival storage vaults by the petabyte; many of them are openly available online.[8] Data volumes have already reached a critical mass to be used in interoperable ways for large-scale syntheses and big data analytics. Assimilation with a host of other geospatial records is an exciting and demanding element of future interdisciplinary scientific research and operational oceanography. It relies on improved connections between data repositories and automated, custom-made queries so as to extract, reveal, and quantify relationships.

Approaching the topic from a social justice perspective, Elisabeth Mann Borgese recognized the value of, and the all-important access to, Earth observation data at a very early stage of its development. Two years after the 1972

6 N. Starosielski, *The Undersea Network* (Durham: Duke University Press, 2015).

7 M. Barrett, D. Bedford, E. Skinner and E. Vergeles, *Assured Access to the Global Commons* (Norfolk, VA: Supreme Allied Command Transformation, North Atlantic Treaty Organization, 2011), http://www.act.nato.int/globalcommons; see also D. Livingstone and P. Lewis, *Space, the Final Frontier for Cybersecurity?* (London: Chatham House, 2016).

8 Examples include the US National Oceanographic and Atmospheric Agency Centers for Environmental Information (https://www.nodc.noaa.gov/), the US National Aeronautics and Space Agency's (NASA) WorldView portal (https://worldview.earthdata.nasa.gov), or the European Union's Copernicus Marine Environmental Monitoring Service (http://marine.copernicus.eu); some non-governmental organizations are focusing on specific themes, for example, the Global Fishing Watch (http://globalfishingwatch.org) and https://windy.com.

launch by the United States of their first civilian Earth Resource Technology Satellite (ERTS-1, later re-named LANDSAT-1), and four years before their pioneering SEASAT radar satellite returned a bounty of ocean measurements, she asserted, "only when satellite detection of natural resources is governed by international law will it benefit mankind."[9] Her 1987 proposal for the establishment of a World Space Organization (WSO) under the auspices of the United Nations was informed by experience gained during the negotiations leading up to the United Nations Convention on the Law of the Sea. Mann Borgese's overarching and principled WSO framework did not find support then. Instead, smaller and voluntary non-binding international and intergovernmental arrangements started to emerge at the time, as the initial scope of satellite observation and resource mapping was broadening to include environmental assessment and monitoring activities.

During the 1980s, the Group of Seven (G7) countries established partnerships in the international arena to "coordinate comprehensive and sustained Earth observations for the benefit of humankind."[10] The G7 Committee on Earth Observation Satellites (CEOS) was initially formed in 1984 as a mechanism for national space agencies to collaborate on missions and data systems. Under the United Nations umbrella, the Global Ocean Observing System (GOOS) informs environmental management policies and agreements and co-ordinates observations for climate, ocean health, and real-time services. The Group on Earth Observations (GEO) is a voluntary intergovernmental partnership of more than 100 nations pursuing the creation of an ambitious Global Earth Observation System of Systems, connecting Earth observation resources with a wide range of designated societal benefit areas. More often than not, these exemplary efforts of governance, collaboration and regulatory capacity-building are struggling to keep up with the relentless pace of ocean-related activities and technology development.

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9 Elisabeth Mann Borgese documented her points of view in two papers: "The Common Heritage," *CERES: FAO Review on Development* (November/December 1974): 55–57; "Towards a World Space Organization," *Canadian Institute for International Peace and Security Points of View* No. 5 (November 1987): 1–7. Both papers are available at https://findingaids.library.dal.ca/elisabeth-mann-borgese-fonds/.

10 CEOS has been in operation since 1984 (http://www.ceos.org); GOOS (http://www.goosocean.org) was established in 1992 by the Intergovernmental Oceanographic Commission of UNESCO; the intergovernmental Group on Earth Observations (http://www.earthobservations.org) first came together in 2003, adopted a Framework Document in 2004 defining scope and intent of the Global Earth Observation System of Systems (http://www.geoportal.org) and endorsed the GEOSS 10-year implementation plan in 2005.

Prospects for Observing Ocean Space from Outer Space through Cyberspace

Not unlike ocean circulation, the oceanic circle of satellite remote sensing data is also a continuous system: from surface to sensor to user, driven by the quest for a constant supply of reliable data and image products. Uninterrupted flow is the key to its function, and open access is essential for widespread applications in the near future. Scientists, researchers, and operational managers will continue to be leaders in marine monitoring activities and forecasting services. Citizen science is likely to join in these efforts, taking advantage of data democratization and data access opportunities. Emergency responders will focus on near real-time analysis for natural and human-made disasters, such as major storms, oil spill pollution, harmful algal blooms, or oxygen-depleted dead zones.

At the institutional level, satellite data are increasingly used in conjunction with other geospatial tools to assess regulatory regime performance and to enforce rules concerning large marine protected areas or illegal, unreported and unregulated fishing. The growing body of spatial-temporal information derived from ocean observing satellite sensors will continue to challenge conventional assumptions of movement and circulation patterns. Many efforts are bound to move beyond co-ordinating the activities of Earth observation producers.[11] Examples include Copernicus, The European Earth Observation Programme[12] and its Marine Environment Monitoring Service,[13] and the Global Fishing Watch.[14] They will involve a complex combination of actors, mandates and authorities. As a case in point, one might consider a private company launching a satellite sensor into space on an Indian or Russian rocket, providing environmental monitoring services and geospatial products via Internet to government or non-governmental organizations concerned with the implementation, enforcement, or monitoring of international regimes.

The role of satellite observations in addressing marine surveillance and environmental issues at local, regional, and global scales could be viewed as being largely instrumental, or technical, complemented by advanced methodological

11 M. Onoda and O. Young, eds., *Satellite Earth Observations and Their Impact on Society and Policy* (Singapore: Springer, 2017), https://link.springer.com/book/10.1007/978-981-10-3713-9; see also D.J. Whalen, "For All Mankind: Societal Impact of Application Satellites," in *Societal Impact of Spaceflight*, eds., S.J. Dick and R.D. Launius (Washington, DC: NASA, 2007), 289–312, https://history.nasa.gov/sp4801-part1.pdf.

12 See Copernicus, http://copernicus.eu/.

13 *Supra* note 8.

14 *Supra* note 8.

approaches first to identify, then classify, and eventually model the magnitude, characteristics, and extent of ocean features. As such, the observations from outer space cannot solve problems of climate change, marine habitat loss, ocean acidification, or overfishing. Yet, reliable satellite data and time series of ocean space will frequently form the geospatial backbone when it comes to addressing, alleviating, and solving these problems. How beneficial the view from above and how useful the digital manifestations of the oceanic satellite data circle can be for humankind will in no small part rely on open access and emerging governance regimes of the cyberspace common.

Large Marine Ecosystems: Their Status and Role in Ocean Governance

Kenneth Sherman
National Oceanic and Atmospheric Administration, National Marine Fisheries Service Laboratory, Narragansett, Rhode Island, United States

Introduction

As a participant in the Intergovernmental Oceanographic Commission's (IOC) annual meetings in the 1980s, I remember at one of the sessions a particularly passionate and forceful delivery by Professor Elisabeth Mann Borgese on the need to advance the legal authority for management of the oceans under the terms of the law of the sea. That memorable delivery was later shared with Professor Lewis Alexander, of the University of Rhode Island (URI), who directed the Marine Affairs Program at URI and was a longtime colleague of Professor Mann Borgese. Professor Alexander participated with her in many law of the sea conferences and workshops.

As Director of the US National Oceanic and Atmospheric Administration (NOAA) Fisheries Laboratory at URI's Bay Campus, I served as a guest lecturer on marine fisheries science in Professor Alexander's seminar courses and was well aware of his expertise in law of the sea matters. It was in the course of joint study with Professor Alexander that we developed the concept of adapting the management principles from the law of the sea to the assessment and management of large marine ecosystems (LMEs) defined on the basis of four ecological criteria: bathymetry, hydrography, productivity, and trophic linkages.[1] Following an initial period of joint study, Professor Alexander and I convened the Symposium on Variability and Management of Large Marine Ecosystems at the annual meeting of the American Association for the Advancement of Science (AAAS) in 1984. We were invited by the AAAS to prepare a peer-reviewed volume of selected papers from the Symposium that was published by the AAAS and serves as the seminal volume on large marine ecosystems.[2]

1 For maps of the 66 large marine ecosystems (LMEs) globally, see the US NOAA LME Portal, http://lme.edc.uri.edu.

2 K. Sherman and L.M. Alexander (eds.), *Variability and Management of Large Marine Ecosystems, American Association for the Advancement of Science* (AAAS) *Selected Symposium 99* (Boulder, CO: Westview Press, 1986).

Large Marine Ecosystems' Fusion of Science and Governance

The fusion of the LME approach to the assessment and governance of coastal ocean goods and services evolved and has emerged as a global LME movement during the past three decades. Among the invited speakers to the initial AAAS LME Symposium and contributors to the seminal LME volume was a multidisciplinary cross-section of well-known experts in marine fisheries (M. Sissenwine), marine population dynamics (J. Beddington, N. Dann), marine economics (G. Pontecurvo, F. Christy), oceanography (A. Bakun, N. McCall), as well as marine law and governance (M. Belsky, T. Scully). From the inception of the Symposium in 1984 and forward over three decades of the LME movement to the present, a concerted effort has been directed towards the integration and fusion of natural sciences with social sciences as an essential foundation of the LME approach to ecosystem-based management (EBM). The LME approach is based on the best available science applied to assess changing conditions or states of the environment and major components of the biogeochemical processes to support governance of marine goods and services within the spatial domains of entire LMEs.

The LME approach to assessment and governance is dependent on quantitative metrics from time-series measurements of suites of indicators under the broad umbrella of five LME modules: (i) productivity, (ii) fish and fisheries, (iii) pollution and ecosystem health, (iv) socio-economics, and (v) governance (Figure 1). The metrics of the first three modules are based on natural science data, and the metrics of the last two modules are based on social science metrics. During the intervening 33 years since the initial 1984 LME Symposium, a firm science foundation has been established through the contributions of 450 authors of 18 volumes of LME studies published by AAAS, Westview Press, Blackwell Science, Elsevier Science, the International Union for Conservation of Nature, and several United Nations agencies. In addition, 304 articles on LMEs have been published in marine science journals. An annotated list of volumes and published journal articles was published in 2016.[3] The published literature includes results of LME assessments based on the broad umbrella of science-based modular indicators.

The productivity module metrics are based on primary productivity measured as gCm^2y^{-1}. The primary productivity drives the trophodynamics of the LME and can be related to the carrying capacity of the ecosystem in relation

3 E. Kelley, ed., *Large Marine Ecosystems of the World: An Annotated Bibliography*, NOAA Technical Memorandum NMFS-F/SPO-167 (Silver Spring, MD: National Oceanic and Atmospheric Administration, 2016).

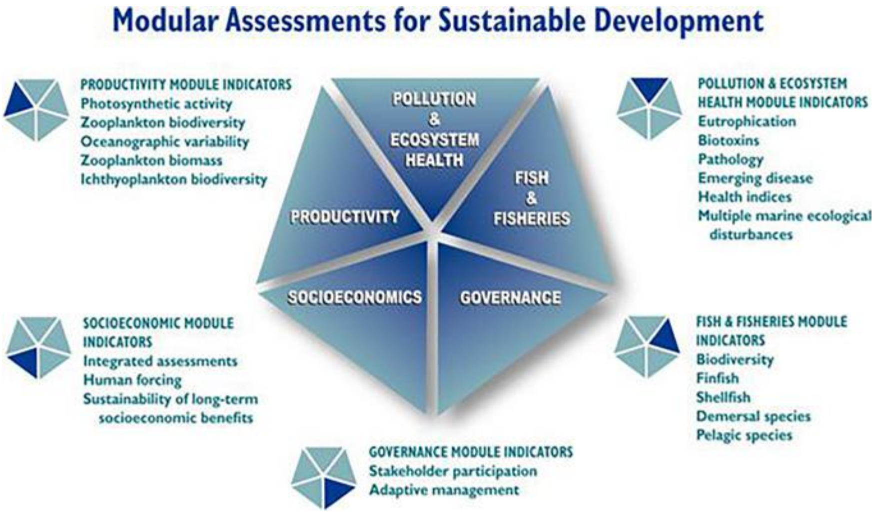

FIGURE 1 The five LME modules and suites of indicators of changing ecosystem conditions. SOURCE: "THE 5 LME MODULES: INTEGRATED ECOSYSTEM ASSESSMENTS," US NOAA, LAST ACCESSED 2 FEBRUARY 2018, HTTP://LME.EDC.URI.EDU/INDEX.PHP/LME-MODULES/2-MODULE-INTRODUCTION.

to supporting fisheries yields.[4] Other biogeochemical indicators of change in LMEs include photosynthetically active radiation, chlorophyll a, zooplankton, and ichthyoplankton and oceanographic conditions including water temperature, salinity, density, circulation nutrient flux, and acidification. Application of satellite derived data is useful for monitoring temperature, chlorophyll, and primary productivity.

The goods and services of LMEs are tightly integrated in the fish and fisheries module. In LMEs, monitoring data on fish and fisheries serve as economic goods and vital trophodynamic services transforming primary productivity to small pelagic fish species, up the food web to mid-size bottom feeders, and on to apex predators, including sharks and marine mammals. Human interaction through overfishing can affect the structure and sustainability of the fisheries, underscoring the need for ecosystem-based adaptive fisheries management.

The pollution and ecosystem health indicators for LMEs include an index to assess the health of coastal ocean waters based on a consideration of LME capacity for (i) food provisioning, (ii) artisanal fishery support, (iii) natural

4 M.J. Fogarty et al., "Fishery Production Potential of Large Marine Ecosystems: A Prototype Analysis," *Environmental Development* 17, no. 1 (January 2016): 211–219.

productivity, (iv) carbon storage, (v) coastal protection, (vi) tourism and recreation, (vii) coastal livelihoods and economics, (viii) clean water, (ix) biodiversity,[5] and (x) multiple marine ecological disturbance.[6] Total dissolved inorganic nitrogen loading from land-based sources of nutrient over-enrichment can lead to extreme conditions of oxygen deficiencies in LMEs and formation of dead zones.

It is the socio-economics module wherein the programmatic application of scientific findings are applied in decision-making, including the results of time-series monitoring of LME productivity, fish and fisheries, pollution and ecosystem health, and habitat conditions (e.g., sea grasses, corals, mangroves). Integration of social and economic indicators is factored into management decisions for recovery, development, and sustainability of LME goods and services.[7] The socio-economics dimension of LME management is critical to the global economy and well-being. An estimated 80 percent of the global marine fishery catch is produced annually in the world's LMEs.

The total goods and services within the spatial domains of the world's LMEs contribute an estimated US$12.6 trillion annually to the global economy. To respond and manage adaptively to changing ecological conditions, socio-economic considerations in operationalized LME projects are being closely integrated with science-based assessments designed to monitor LMEs at appropriate spatial and temporal scales to implement ecosystem-based management practices.[8]

Governance Module V

The application of the science-based assessment modules has evolved over three decades. Those of us engaged in the development of the LME approach to the assessment and management of coastal ocean goods and services were

5 B. Halpern et al., "Ocean Health Index for the World's Large Marine Ecosystems," in *Large Marine Ecosystems: Status and Trends*, IOC-UNESCO and UNEP (Nairobi: United Nations Environment Programme, 2016), 239–249.

6 B.H. Sherman, "Multiple Marine Disturbance Assessments for Latin American and Caribbean Large Marine Ecosystems," *Environmental Development* 22 (June 2017): 129–142.

7 A.M. Duda, "Strengthening Global Governance of Large Marine Ecosystems by Incorporating Coastal Management and Marine Protected Areas," *Environmental Development* 17, no. 1 (January 2016): 249–263.

8 V. de Barros Neto et al., "Two Decades of Inter-governmental Collaboration: Three Developing Countries on the Move towards Ecosystem-Based Governance in the Benguela Current Large Marine Ecosystem," *Environmental Development* 17, no. 1 (January 2016): 353–356.

acutely aware that we were among those in the marine science community undertaking a paradigm shift. The shift from single species and single sector focused management actions to multispecies and multisectoral ecosystem-based management was seen as a more effective strategy for moving toward sustainable development of the oceans.

The changeover movement towards EBM in the United States had its origins with the Stratton Commission Report that argued for establishment of a cabinet level organization to consolidate and oversee US ocean activities. Professor Alexander was active in drafting the Stratton Commission Report. He believed that reorganization of the federal government for advancing a national oceans agenda and principles of the law of the sea was desirable and practical. In this regard the legal opinions of Martin Belsky, as published in several LME volumes, supported the legal status of LMEs as an ecologically defined domain for implementing EBM practice.[9] When Professor Alexander and I conceived of the LME approach in 1983, we were in step with a growing movement towards an ecosystem-based governance system. I had been drafted from my plankton research in the National Marine Fisheries Service (NMFS) in the early 1970s to serve on a planning group in NMFS's Washington, DC, headquarters to plan a conversion to multidisciplinary fishery science for the entire NMFS as a national Marine Research Monitoring, Assessment, and Prediction program (MARMAP).

I returned from NMFS headquarters following the two-year (1970–1972) effective transition from individually operating NMFS laboratories around the United States to a formally organized national system of four fisheries science centers. The Northeast Fisheries Science Center, Southeast Fisheries Science Center, Southwest Fisheries Science Center, and Northwest and Alaska Fisheries Science Center were merged into the newly established NOAA in 1970. The MARMAP program was described for implementation as a groundfish monitoring component modeled after the US Northeast Continental Shelf groundfish monitoring program at the NEFSC and an oceanographic–ichthyoplankton/zooplankton monitoring program modeled after the California Comparative Fisheries Investigation (CALCOFI). Both activities were incorporated into a long-term assessment of the changing conditions of the US Northeast Continental Shelf LME extending 260,000 km^2 from the Gulf of Maine to Cape

9 M.H. Belsky, "Legal Regimes for Management of Large Marine Ecosystems and their Component Resources," in *Large Marine Ecosystems: Stress, Mitigation and Sustainability*, eds., K. Sherman, L.M. Alexander and B.D. Gold (Washington, DC: AAAS, 1993), 227–236.

Hatteras.[10] It was largely from this experience that the MARMAP program served as the precursor to the global LME approach.

In 1993 I was invited by the Global Environment Facility (GEF) to brief them on the LME approach. The GEF provides financial support to economically developing countries that are committed to improving their environment, including sustaining the goods and services of LME. In 1995 the GEF adopted the LME approach in their operational program as a means to introduce and support EBM practices for developing coastal countries around the globe. Since these initiatives, NOAA has been providing scientific and technical assistance to the development and implementation of 22 LME-based EBM projects in Africa, Asia, Latin America, Eastern Europe, and the Pacific. The GEF support for advancing the LME approach to sustainable development of the oceans is consistent with the statements of world political leaders made at three global environmental summits (1992 United Nations Conference on Environment and Development; 2002 World Summit on Sustainable Development; 2012 Rio +20) and the United Nations commitment in 2015 to the Sustainable Development Goal for the oceans (SDG 14).[11]

GEF and LME Governance Strategy Supporting Ocean Sustainability

The commitment of the GEF is in keeping with Professor Mann Borgese's idea of international peace and order through the oceans. One can view it as a tangible expression of the community of nations contributing substantial amounts of financial support to economically developing countries to empower their people in a global effort to advance sustainable development of LMEs along their coasts. Since 1995, 110 countries have been provided with US$3.15 billion in catalytic financial support from the GEF and its co-financing partners for the planning and implementation of EBM practice in LMEs.[12] This global movement is consistent with the goal and targets of the SDG14 practice of EBM in LMEs. This practice is based on a governance regime that is in keeping with the country-driven proposition of bottom-up solidarity in joint planning of a transboundary diagnostic analysis (TDA). It uses science-based methods for

10 K. Sherman, N.A. Jaworski and T. Smayda (eds.), *The Northeast Shelf Ecosystem: Assessment, Sustainability and Management* (Cambridge, MA: Blackwell Science, 1996).

11 See essay by David VanderZwaag in this volume.

12 K. Sherman, "Toward Ecosystem-Based Management (EBM) of the World's Large Marine Ecosystems During Climate Change," *Environmental Development* 11 (2014): 43–66.

determining the priority of ecosystem issues to be addressed by the participating countries planning and implementing GEF supported LME projects. The TDA phase is followed by the policy-driven Strategic Action Programme (SAP) to be implemented over an initial typically five-year operational phase. In some cases, the GEF will support successful SAPs for several multi-year cycles into a self-financing sustainable project future. The TDA and SAP processes serve as a bottom-up governance approach to reach consensus in prioritizing stressors to be mitigated by countries sharing the goods and services of LMEs wherein they join together in moving towards ecosystem-based governance practices. The movement is multidisciplinary in strategy and multisectoral in operation across the five modules (Figure 1) and major socio-economic sectors, namely, fishing, energy, tourism, shipping, and mining.

From a philosophical perspective, the LME approach is in keeping with Professor Mann Borgese's ocean vision for the "making of a new integrated order based on new forms of international cooperation and organization."[13] Countries have shown a willingness to come together for the common purpose of developing and sustaining their shared LME goods and services across national boundaries within the spatial domain of ecologically defined LMEs of the world. The world's first LME governance Commission and Convention was established by the three nations sharing the goods and services of the Benguela Current LME, namely, Angola, Namibia, and South Africa. The Commission was established in 2007 and the Convention for the Benguela Current LME was ratified by the three countries in 2014.[14] Together they reflect a new way of ocean governance that is very much in keeping with Professor Mann Borgese's philosophy wherein the common ocean interests bind countries together in peaceful pursuit of socio-economic benefits on behalf of their people.

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13 E. Mann Borgese, *The Future of the Oceans: A Report to the Club of Rome* (Montreal: Harvest House, 1986).

14 De Barros Neto et al., *supra* note 8.

Ocean Acidification in Canadian Waters

Kumiko Azetsu-Scott
Department of Fisheries and Oceans, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada

About one quarter of the carbon dioxide (CO_2) produced by human activities since the start of the Industrial Revolution (anthropogenic CO_2, mostly from fossil fuel burning with much smaller contributions from cement production and land use change) has been taken up by the oceans.[1] The oceans provide a great service to the planet by slowing down the accumulation of CO_2 in the atmosphere, which is the major cause of global warming. However, this additional CO_2 is changing the fundamental chemistry of the oceans. CO_2 dissolves in the surface water to form carbonic acid, which upon dissociation results in a decrease in pH and the concentration of the carbonate ion, a building block of calcium carbonate ($CaCO_3$) shells and skeletons. Ocean acidification (OA) refers to the decrease in pH and carbonate ion concentration due to the increasing anthropogenic CO_2 in the ocean (Figure 1). The upper ocean pH has decreased by 0.1 pH unit (approximately 30 percent increase in acidity) over the past 200 years and is expected to fall an additional 0.3 pH unit by 2100 (approximately 150 percent increase in acidity).[2] Oceans have not experienced such a rapid pH change for at least the last 66 million years, and possibly the last 300 million years. This raises serious concerns about the ability of marine organisms to adapt. During some of the acidification events in the Earth's history, selective extinction and slow recovery of some species have occurred.[3]

Organisms that form $CaCO_3$ shells and skeletons will experience direct impacts because acidity increases the solubility of $CaCO_3$. Both ecologically and economically important organisms in a variety of tropic levels have $CaCO_3$ structures. Some examples of ecologically important organisms are coccolithophores, which are the basis of some marine food chains, pteropods, which are a food source for a variety of northern fish, and warm and cold water corals which provide important habitats for other organisms. Economically

1 C.L. Sabine et al., "The Oceanic Sink for Anthropogenic CO_2," *Science* 305, no. 5682 (2004): 367–371, doi.org/10.1126/science.1097403.

2 K. Caldeira and M.E. Wickett, "Ocean Model Predictions of Chemistry Changes from Carbon Dioxide Emissions to the Atmosphere and Ocean," *Journal of Geophysical Research Oceans* 110, no. C9 (2005): C09S04, doi.org/10.1029/2004JC002671.

3 B. Hönisch et al., "The Geological Record of Ocean Acidification," *Science* 335, no. 6072 (2012): 1058–1063, doi.org/10.1126/science.1208277.

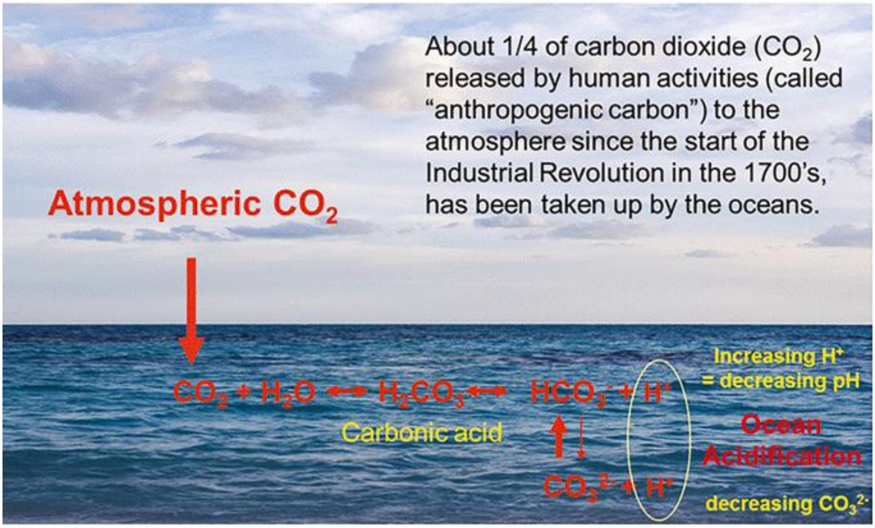

FIGURE 1 What is ocean acidification?

important organisms with $CaCO_3$ structures include shellfish such as oysters, mussels, clams, shrimp, lobsters and crabs. Studies of biological responses to OA have been an active research field over the last 10–15 years. These laboratory studies have shown malformation and dissolution of shells of organisms including cocolithophores, pteropods, and oyster and clam larvae in seawater with high CO_2, therefore low pH. Biological effects of OA to both $CaCO_3$ and non-$CaCO_3$ organisms have also been reported. Studies have demonstrated decreased survival, calcification, growth, development, and abundance in response to acidification,[4] reproduction and physiology, metabolic rate, depression of immune systems, behavioral change, and taste of shrimp.[5]

Although many organisms with $CaCO_3$ shells and skeletons showed negative effects from OA, some were not affected and others even thrived in acidified water. Given the variable responses of individual types of organisms to ocean acidity, together with other stressors such as warming, deoxygenation, and pollution, it is difficult to predict how whole marine ecosystems respond to climate change and acidification. To investigate marine ecosystem response,

4 K.J. Kroeker et al., "Impacts of Ocean Acidification on Marine Organisms: Quantifying Sensitivities and Interactions with Warming," *Global Change Biology* 19, no. 6 (2013): 1884–1896.

5 S. Dupont, E. Hall, P. Calosi and B. Lundve, "First Evidence of Altered Sensory Quality in a Shellfish Exposed to Decreased pH Relevant to Ocean Acidification," *Journal of Shellfish Research* 33, no. 3 (2014): 857–861.

several studies have been conducted using mesocosms,[6] which mimic future warm and acidified oceans, and studies using natural analogues such as underwater volcanos where CO_2 gas is released and natural acidification conditions are formed.[7]

Since $CaCO_3$ shells and skeletons are more soluble at lower temperatures and higher pressures, high latitude and deep water ecosystems will be more vulnerable to the stress of OA. Also, the solubility of gases, including CO_2, is higher in cold water than in warm water. Thus, although OA is a global threat, cold waters in Canada may be particularly vulnerable. Ocean acidification also lowers the oceans' capacity to absorb anthropogenic carbon directly (the solubility pump) and through changes in primary productivity and phytoplankton species composition (the biological pump), providing a negative feedback to climate change.

Ocean acidification is controlled and enhanced by various mechanisms and Canada's three oceans have distinct drivers (Figure 2). In the Pacific, wind-driven upwelling brings the intermediate depth water, corrosive to organisms with $CaCO_3$ shells and skeletons, to the surface.[8] This upwelling is a natural phenomenon and occurs seasonally. The intermediate water of the Pacific has inherently higher CO_2 than Atlantic water due to the accumulation of CO_2 produced by microbial respiration. The supplementary addition of anthropogenic CO_2 has, however, lowered the pH of this water to a critical level. In the Arctic, the first observations of corrosive surface ocean waters were reported.[9] The Arctic Ocean receives a large amount of fresh water from rivers, seasonal ice melt, and glacial meltwater. This fresh water has little buffer capacity and effectively reduces the pH of Arctic waters. Decreasing ice cover enhances the uptake of

6 U. Riebesell, R.G.J. Bellerby, H-P. Grossart and F. Thingstad, "Mesocosm CO_2 Perturbation Studies: From Organism to Community Level," *Biogeosciences* 5 (2008): 1157–1164, doi.org/10.5194/bg-5-1157-2008.

7 J.M. Hall-Spencer et al., "Volcanic Carbon Dioxide Vents Show Ecosystem Effects of Ocean Acidification," *Nature* 454 (2008): 96–99.

8 R.A. Feely et al., "Evidence for Upwelling of Corrosive 'Acidified' Water onto the Continental Shelf," *Science* 320, no. 5882 (2008): 1490–1492, doi.org/10.1126/science.1155676.

9 M. Chierici and A. Fransson, "Calcium Carbonate Saturation in the Surface Water of the Arctic Ocean: Undersaturation in Freshwater Influenced Shelves," *Biogeosciences* 6 (2009): 2421–2432; M. Yamamoto-Kawai et al., "Aragonite Undersaturation in the Arctic Ocean: Effects of Ocean Acidification and Sea Ice Melt," *Science* 326, no. 5956 (2009): 1098–1100, doi.org/10.1126/science.1174190; L. Robbins et al., "Aragonite Undersaturation in Greater than 20% of Canadian Basin, Western Arctic," *PLOS One* 8, no. 9 (2013): e73796, doi.org/10.1371/journal.pone.0073796.

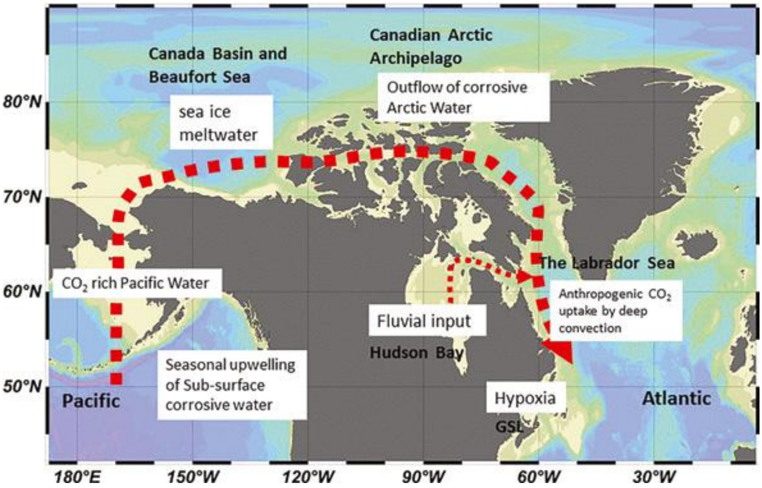

FIGURE 2 Canadian acid highway and regional amplification drivers.

atmospheric CO_2, further accelerating Arctic acidification.[10] In the Atlantic, the effects of corrosive Arctic water, freshwater input from the St. Lawrence River, hypoxic (low oxygen) water in the Gulf of St. Lawrence, and high rates of anthropogenic CO_2 uptake in the deep convection region of the Labrador Sea act to enhance OA. Corrosive Arctic water can be traced southwards along the biologically and commercially active shelf region of Eastern Canada.[11] In the St. Lawrence Estuary, acidification is closely related to hypoxia caused by the multi-decadal changes in water mass composition due to circulation. Its pH has decreased from 7.9 in the 1930s to 7.65 by the 2000s, much faster than the global average.[12] Labrador Sea Water (LSW) is formed each year in the Labrador Sea by winter deep convection, subsequently spreading to the intermediate and deep waters of the North Atlantic. LSW is well ventilated and contains high concentrations of anthropogenic CO_2. As a result, the pH of the LSW is steadily decreasing.

Ocean acidification in coastal regions exhibits much higher temporal and spatial variability than in open oceans. Seasonally variable freshwater inputs

10 Arctic Monitoring and Assessment Programme (AMAP) (2013), *AMAP Assessment 2013: Arctic Ocean Acidification* (Oslo: AMAP, 2013).

11 K. Azetsu-Scott et al., "Calcium Carbonate Saturation States in the Waters of the Canadian Arctic Archipelago and the Labrador Sea," *Journal of Geophysical Research* 115, no. C11 (2010): C11021, doi.org/10.1029/2009JC005917.

12 A. Mucci, M. Starr, D. Gilbert and B. Sundby, "Acidification of Lower St. Lawrence Estuary Bottom Waters," *Atmosphere-Ocean* 49, no. 3 (2011): 206–218, doi.org/10.1080/07055900.2011.599265.

from rivers and glacial meltwater also reflect the local geology,[13] therefore, freshwater inputs affect each coastal region differently. Nutrient input from the land enhances coastal productivity, resulting in increased microbial respiration leading to oxygen depletion and further CO_2 production. As a result, ocean acidification is accelerated.[14] In urban coastal areas, emissions of other acidifying gases, such as nitrogen oxides (NO_x) and sulfur oxides (SO_x), can also contribute to enhanced coastal acidification.[15]

Canada is one of the first countries in the world to experience the adverse impacts of OA. Ocean acidification is likely to alter the structure and function of its marine ecosystems. Hence, fishing industries, subsistence fisheries by Indigenous communities, and tourism will be directly influenced. The results of these changes will threaten economies, especially those directly connected with fisheries, culture, and subsistence of Indigenous peoples and eco-tourism.

Beyond Canadian waters, global food security risks caused by OA and climate change, especially for developing nations, need to be emphasized. Reducing nutrient input to the coastal area, developing new aquaculture practices such as close monitoring of intake water to the hatcheries, and cutting down the emissions of acidic gases such as NO_x and SO_x can help to slow down the progress of local OA and thus manage risks. However, global ocean acidification will inevitably progress further unless the global emission of CO_2 resulting in the accumulation of CO_2 in the atmosphere is controlled and reduced.

13 K. Azetsu-Scott, M. Starr, Z-P. Mei and M. Granskog, "Low Calcium Carbonate Saturation State in an Arctic Inland Sea Having Large and Varying Fluvial Inputs: The Hudson Bay System," *Journal of Geophysical Research Oceans* 119, no. 9 (2014): 6210–6220, doi.org/10.1002/2014JC009948.

14 D. Ianson et al., "Vulnerability of a Semi-enclosed Estuarine Sea to Ocean Acidification in Contrast with Hypoxia," *Geophysical Research Letters* 43, no. 11 (2016): 5793–5801, doi.org/10.1002/2016GL068996.

15 K.A. Hunter et al., "Impacts of Anthropogenic SO_x, NO_x and NH_3 on Acidification of Coastal Waters and Shipping Lanes," *Geophysical Research Letters* 38, no. 13 (2011): L13602, doi.org/10.1029/2011GL047720.

Ecological Change in the Oceans and the Role of Fisheries

Boris Worm
Department of Biology, Dalhousie University, Halifax, Nova Scotia, Canada

When I took a course with Elisabeth Mann Borgese in 1999, she reminded us that the oceans are constantly changing, both in their outer appearance, and their internal workings. Constant ecological change makes the ocean fascinating to observe and study, but challenging to understand and manage.

Long-term changes are brought about by geological processes such as sediment transport, volcanism, and plate tectonics that affect the very shape of ocean basins and the extent of habitat features such as shallow shelf seas conducive to biological productivity. On intermediate time scales, climate-driven changes in ocean temperature, circulation, and chemistry can have profound ecological effects on the abundance and distribution of marine life forms, and even caused massive extinction events in the past. Over the last few thousand years, however, people have gradually become a dominant agent of change in the oceans. Initially tied to the continents where we evolved, human hunters at least 42,000 years ago started to venture out into the ocean to pursue large fish.[1] Driven by changes in fishing technology, human population size, and global trade, this role has been extending to all ocean basins, and even parts of the deep sea. Over the last two decades, the profound ecological change brought about by human activities has also been studied in detail by the scientific community.

Although human impacts on ocean ecosystems involve many pathways, there is little doubt that fishing— defined here as any extraction of marine animals and plants—is the activity that historically has had the most transformative ecological effects.[2] Although it is not clear how much marine life has been removed over the entire history of fishing, recent total catches likely

1 S. O'Connor, R. Ono and C. Clarkson, "Pelagic Fishing at 42,000 Years Before the Present and the Maritime Skills of Modern Humans," *Science* 334, no. 6059 (2011): 1117–1121, doi.org/10.1126/science.1207703.

2 B. Worm and H.S. Lenihan, "Threats to Marine Ecosystems: Overfishing and Habitat Degradation," in *Marine Community Ecology and Conservation*, ed., M.D. Bertness (New York: Sinauer, 2013), 449–476.

exceed 100 million tonnes each year, when accounting for unreported landings and discards that are not captured by official statistics.[3]

This intense pressure has caused many species to become rare, or even extirpated at a local scale. For example, an estimated 96% of local extinctions in coastal ecosystems around the world involved fishing and hunting.[4] Another study of the factors that drive extinction risk today found that exploitation caused a majority of marine species losses (55 percent), followed by habitat loss (37 percent).[5] Clearly, by targeting certain species of commercial interest, we can eliminate these species from local ecosystems and regional seas, although very few cases of global marine extinctions have so far been documented.

Unfortunately, many fishing methods are unselective, such that a number of species are captured in addition to the intended target species. Bycatch is often thrown back dead at sea, and such total global discards may exceed 10 million tonnes per year.[6] Consequently, while contemporary fisheries are not usually targeting marine mammals, seabirds, and sea turtles, 20 to 38 percent of these species are threatened, many of them because they end up as bycatch in various fisheries.[7]

The depletion of both target and bycatch species can have a range of secondary effects, depending on how those species are connected in the local food web. Numerous studies have now quantified these ripple effects, such as the unregulated growth of certain prey species, or the decline of predators that were dependent on a fished forage species. Some of these so-called trophic cascades may have even changed plankton species composition at the bottom of the food web, although it is not yet clear how general these effects may be.

Another class of effects arises from the interaction of fishing with seafloor habitats and sedentary species, many of which are affected by bottom-touching trawls and dredges. Biogenic habitats formed by corals, sponges, and other fauna tend to be particularly vulnerable, and often take many years to recover after being impacted by fishing gear. Scientists are now trying to map the distribution of such sensitive habitats in order to protect them from repeated disturbance.

3 D. Pauly and D. Zeller, "Catch Reconstructions Reveal that Global Marine Fisheries Catches are Higher than Reported and Declining," *Nature Communications* 7 (2016): 10244, doi.org/10.1038/ncomms10244.

4 H.K. Lotze et al., "Depletion, Degradation, and Recovery Potential of Estuaries and Coastal Seas," *Science* 312, no. 5781 (2006): 1806–1809, doi.org/10.1126/science.1128035.

5 N.K. Dulvy, Y. Sadovy and J.D. Reynolds, "Extinction Vulnerability in Marine Populations," *Fish and Fisheries* 4, no. 1 (2003): p. 25–64, doi.org/10.1046/j.1467-2979.2003.00105.x.

6 Pauly and Zeller, *supra* note 3.

7 Worm and Lenihan, *supra* note 2.

When taken together, these various impacts can bring about lasting ecological changes. Heavily fished ecosystems tend to lack many of the larger, slow-growing predators such as sharks and groupers. The density of large predators is often reduced by an order of magnitude or more, and their prey species may dominate the ecosystem, if they are not fished in return. We often find a pattern of serial depletion from high-value to low-value species, called fishing-down (or fishing-through) food webs. In many coastal ecosystems today, the size spectrum is heavily skewed towards small species, harvestable fish and invertebrates have become scarce, and their local diversity is depressed. Shelf ecosystems are often heavily trawled and formerly abundant species have been compromised, with some under strict management to rebuild their depleted stocks. Open-ocean and deep-water ecosystems are exploited by globally operating distant-water fleets, which may lack the strong oversight now seen in some coastal waters. As a consequence, there are very serious concerns about unregulated overexploitation of pelagic fish such as tuna, billfish, and sharks, as well as poorly known deep water species of diverse taxonomic origin.

In summary, the long history of fishing has drastically changed the species composition, abundance, and diversity of most coastal and shelf ecosystems, with increasing global changes seen in open water and deep-sea habitats as well. Many of these changes are poorly understood due to the 'shifting baseline syndrome',[8] whereas data collection only began after many impacts had already taken place, and successive generations of people perceived the changed ocean of their youth as a 'natural' baseline. As populations decline, it is also difficult to distinguish the effects of fishing from those of other growing impacts such as pollution, coastal habitat transformation, and climate change. Looking forward, there is a concern that increasing industrialization of the ocean through energy projects, aquaculture, and urban expansion could accelerate the 'defaunation' process that began on land and is now well underway in many ocean ecosystems.[9]

A detailed assessment of ecological change in the oceans, and its consequences for human well-being, has detailed many of the unintended consequences, including compromised productivity, ecosystem stability, fishery yield, coastal protection, and water quality.[10] Harmful events such as toxic algal blooms, beach closures, and fishery collapses became more common

8 D. Pauly, "Anecdotes and the Shifting Baseline Syndrome of Fisheries," *Trends in Ecology & Evolution* 10, no. 10 (1995): 430, doi.org/10.1016/S0169-5347(00)89171-5.

9 D.J. McCauley et al., "Marine Defaunation: Animal Loss in the Global Ocean," *Science* 347, no. 6219 (2015): 1255641, doi.org/10.1126/science.1255641.

10 B. Worm et al., "Impacts of Biodiversity Loss on Ocean Ecosystem Services," *Science* 314, no. 5800 (2006): 787–790, doi.org/10.1126/science.1132294.

with the increasing depletion of species and degradation of ecosystems. Conversely, many of these changes were shown to be reversible when local areas were protected from fishing and direct impacts of human use. A subsequent study also showed that improved fisheries management can reverse many of the consequences of historic overfishing seen at larger scales.[11] These studies provide both a warning and a hopeful incentive to reverse some of the ecological changes brought about by a long history of overexploitation.

A key challenge in contemporary ocean management, however, is to find the right balance between using ocean ecosystems for human benefit, and protecting them from deleterious change (or reversing such change where it has occurred). This challenge is amplified by global climate change, which can profoundly affect ocean ecosystems. Well-enforced protected areas in a wide range of representative ecosystems can serve as a tool to hedge against management uncertainty, but also as a laboratory to isolate the effects of certain impacts, such as fishing, from other factors, such as climate change. Marine protected area coverage has been increasing steadily at a relative growth rate of approximately 8 percent per year since 1960, and now exceeds 4 percent of global ocean area.[12] Many of these areas are not well managed, staffed or funded, however, compromising their usefulness.[13] Moreover, the management of fisheries in the remaining 95 percent of global ocean area has only slowly been progressing towards sustainability, and business-as-usual scenarios still project continued depletion.[14] Improved management would bring about profound economic and ecological benefits, particularly in heavily exploited waters found, for example, across East Asia and Europe.[15] Unfortunately, only strong political will, global enforcement of existing rules, and elevated international coordination will make this happen.

Addressing the wider ecological impact of fishing requires careful scientific analysis and the construction of 'dose–response' functions that examine the trade-offs between various degrees of ocean use and their ecological impacts. A recent example concerns the fishing of small planktivorous 'forage' fish, which represent a critical food source for many seabirds, marine mammals,

11 B. Worm et al., "Rebuilding Global Fisheries," *Science* 325, no. 5940 (2009): 578–585, doi.org/10.1126/science.1173146.

12 B. Worm, "Marine Conservation: How to Heal an Ocean," *Nature* 543 (2017): 630–631, doi.org/10.1038/nature21895.

13 Id.

14 C. Costello et al., "Global Fishery Prospects under Contrasting Management Regimes," *Proceedings of the National Academy of Sciences of the United States of America* 113, no. 18 (2016): 5125–5129, doi.org/10.1073/pnas.1520420113.

15 Id.

and predatory fishes. Increasing demand for fishmeal from globally expanding aquaculture and livestock operations has put growing pressure on these fisheries. A comprehensive modeling study[16] quantified the benefits (forage fish yield) versus unintended impacts (mammals, birds, and fish species negatively affected) of these fisheries in a range of representative ecosystems (Figure 1), providing fisheries managers with a science-based decision-making tool. The study concluded that most negative impacts can be avoided by reducing exploitation rate by about 50 percent below the rate that would produce maximum sustainable yield (MSY). This management scenario still offers near-optimal yield (~ 80 percent of MSY) while greatly reducing associated ecosystem impacts.

Another recent paper came to similar conclusions with respect to the ecosystem effects of fishing invertebrates,[17] and a third report showed this more generally for the effects of fishing on the collapse of bycatch and weakly productive target species.[18] All three studies clearly indicate that traditional management targets of MSY produce large unintended consequences that can be mitigated by treating MSY as a limit, not a target. Substantially lower exploitation rates will initiate the rebuilding of fish biomass and size structure, help to recover collapsed stocks, and reverse some of the most deleterious ecosystem consequences. In the medium to long term, this will produce comparable fishery benefits, while minimizing ecosystem impacts, and reducing the cost of fishing, thus increasing the profit margin for fishers towards maximum economic yield (MEY). Therefore, reducing the exploitation rate below the level of MSY will greatly benefit fishers (greater profit and security), managers (sustainable long-term yield from a more stable and productive ecosystem), and species (fewer collapses and more robust populations). So far, very few regions may have reached this goal; however, one well-documented example concerns the California Current large marine ecosystem,[19] where previous overexploitation has been reduced to a level that is consistent with greatest conservation benefits.

In conclusion, while ecological change is the norm over the ocean's history, many of the changes seen in recent decades are brought about by the overuse of marine living resources, the unintended consequences of fishing, as well as other human impacts. Many of these impacts still appear to be reversible, and

16 A.D.M. Smith et al., "Impacts of Fishing Low-trophic Level Species on Marine Ecosystems," *Science* 333, no. 6046 (2011): 1147–1150, doi.org/10.1126/science.1209395.

17 T.D. Eddy et al., "Ecosystem Effects of Invertebrate Fisheries," *Fish and Fisheries* 18, no. 1 (2017): 40–53, doi.org/10.1111/faf.12165.

18 Worm, *supra* note 11.

19 Id.

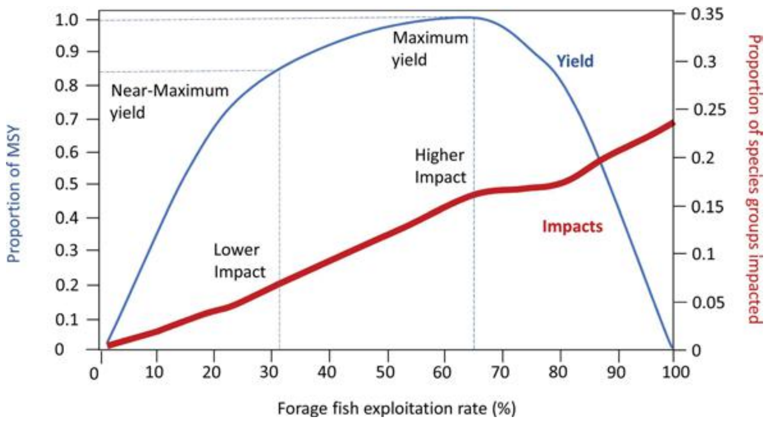

FIGURE 1 Modeling of trade-offs in fisheries management. The projected long-term fishery yield (thin line) is shown as a proportion of maximum sustainable yield (MSY) of targeted forage fish species. The ecological impact of taking that yield (thick line) is measured as the proportion of marine mammals, seabird, and fish species groups whose biomass varied by more than 40 percent as a result of forage fish depletion (after data in Smith et al., *supra* note 16). Environmental impacts of two different management strategies for maximum yield, and near-maximum yield are illustrated, respectively.

few global extinctions have occurred in the ocean. Both the knowledge base and the management innovations needed to constrain or reverse deleterious ecological change do exist, and are being used in a variety of regions around the world. It is my hope that fisheries management can transform itself and may increasingly contribute towards a sustainable, resilient, and carefully managed ocean ecosystem.

Caring for the Coasts

Paul V.R. Snelgrove
Departments of Ocean Sciences and Biology, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador, Canada

Anna Metaxas
Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada

Overview of Habitats

Coastal habitats at the land–sea interface span from hard substratum, rocky intertidal environments to sediment-covered estuaries, salt marshes, eelgrass beds, mangals (mangrove habitats), and sandflats and mudflats (Figure 1). Sedimented intertidal and subtidal nearshore habitats occur globally; sandflats and mudflats occur from the equator to the poles, in contrast to temperate latitude salt marshes and tropical mangroves. Seagrasses occur globally except at the poles. The accessibility of these habitats has enabled studies that generated important ecological paradigms, but the extremely harsh conditions of some of these environments limits transferability of knowledge to other habitats. Many species cannot tolerate energy from waves, potential aerial exposure, and fluctuating temperatures and salinities, resulting in low species diversity, but the availability of abundant sunlight, nutrients from land, and substrata all help support high abundances of tolerant species. Indeed, these habitats provide critical support for abundant juveniles of many commercial species, among others. The structural complexity afforded by seagrass beds, salt marshes, and mangals also pre-empts coastal erosion.[1]

Sandflats and mudflats are generally the least productive sedimented habitats. Nonetheless, their invertebrate fauna such as mud shrimp (amphipods) support migratory seabirds and other transient species. The plants that dominate eelgrass, salt marshes, and mangals produce organic matter and biogenic habitat that support high abundances of other species that utilize the plant detritus, associated grazers, and structural complexity to avoid predators. Microbial breakdown of organic material can exhaust oxygen, resulting in hypoxia (low oxygen) near the seafloor or just below the sediment surface, reducing species richness.

1 D.M. Alongi, *Coastal Ecosystem Processes* (Boca Raton, FL: CRC Press, 1998).

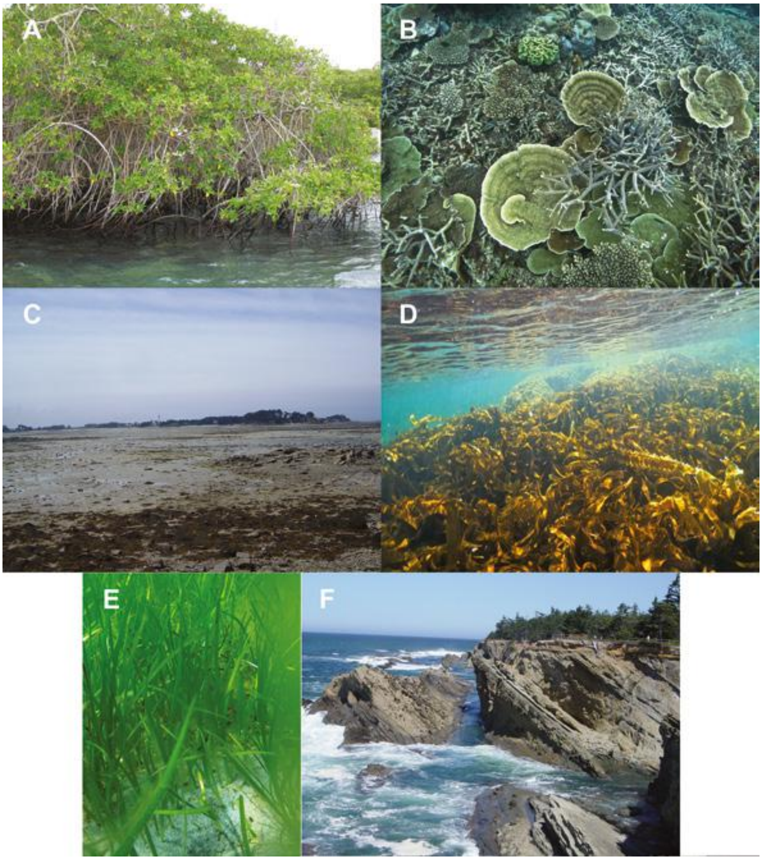

FIGURE 1 Coastal environments. (A) Mangals with mangroves and associated fauna, Galapagos Island, Ecuador; (B) Corals, Great Barrier Reef, Australia; (C) Mudflat, Roscoff, France; (D) Kelp bed, Nova Scotia, Canada; (E) Eelgrass, Newfoundland and Labrador, Canada; (F) Rocky intertidal, Oregon, United States.
PHOTO CREDITS: A, C, F (P. SNELGROVE); B, D (A. METAXAS); E (R. GREGORY).

Tropical and temperate reefs, the primary occupants of hard substrata in coastal habitats, extend from intertidal to subtidal depths, limited primarily by light penetration to the seafloor. As with some sedimented habitats described above, both types of reefs create biogenic habitats where dominant species (corals and seaweeds, respectively) 'engineer' physical structure that provide refugia from predation, augment food supply, and enhance abundance and biodiversity, among other functions.

Most tropical coral reefs occur in warm, shallow waters between the Tropics of Cancer and Capricorn, covering a total area of ~ 250,000 to 600,000 km^2. The main architects, scleractinian (stony) corals, generate calcium carbonate skeletons and build structurally complex colonies. Corals harbor algal symbionts (termed zooxanthellae) that provide the coral with organic carbon, allowing them to thrive in regions depleted in nutrients and otherwise low in primary productivity.

Most ecologists consider coral reefs to be the most biodiverse marine habitat. This diversity results from the many species associated with the reef, rather than the corals themselves (~ 1,000 species worldwide). Tropical reef species range from macroalgae to diverse invertebrates (e.g., annelids, molluscs, echinoderms) to fish, with thousands of morphospecies in single regions. Macroalgae use the physical structure for attachment and the rich nutrients generated through excretion for growth. Similarly, increased particulate concentration, and thus, food availability, attracts many small invertebrate species. Fish use coral reefs for feeding, spawning, nesting, mating, and sheltering.

Highly productive temperate reefs similarly have increased biomass and biodiversity relative to the surrounding habitats. On these reefs, dense stands of canopy-forming macroalgae (mostly brown, but also reds and greens) generate habitat structures sufficiently complex to support entire ecosystems. Kelp beds and forests, and rockweed beds, are the most common plant-dominated ecosystems on rocky substrata in temperate and polar oceans. Kelp beds cover > 25 percent of the world's coastlines and thrive in cold-water, nutrient-rich areas. Kelps live up to 25 years, depending on species, exhibit high rates of primary production, and provide important functions, thus attracting many species. Many herbivores, particularly gastropods (e.g., snails, abalone) and echinoids (sea urchins) aggregate in kelp beds because of the rich production, and many detritivores feed on degrading kelp material. Abundant secondary producers, in turn, attract predators (e.g., crabs, fish, mammals) to kelp beds. Many invertebrates (e.g., echinoids, asteroids) and fishes (e.g., rockfish) also use kelp bed shelter as nurseries. Kelp beds export large amounts of detritus to adjacent ecosystems, both onto beaches and into deeper, nutrient-limited subtidal environments. In regions with a narrow continental shelf, the reach can extend to bathyal submarine canyons at 200 to 2,000 meters.

Continental shelves include some of Earth's most productive habitats, fueled by nutrients from land and rivers, and upwelling from deeper waters. These habitats support most of the world's major fisheries. Reduced wave energy relative to the intertidal and shallow subtidal environments, coupled with sediments supplied by riverine input and coastal runoff, cover much of the continental shelf in sediment. Depending on wave energy, sediment supply, and history, mud or sand may dominate a location, each with different faunas. Suspension feeding organisms, such as surf clams, dominate higher energy sand environments, whereas deposit feeding organisms, such as sea cucumbers, dominate lower energy, mud-covered environments. Collectively, these environments recycle organic matter and regenerate nutrients critical to ocean production.

Knowledge Gaps

The complexity of coastal systems (e.g., population connectivity, dispersal potential, species interactions, biodiversity, and ecosystem functioning) leaves many knowledge gaps that limit our capacity for their sustainable use. Our current knowledge is biased towards larger organisms (e.g., fish) and commercial species relative to small invertebrates and microbes, and towards temperate environments in developed nations over those in tropical and polar environments and developing nations.

Overview of Pressures

Because of their proximity to human populations, coastal environments experience many human-induced pressures acting together, including pollution, loss of habitat, ocean warming, ocean acidification, sea level rise, invasive species, aquaculture, and increased fishing pressure.[2]

Increased coastal development has caused habitat loss in recent decades on the order of 1–10 percent per year. Physical disturbance, such as from dredging and bottom trawling, alters substrate and thus modifies habitat suitability or physically removes ecosystem engineers, such as seagrass and kelp beds. Increased sedimentation, whether from deforestation or increased riverine input, reduces light penetration, inhibiting plant and algal growth. Inorganic (e.g., metals) and organic pollutants (e.g., untreated waste, fertilizers, plastics) can affect marine organisms and their communities, lethally or sub-lethally, or cause eutrophication (excess nutrient supply) and anoxia.

Global change can impact coastal habitats profoundly. Faster warming of coastal waters than of the open ocean places key species at risk, causing

2 C.M. Duarte et al., "Paradigms in the Recovery of Estuarine and Coastal Ecosystems," *Estuaries and Coasts* 38, no. 5 (2015): 1202–1212.

'tropicalization' of temperate ecosystems in some regions. Coral death from bleaching, caused by symbiotic algae when a thermal threshold is exceeded over protracted periods, has reached alarming levels in most tropical oceans. Cold-adapted kelps are also vulnerable to warming waters, resulting in ongoing regime shifts to surf-dominated ecosystems, particularly in rapidly changing regions, such as the Northwest Atlantic. Temperate species that inhabit coastal areas are shifting towards polar regions, with profound ecosystem-level changes. Ocean acidification will further impact coastal ecosystems, reducing survival of species with calcareous shells or skeletons, such as economically valuable bivalves (e.g., oysters, clams, mussels) and reef-building corals. Lastly, sea level rise is expected to impact low lying coastal areas globally. Models predict average rises of 30 to 120 cm by the year 2100, although predicted rises increase annually with ongoing delays in implementing strategies to mitigate climate change. Sea level rise will affect regions of the world differently, with purported disappearance of some low-lying islands already (e.g., five reef islands in the Solomon Islands, Southwest Pacific).

Increased marine traffic globally has already accelerated the spread of invasive species. Proximity to ports, tourism operations, and aquaculture sites has impacted coastal habitats in particular. Non-native species typically lack predators and competition, grow fast, and are generalists in the invaded regions. In turn, they can outcompete native species, limit the abundance of their prey, and alter trophic interactions. Several systems illustrate significant ecosystem changes, such as the alteration of intertidal trophic interactions on the east coast of North America by introduced Chinese mitten crabs, and the effects of lionfish introductions on fish recruitment in Caribbean reefs.

Coastal mineral and oil extraction add further pressures. Removal of sand for beach replenishment or for minerals alters local seafloor biota, and dumping of waste material from mining can smother seafloor communities. Oil exploration adds noise and unknown impacts of seismic surveys, whereas drill cuttings can smother local seabed communities, in contrast to the more widespread and catastrophic effects of oil spills, particularly on seabirds, marine mammals, and intertidal environments.

Humans extract large quantities of living resources from coastal environments in various fisheries, from fish to invertebrates to macroalgae. Nations depending on these fisheries for jobs, revenue, and food, i.e., protein, have depleted many stocks. This intense fishing effort has also altered food webs and damaged bottom habitat. The removal of many top predators has necessitated switches to other, lower value fish species and extension of fishing effort into deeper water. Bottom contact fishing gear can damage biogenic habitats, homogenizing complex seafloor habitat and eliminating the species associated with those habitats.

The collapse of many fisheries has contributed to rapid expansion of marine aquaculture of many finfish and invertebrate species, as well as macrophytes such as kelp and commercial seaweeds. Most aquaculture occurs in nearshore habitats, sometimes increasing organic enrichment, spreading disease, and decreasing the genetic diversity of wild populations. Finfish aquaculture usually depends on fishmeal produced from wild fisheries, e.g., anchovies, a practice that further pressures natural populations.

Needs and Solutions

The dense, complex human activities in the coastal region require multiple approaches to achieve sustainable use, maintenance of ecosystem integrity, and, where possible, rehabilitation of degraded ecosystems. However, although some pressures can be addressed locally or regionally, others require coordinated global efforts.

Integrated ecosystem based management (IEBM) and marine spatial planning are integral components of a solution. The spatial proximity of and multiple connections between coastal ecosystems require holistic management of human use of coastal areas. IEBM recognizes complex interactions within and among ecosystems, rather than focusing on the ecology and pressures experienced by single species. Although slow to operationalize, the approach is gaining momentum with increasing recognition of the complexity of coastal environmental issues. Marine spatial planning (MSP) is one tool to support IEBM. MSP brings together multiple marine users and stakeholders and allows comprehensive evaluation of individual and cumulative pressures in a particular area, facilitating IEBM implementation.

Marine protected areas (MPAs) can protect relatively unaffected coastal ecosystems or facilitate recovery once stressors of impacted systems are removed.[3] Most coastal states that signed the Convention on Biological Diversity are now establishing MPAs to meet their commitment to protect at least 10 percent of their coastal and marine environments by the year 2020. Effective MPAs, zoned to include some no-take areas, are difficult to achieve in coastal regions because of the needs of multiple stakeholders. However, effective

3 J. Claudet, *Marine Protected Areas: A Multidisciplinary Approach* (Cambridge: Cambridge University Press, 2011).

networks of MPAs do exist, based on sound ecological principles and direct engagement of major stakeholders (e.g., along coastal California).

Ecological restoration can rehabilitate degraded coastal ecosystems, such as seagrass beds and oyster reefs. Some restoration efforts include mass seagrass planting to restore meadows, out-planting cultured oysters to create oyster reefs, and creation of artificial coral reefs to enhance recruitment to natural reefs. Though time-consuming and expensive, ecological restoration has met success in regions of the United States such as Virginia and Florida (seagrasses) and Chesapeake Bay (oysters). Effective restoration requires first removing the stressor that degraded the ecosystem. Additionally, success hinges upon ecosystem monitoring during restoration. Trade-offs between marine protection and restoration will determine the best approach for a particular location.

Many also view ecosystem based management as critical for enhanced fisheries management efforts, which also uses tools such as gear restrictions (and size selection), spatial and temporal closures, and bycatch limits. But many fisheries biologists emphasize a precautionary approach that identifies population reference points for each species, below which significant declines in numbers will occur. In parallel, aquaculture is working to develop plant-based feeds and better containment practices.

Conclusion

Intense human interaction with the coastal ocean has depleted coastal habitats more severely than other marine regions. Our dependence on fisheries, aquaculture, and other coastal resources demands more sustainable efforts, particularly given expected increases in human populations and their need for protein and other marine resources. Improvements in scientific tools (sensors, genetics, models, digital imaging, etc.) offer substantial opportunities for addressing how we manage ocean use. However, political will and societal support will ultimately determine whether we can reverse coastal degradation and sustain these critically important habitats.

Caring for the Deep Sea

Anna Metaxas
Department of Oceanography, Dalhousie University,
Halifax, Nova Scotia, Canada

Paul Snelgrove
Departments of Ocean Sciences and Biology, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador, Canada

Overview of Habitats

The deep sea is one of the most remote and expansive habitats on Earth, spanning depths of 200 m to beyond 10,000 m in the deepest trenches. The oceanic seafloor forms through a combination of seafloor spreading at mid-ocean ridges (MOR) and sedimentation of materials from the sea surface over millions of years, as ocean plates move from their origin at MOR to subduction zones. The generally uniform temperature and salinity, and absence of light, define an environment far less variable than in most shallow-water environments.[1]

The area of sediment-covered seafloor comprises more habitat than all others on Earth combined. Near the continental shelf, sediments often contain terrigenous material transported by rivers and coastal currents, whereas sediments in the abyssal plains (sometimes more than one kilometer thick) are derived from the shells of open-water organisms. The composition of sediments defines the fauna living on and within them. Because of the absence of light, most deep-sea organisms depend on sinking food material produced in surface waters (phytodetritus), fecal pellets, fish or zooplankton carcasses, or material transported laterally (pieces of kelp and land-based organic material such as wood).

Exposed hard substratum occurs mainly in areas with relatively steep profiles, such as the walls of submarine canyons and the flanks of seamounts, as well as on newly produced seafloor near spreading centers. Strong currents typically characterize steep sloping environments, limiting accumulation of sediments, and exposing hard substratum.

Submarine canyons incise the continental slope and can range over 1,000 m in depth. Because of their topography, canyons can act as conduits of sediment,

1 E. Ramirez-Llodra et al., "Deep, Diverse and Definitely Different: Unique Attributes of the World's Largest Ecosystem," *Biogeosciences* 7 (2010): 2851–2899.

DOI:10.1163/9789004380271_041

phytodetritus, and other food falls, and influence the direction and velocity of ocean currents. Seamounts are underwater mountains, mostly volcanic in origin, that rise at least 1,000 m above the seafloor but do not break the sea surface. The exact number of seamounts is unknown, but they supply a large proportion of the hard substratum in the deep sea. Seamounts provide mosaics of different habitats of varying slope, depth, elevation, coarseness of substratum and hydrothermal activity, and their shape and elevation affect ocean circulation.

Areas at MOR are tectonically, and in some cases volcanically, very active. Slabs of basalt or chimney-like structures of sulphides comprise the newly created seafloor, where hydrothermal vents occur, expelling hot, chemically-altered seawater either through focused flows on chimneys or diffuse flows through cracks in the basalt. The hydrothermal fluid is enriched in toxic metals and hydrogen sulphide and devoid of oxygen, with temperatures that can reach 20–40°C in diffuse flows and > 400°C in the fluid emanating from black smokers.

Overview of Biological Communities

The soft-sediment communities that dominate the deep sea include species that remove particles from suspension and others that ingest sediment grains and associated food (Figure 1). Small worms, crustaceans, molluscs, and other invertebrates dominate these sediments; the limited and often poor quality of food limits the sizes and numbers of individuals that these environments can support. Fishes living near the seafloor feed on these organisms, but the cold temperatures and limited food result in reduced metabolic rates and organisms grow slowly, produce low numbers of offspring, and reproduce at a late age. Reduced numbers and size do not mean reduced diversity, however, and we now recognize the deep sea as among the most species-rich environments on Earth. These sedimentary organisms recycle carbon, nitrogen, and phosphate, the basic building blocks of life on Earth. Despite generally low process rates in the deep sea, these organisms play a vital role in the delivery of global ecosystem functions (that support life on Earth) and services (benefits derived by humans) because they cover such vast areas.

Species that occur on hard substratum need a firm surface on which to affix, typically suspension feeding and thus requiring currents that deliver a supply of food particles (Figure 1). The most common megafaunal invertebrate species include sponges, deep-water hard and soft corals, sea pens, anemones, bryozoans, and bivalves, whose sessile adult stages occupy canyon walls and

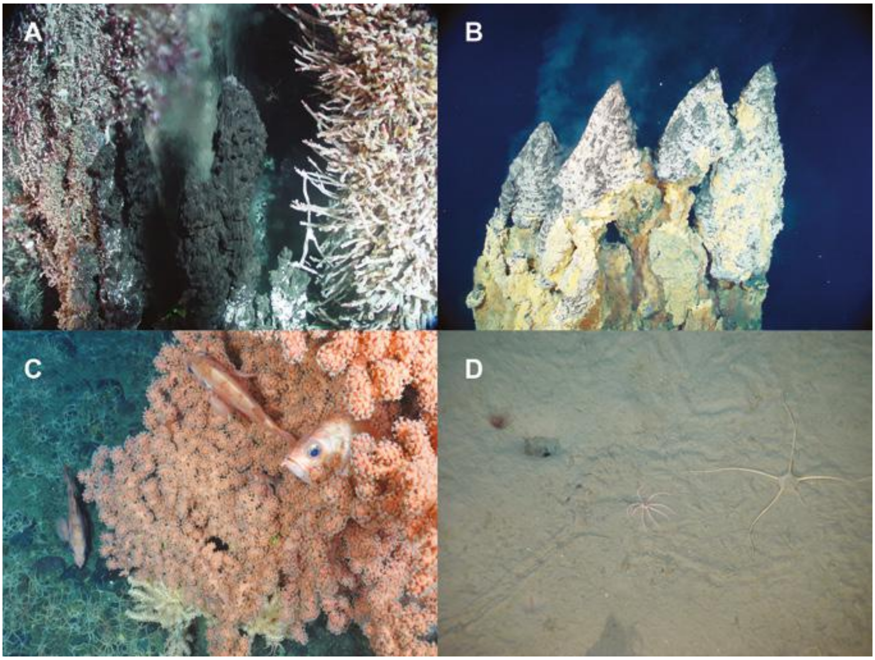

FIGURE 1 Deep-sea hard (A–C) and soft (D) substratum environments. (A) Hydrothermal vent tubeworms, Endeavour, Northeast Pacific; (B) Corals and fishes, East Diamante Volcano, Western Pacific; C) Deep-water coral and redfish, Northeast Channel canyon, Nova Scotia, Canada; (D) Muddy continental slope, Nova Scotia, Canada.
PHOTO CREDITS: A. METAXAS/ROPOS.

seamounts. These phyla can reach locally high abundances with favorable conditions such as adequate food supply. For example, increased local primary productivity can occur near the summit of seamounts. As a result, seamounts support large concentrations of reef-forming stony corals and gorgonian and soft corals, as well as dense aggregations of fish such as redfish, grenadiers, tuna, and sharks.

The communities at hydrothermal vents are highly specialized to the unique environmental conditions, with polychaetes, bivalves, gastropods, decapods, and fish dominating the biomass. Biodiversity in these habitats is lower than the surrounding deep sea, with mostly endemic species. Primary production by microbes that utilize the hydrothermal fluid drives these ecosystems and accumulates much higher biomass than in the surrounding deep sea. Most metazoan secondary producers harbor these microbes as obligate or facultative symbionts that supply them with a reliable source of carbon.

Knowledge Gaps

Less than 0.0001 percent of the area of the deep sea has been investigated, and not all habitats at the same rate. Hundreds of thousands (possibly millions) of species remain unknown and most will never be known. We lack fundamental knowledge on the structure and function of populations, communities, and ecosystems and the processes that regulate them. Certain benthic ecosystems are particularly data poor, such as in the abyssal plains and trenches. The remoteness and harshness (e.g., crushing pressures, no light) of the habitats make experimentation on rates of these processes challenging. One habitat that remains particularly elusive is the deep water-column, in the benthopelagic (1,000–4,000 m) and abyssopelagic (> 4,000 m) zones, where a virtually unknown fauna of deep-sea fishes, gelatinous zooplankton, and pelagic molluscs dominate.[2]

Overview of Human Pressures

Climate change is expected to have significant impact in the deep sea. The composition and abundance of the dominant primary producers, secondary consumers, and associated trophic links in surface waters will change throughout the world's ocean, and, most importantly for the deep sea, in the large gyres overlying the abyssal plains. These changes, in turn, will affect the export of surface production to the deep sea, where it constitutes the main source of energy. The total available energy to the deep sea is expected to decrease, and changes in food quality may lead to taxonomic shifts in the dominant players, and possible associated changes in ecosystem function. The warmer, more acidic waters associated with global change are already moving into the deep ocean. For organisms with shells or calcium carbonate skeletons, such as deep-water corals, significant impacts are expected, with cascading effects on other fauna that feed on these organisms or depend on them for habitat. In some parts of the ocean, reduced abundances and reduced biological diversity already occur in oxygen depleted areas known as oxygen minimum zones. Climate change and nutrient loading are increasing the spatial extent and frequency of such zones.[3]

2 R. Danovaro, P.V.R. Snelgrove, and P. Tyler, "Challenging the Paradigms of Deep-sea Ecology," *Trends in Ecology and Evolution* 29, no. 8 (2014): 465–475.

3 E. Ramirez-Llodra et al., "Man and the Last Great Wilderness: Human Impact on the Deep Sea," *PLoS One* 6, no. 8 (2011): e22588, doi.org/10.1371/journal.pone.0022588.

The collapse of many coastal fisheries has pushed fishing pressure into deeper waters over the last 50 years. Arguably, no deep-sea fishery is sustainable because recovery of populations is very slow. Some deep-sea fisheries target specialized habitats, such as seamounts and canyons, focusing pressure and causing serial depletion. Because many of these fisheries occur in international waters, known as areas beyond national jurisdiction (ABNJ), they are poorly managed and monitored, if at all, leaving behind depleted habitats often badly damaged by bottom-contact fishing gear.

Oil and gas activities occur on all continental margins, except Antarctica, and continue to expand. The effects of these activities can be localized to a few hundreds of meters during equipment installation and up to kilometers during discharge of drilling muds and other water-based toxic or smothering discharges. Unpredictable effects can occur over tens of kilometers and throughout the water column during accidental oil blowouts, as with the Deep Water Horizon in the Gulf of Mexico in 2010. The impacts can range from the destruction of long-lived, slow growing, vulnerable marine ecosystems, to changes in ecosystem functions. The effects may persist over years to decades or longer, depending on the magnitude and frequency of the activities or accidents.

Deep-sea mining has been gaining momentum both within exclusive economic zones (EEZs) and in the Area where the International Seabed Authority (ISA) has already granted contracts for mining exploitation in the Clarion-Clipperton Zone in the Pacific Ocean, the Mid-Atlantic Ridge, and the Southwest Indian Ridge. The targeted resources are manganese nodules in the abyssal plains, massive seafloor sulphide deposits on hydrothermal vents, and cobalt crusts on seamounts for valuable metals such as nickel, copper, cobalt, gold, and silver. Mining activities destroy bottom habitat during the physical removal of nodules, sulphides, and crusts, and generate smothering plumes during physical removal and disposal of discharges from the support ship. Recovery of the sediment ecosystems in the abyssal plains is expected to take decades to centuries, and millennia for individual nodules. Ecosystems at hydrothermal vents are not uniformly resilient to disturbance and recovery may take from a few years to decades or centuries. Mining of cobalt crusts will affect vulnerable marine ecosystems that abound on seamounts that can be several centuries old, and require several decades to centuries to recover.

Needs and Solutions

Many of the pressures in the deep sea require global solutions, such as the reduction in carbon dioxide emissions, and a deep-sea specific strategy to mitigate their impacts is not feasible. However, some pressures can be alleviated by sustainable practices. While it is almost impossible to predict with any accuracy the overall impact of anthropogenic activities on deep-sea habitats, the precautionary principle can guide our efforts as we continue to collect more information.

The deep sea exemplifies the 'tragedy of the commons'; the lack of clear 'ownership' of resources creates a challenge for effective management, particularly in ABNJ. Increasing recognition of the problem has led to some international efforts to reduce pressures in particularly sensitive areas, such as those with abundant deep-water corals; however, these efforts are complicated by challenges of appropriate legal tools, adequate enforcement, and international compliance.

Clearer and stricter guidelines can be used to control the activities of extractive industries, such as oil and gas and deep-sea mining. While oil and gas activities generally fall within national jurisdictions, international agreements are needed for the regulation of mining in the Area. The mandate and responsibility for safeguarding ecosystems from serious harm in the Area falls within the ISA. Given the increasing momentum, and the already awarded contracts, the ISA needs to accelerate the development of regional strategic management plans and regulations that protect the marine environment from serious harm.

One spatial tool that we have available is an effective network of marine protected areas (MPAs). Many states are designing such networks to protect representative ecosystems and enhance the overall resilience of the deep sea to disturbance. In British Columbia, Canada, an offshore MPA is being considered that will include all known hydrothermal vents and many seamounts in the EEZ. In the United States, national marine monuments were established to protect submarine canyons and seamounts off New England. International efforts by scientists, contractors, and the ISA are attempting to design networks of areas protected from the influence of any mining activities, following the same elements as those for MPAs.

Conclusion

The vastness of the deep sea can lull us into thinking that it is inexhaustible. However, evidence of human impacts is now seen in every deep-sea environment that has been explored, even in the deepest trenches, spanning from contaminants to trawl scars to garbage. Because the deep sea is one of the most pristine remaining habitats on Earth, we must develop effective strategies to preserve its rich biodiversity and ecosystem functions and services. We have the opportunity to collect baseline information prior to development, so that we know what 'normal', 'unimpacted', or 'healthy' actually mean. However, just as rapid advancements in science technology offer hope, parallel advances in fishing and oil/mineral development are accelerating pressures and increasing the urgency to address the problem. "Caring for the deep sea" will require regional and international cooperation, compromise and creativity. We cannot afford to wait; we must act now to protect this unique and irreplaceable part of the ocean commons.

The Role of Citizen Science in Ocean Governance

John A. Cigliano
Department of Biological Sciences, Cedar Crest College, Allentown, Pennsylvania, and Schoodic Institute at Acadia National Park, Winter Harbor, Maine, United States

What Is Old Is New

Over 40 years ago, Professor Elisabeth Mann Borgese recognized the need for effective governance of the oceans for the good of all of humanity. This need still exists, maybe even more so now, in addressing issues such as climate change, ocean acidification, overfishing, and floating islands of trash (to name just a few). But what can we do to advance effective and lasting governance of the ocean? Are there new techniques, policies, or international agreements that we can employ? Actually, I would argue that something as old as recorded history is one of our better hopes, namely, citizen science.

Citizen science is public participation in scientific research, i.e., science conducted by amateurs. Prior to the late nineteenth century, almost all of science was conducted by amateurs (today, we would call them citizen scientists). Quite a few of these so-called amateurs have had a profound effect on science: Aristotle, Copernicus, and Darwin, to name a few. Darwin is of particular note, not only because of his theory of evolution by natural selection, but because as he was developing and working to experimentally support his theory, he collaborated with other citizen scientists from around the world who sent him observations and specimens, thus, making Darwin an early adopter of 'crowdsourcing'[1] citizen science.

By the beginning of the twentieth century, amateur scientists became marginalized as the number of professional scientists increased and gained positions of authority.[2] Fortunately, citizen science did not go extinct. Citizen science projects continued with professional scientists leading and citizen scientists contributing. Examples include Wells Cooke's collaboration with citizen scientists (he referred to them as co-operative observers) on bird

1 Crowdsourcing is the process of obtaining data by soliciting contributions from a large, undefined network of people.

2 J. Vetter, "Introduction: Lay Participation in the History of Scientific Observations," *Science in Context* 24, no. 2 (2011): 129.

doi:10.1163/9789004380271_042

migration from 1881 to his death in 1916.[3] But there were still examples of the 'old' citizen science. For ocean science and governance, the most notable example is Jacques Cousteau. No one can deny the influence Cousteau had (and still has) on marine biology, conservation, public awareness, and stewardship.

Today, citizen science is not just surviving, it is thriving,[4] though the use of marine and coastal citizen science for conservation has lagged behind its use in freshwater and terrestrial systems.[5] But it is growing. And it has made a difference.

Citizen Science and Ocean Governance

To develop effective ocean governance, it is critical to increase our understanding of the effects of stressors on marine species and ecosystems. No stressor will likely have as much of an impact on our ocean as climate change, in both magnitude and scope. Citizen scientists are helping to increase our understanding on how coastal ecosystems are being affected and are helping to develop mitigation strategies. For example, the Coastal Observation and Seabird Survey Team (COASST) collects information on beached seabirds in the US Pacific Northwest, which has helped to understand the mechanism(s) of elevated mortality and/or beaching caused by climate forcing.[6] In the Gazi Bay Project, local stakeholders in Kenya, in collaboration with professional scientists, conduct long-term and large-scale experiments on mangrove restoration, which has led to the planting and monitoring of over 20,000 trees and the development of the first community-led blue carbon project.[7]

However, to really have a significant effect on ocean governance, citizen science must influence policy and management. Townhill and Hyder argue that one of the greatest promises of marine and coastal citizen science is in the

3 T.S. Palmer, "In Memoriam: Wells Woodbridge Cooke. Born Jan. 25, 1858–Died March 30, 1916," *The Auk* 34, no. 2 (1917): 119–132.

4 J.A. Cigliano and H.L. Ballard, "The Promise of and the Need for Coastal and Marine Citizen Science," in *Citizen Science for Coastal and Marine Conservation*, eds., J.A. Cigliano and H.L. Ballard (New York: Routledge, 2017), 3–15 at 4.

5 J.A. Cigliano et al., "Making Marine and Coastal Citizen Science Matter," *Ocean & Coastal Management* 115 (2015): 77–87, doi.org/10.1016/j.ocecoaman.2015.06.012.

6 J.K. Parrish et al., "Defining the Baseline and Tracking Change in Seabird Populations: The Coastal Observation and Seabird Survey Team (COASST)," in Cigliano and Ballard, *supra* note 4, 19–38.

7 J.A. Cousins, M. Huxham and D. Winton, "Using Citizen Science to Address Conservation Issues Related to Climate Change and Coastal Systems," in Cigliano and Ballard, id., 19–39 at 19–33.

support of policy, legislation, and management because the issues that need to be addressed are at large spatial and temporal scales.[8] One of the advantages of citizen science is the ability to collect large amounts of data in time and space. The Wetland Bird Survey (WeBS) Project in the United Kingdom is an example of how citizen science has influenced policy. Citizen scientists monitor waterbirds, and the information collected has been used to designate protected areas and to inform environmental impact assessments.[9] Citizen science also informs the management of marine protected areas (MPAs) in California, United States. California adopted a two-phased approach to monitoring: regional baseline monitoring and statewide long-term monitoring. Citizen scientists from multiple organizations play a significant role in conducting baseline surveys throughout the state. Data from the monitoring programs are used to determine management effectiveness of the MPAs.[10]

Ultimately, our best hope for effective *and long-lasting* ocean governance is through building capacity for stewardship in local communities, and through public awareness and education to encourage local and global governance. Citizen science has been effective in both. An example of effective capacity-building is the One People One Reef (*Hofagie Laamle*) project, located in the Federated States of Micronesia. The project was initiated by the local community of Falalop Island of Ulithi Atoll because of concerns about declining fisheries and reef degradation. It has now expanded to communities on all of the inhabited islands of the atoll. Professional scientists, who were invited to participate by local community leaders, and local citizen scientists work together to collect ecological and fisheries data. This project is a true collaboration: the local citizen scientists share their knowledge of their reefs, which has framed the research program, and the professional scientists train local scientists on how to collect data, share the data from the research, and interpret the data *with* community leaders. The information gained from the research has informed management plans, which were developed and implemented by the local communities. An unexpected and welcomed consequence of the project

8 B.L. Townhill and K. Hyder, "Citizen Science and Marine Policy," in Cigliano and Ballard, id., 178–193 at 178–179.

9 "The Wetland Bird Survey (WeBS)," British Trust for Ornithology, http://www.bto.org/volunteer-surveys/webs.

10 R. Meyer, E. Meyer, L. Sievanen and A. Freitag, "Using Citizen Science to Inform Ocean and Coastal Resource Management," in Cigliano and Ballard, *supra* note 4, 132–152 at 136–147.

was a renewed interest in traditional practices and cultural history related to fishing and management.[11]

Many conservation-related citizen science projects have educational component and public awareness goals. Often the focus is on school children, such as the Long-term Monitoring Program and Experiential Training for Students (LiMPETS) program that engages schoolchildren in sandy beach and intertidal monitoring in California. The goals of this program are to increase ocean and science literacy in schoolchildren, to develop a long-term dataset that can be used by researchers and resource managers (LiMPETS conducts baseline surveys as part of the management plan for California MPAs, see above), and to encourage students to become environmental leaders and stewards. LiMPETS accomplishes this by engaging local schoolchildren and their teachers fully in the scientific process, from data collection to analysis and presentation.[12]

There are also quite a few programs that are using technology to raise awareness and to educate on a regional or global scale. Redmap (Range Extension Database and Mapping Project) focuses on Australia.[13] The project has two main goals: (1) ecological monitoring to provide an early indication of potential species range shifts along the coasts of Australia by collaborating with citizen scientists who report observations of marine species that are uncommon to a particular location, and (2) actively engaging the marine and broader community in a constructive dialogue on marine climate change. The Redmap team does this virtually (through the website and webinars) and in person; it regularly makes presentations and holds question and answer sessions at various venues around Australia (e.g., boat shows, fishing competitions, dive clubs, schools, and marine community festivals). As of 2016, Redmap's website had almost one million visitors, was featured in over 245 media reports, and received five major awards for community engagement and scientific excellence.[14]

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11 N.L. Crane et al., "Collaborating with Indigenous Citizen Scientists Towards Sustainable Coral Reef Management in a Changing World: The *One People One Reef* Program," in Cigliano and Ballard, id., 197–216.

12 A. Wasser, "Engaging Youth and Schools in Coastal Citizen Science: Balancing both Education and Science Goals," in Cigliano and Ballard, id., 218–236.

13 For an example of a global program, see Marine Debris Tracker, http://www.marinedebris.engr.uga.edu.

14 E.J. Hind-Ozan, G.T. Pecl and C.A. Ward-Paige, "Communication and Trust-building with the Broader Public through Marine and Coastal Citizen Science," in Cigliano and Ballard, *supra* note 4, 261–278 at 264–268.

The Need for and Potential of Citizen Science for Effective and Lasting Ocean Governance

Professor Mann Borgese was obviously correct about the need for effective and lasting ocean governance. Citizen science can help bring this about. But while there have been significant advances in the use of citizen science to support ocean governance, it has not reached its full potential. So now, what can we do to ensure that citizen science does reach its full potential? Here are a few recommendations.

1. *Purposely engage key stakeholders* such as beachgoers, recreational and commercial fishers, divers and snorkelers, surfers, and boaters. These are people who have an interest or stake in the health of marine and coastal systems and who are passionate about, connected to, or feel responsibility for the oceans and coast near and far from their own homes. Engaging these stakeholders helps to ensure that information from citizen science projects will be acted upon, by the stakeholders becoming better stewards themselves and possibly by becoming leaders in efforts to change policy. And when communities are engaged, there is potential for relatively quick and broad advances in governance.[15]
2. *Increase public awareness* through education and public outreach. Engaging young school children could be especially fruitful. The oft-used phrase that 'our children are our future' is true. Engaging communities directly in citizen science projects or in public awareness activities that are based on the project can be very effective in raising awareness, and I would argue, should be part of every citizen science project. A particularly promising way to *virtually* engage and educate large numbers of citizen scientists over large areas is through the use of smartphone technology. There have been significant advances over the last several years in using smartphones to take and upload photos, and in the development and use of smartphone apps. Many projects that engage citizen scientists in this way have associated websites and social media platforms to build community and to educate and raise awareness.[16] Projects that directly engage citizen scientists also use websites and social media to build community and raise awareness.[17]
3. *Engage policy-makers and managers* in projects as citizen scientists. Co-creating projects or collaborating with policy-makers and managers

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15 *Supra* note 11.

16 Some additional examples include flukebook (flukebook.org) and Secchi Disk (www.secchidisk.org).

17 For example, Earthwatch.org, REEF.org, and Reefcheck.org.

> can be especially effective for advancing ocean governance.[18] After all, these are the people who will make and enact governance policy. Engaging with them will not only allow them to see the issues that are affecting the ocean up close, but it will also build trust between them and professional scientists. And it could increase the likelihood that they will use the findings of citizen science projects to inform policy and management (e.g., overcoming the doubt about data quality).[19]

Citizen science has and still can contribute significantly to effective and lasting ocean governance. Of course, it alone cannot fulfill Professor Mann Borgese's hope for an ocean that is effectively governed for all of us. But it can, and should, be a major part of our efforts to fulfill her hope.

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18 *Supra* note 5.

19 *Supra* note 5.

PART 5

Integrated Coastal and Ocean Management

Co-management, of course, is not a panacea. Its applicability is limited. Its take-off point is rather high on the scale of social development. It presupposes the existence of infrastructure — cooperatives, village councils, organized user groups, etc. Poor coastal villages in poor countries do not have this sort of infrastructure, and the task of making them active partners in integrated coastal management is daunting. And yet if integrated coastal management does not include them, integrated coastal management is neither integrated nor sustainable. The upgrading of livelihoods in poor coastal villages is also essential if migration of the poorest people to the shanty towns of coastal megacities is to be halted and further urban sprawl, entailing further degradation of the coastal environment and exposing swelling masses of poor to the hazards of natural or anthropogenic catastrophes, are to be prevented. Ways must be found to include the inhabitants both of poor villages and coastal megacities in integrated coastal management.

Elisabeth Mann Borgese*

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* *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 137–138.

Introduction

Editor: Scott Coffen-Smout

Elisabeth Mann Borgese was visionary on institutional requirements for integrated coastal and ocean management (ICOM), particularly for the governance design of mega-cities that occur primarily in coastal areas. In thinking about the social development aspects of ICOM, Professor Mann Borgese advocated that environmentalism and human rights were key elements in future ICOM arrangements and strongly believed that capacity building was essential for its success. Furthermore, she viewed ICOM on a broad geographic scale as

> including the EEZ on the seaward side and the watershed on the landward side. It necessarily includes the management of rivers that may originate in land-locked countries. It will therefore become necessary to include land-locked countries of the hinterland.[1]

Big ideas were Elisabeth's forte, as well as her lifelong work and passion. She believed that good ocean management

> must enhance efficiency in the economic system, safeguard the integrity of the ecosystem, and promote equity, both intragenerational and intergenerational. That is the very essence of the new paradigm.[2]

With that expansive framing for this part on ICOM, the informative and thought-provoking essays cover aspects of questioning and rethinking ICOM assumptions, outlining the theory and practice of coastal and marine spatial planning, the use of geospatial data infrastructures for ocean governance, and marine protected areas for conservation planning. Additional coastal and ocean management themes include the application of ecological economics, sustainable tourism considerations, protecting marine species at risk, the mitigation and regulation of ocean noise, the use of information and knowledge at the science–policy interface for ICOM, and addressing climate change impacts on the world's oceans and coasts.

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1 E. Mann Borgese, *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 147–148.

2 E. Mann Borgese, *Ocean Governance and the United Nations* (Halifax: Centre for Foreign Policy Studies, Dalhousie University, 1995), 111.

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The Promise of Integrated Coastal and Ocean Management: Questioning the Past, Rethinking the Future

Lucia M. Fanning
Marine Affairs Program, Dalhousie University, Halifax, Nova Scotia, Canada

Introduction

There is general agreement that the 1992 United Nations Conference on Environment and Development held in Rio de Janeiro provided global recognition and acknowledgement of the dismal failure of sectoral management in understanding, anticipating, and responding to consequences arising from our interactions with other biotic and abiotic components of coastal and marine ecosystems. The conference is credited with also providing a globally accepted alternative approach to marine and coastal area management and development as outlined in Chapter 17 of Agenda 21.[1] One that spans not only multiple jurisdictional levels but requires the co-ordination of sectoral activities and influences across the land-sea-air interface. With over 178 heads of state signing the final text of the agreement at the Rio Conference, the stage was set to adopt and implement integrated coastal and ocean management (ICOM).

In her 1995 reflection on progress regarding the implementation of Agenda 21 and the integrated approach for managing coastal and ocean activities, Elisabeth Mann Borgese cautioned that we needed to take a long-term view and not be frustrated by the apparent lack of political will and means available for implementation that she was observing some three years after the Rio Earth Summit.[2] She had reason for such optimism as within a few years, scholars and practitioners alike from across the globe were documenting the exponential growth in projects and programs focusing on developing and implementing ICOM.[3]

1 United Nations Conference on Environment and Development, UN Doc. A/Conf.151/26 (Vol. II), 13 August 1992.

2 E. Mann Borgese, "Commentary: Earth Summit Implementation: Progress Achieved on Oceans and Coasts," *Ocean & Coastal Management* 29, no. 1–3 (1995): 13–21.

3 B. Cicin-Sain and R.W. Knecht, *Integrated Coastal and Ocean Management: Concepts and Practices* (Washington, DC: Island Press, 1998), 517; A. Vallega, *Fundamentals of Integrated Coastal Zone Management* (Dordrecht: Kluwer, 1999), 267; J. Sorensen, "Baseline 2000

In this essay, my intent is not to detail how one goes about implementing the ICOM approach or to evaluate the myriad of reported successes and failures that have been communicated by ICOM scholars, practitioners, and critics over the past twenty-five years. I will instead focus on two areas more worthy of reflection, which I hope Elisabeth Mann Borgese would have found interesting and provoking. Drawing on the work of biodiversity researcher Raphaël Billé, the first focuses on observing past practices and the apparent unchallenged acceptance of assumptions that have obtained an aura of dogma for many who teach and work in this field. The second area raises concern over our naïveté surrounding the resolution of current and future issues confronting coastal and marine socio-ecological systems at a time of unprecedented and dynamic global change.

Questioning the Past

Having taught a graduate-level course on ICOM to master's students in marine management for over a decade, I have found that many of them unquestioningly accept the theories and underlying assumptions that they have been exposed to in the abundance of readings, lectures, and seminars attended since starting graduate school. To counter this perceived intellectual apathy, the first reading assigned to them in my class is Billé's 2008 paper challenging the 'entrenched illusions' associated with integrated coastal management.[4] The resulting class discussions always fulfill my intended effect, with one student this year stating how angry she was after reading the paper as it meant that many of the supporting arguments used in her thesis required a rethinking! Using examples drawn primarily from a European context, Billé sets out to question the validity of key assumptions underpinning the progress associated with ICOM since Agenda 21.

The first of these illusions centers on the notion that managing problems in the coastal zone can be achieved through co-ordination, using processes of stakeholder consultation, and consensus building. If this is indeed so, Billé asks, "Does presenting environmental management as a pure problem of co-ordination tacitly imply the existence of one general interest, with objectives

Background Report: The Status of Integrated Coastal Management as an International Practice (Second Iteration)," Urban Harbors Institute Publications Paper 31 (Boston: University of Massachusetts Boston, 2002).

4 R. Billé, "Integrated Coastal Zone Management: Four Entrenched Illusions," *Surveys and Perspectives Integrating Environment & Society* 1, no. 2 (2008), http://sapiens.revues.org/198.

common to society as a whole?"[5] Clearly this is not the case, and the limitations imposed by consensus in addressing the multiple values and interests in coastal and marine social systems become evident. Situations in which there is an absence of conflict or unequal power relationships among the diversity of stakeholders are relatively rare in ICOM.

The second illusion centers on the notion of coastal management being led by a single coastal manager, be it an individual or organization. While individual coastal projects may have identifiable project managers under a particular agency, the approach leading to successful integrated management of socio-ecological systems clearly is not under the control of a single coastal manager or unit. Billé suggests that possible explanations for this continued illusion is the perception of control it allows and the convenient veiling of the reality of power struggles and conflict in the coastal zone.

The third illusion focuses on the notion of a community as coherent, egalitarian, and consensual, thereby advancing calls for a community-based response to managing coastal and marine socio-ecological systems. Additional characteristics associated with the illusion are that there is community leadership and a defined territory to be managed by the 'community'. Despite evidence to the contrary, Billé suggests an explanation for the longevity of the illusion may be found in the synonymous use of the terms 'community' and 'local' and the not necessarily valid assumption that community-based management includes public participation and inclusion of local needs and knowledge in management decision making.

The final illusion relates to the belief that more knowledge leads to better decisions, what Billé identifies as the 'positivist illusion'. While numerous examples from across the globe invalidate this assumption, efforts aimed at ICOM still focus heavily on filling knowledge gaps. Paradoxically, while scientists generally address their understanding of uncertainty associated with socio-ecological systems with the call for more research, they are also among the first to (correctly) note that we can never acquire all the knowledge needed to make fully informed decisions. While not disputing the need to be better informed, ICOM requires interventions in the form of actions, using the best available knowledge. As quoted from R.E. Johannes and cited by Billé, "the key question … is no longer what data is needed to make the right decision, but rather what are the best decisions that can be made given the (incomplete and controversial) knowledge on hand."[6] This is the precautionary principle as applied to ICOM.

5 Id., at 2.
6 Id., at 9.

Rethinking the Future

> [I]n a world in which uncertainty is the name of the game, the only thing that is certain is that this world will change.[7]

Despite some skeptics, the human ability to fundamentally influence processes essential to ecosystem functioning has resulted in both intended and unintended consequences, manifested at scales ranging from local to global. Given the increasing speed with which drivers of change are affecting coastal and marine socio-ecological systems, the demand for ICOM to effectively respond to these challenges is equally pressing. I will use two examples to highlight the urgent need for practitioners and scholars of ICOM to re-evaluate whether current approaches and tools will be appropriate to address this new reality and its prevalence for surprises.

The first example focuses on the need to rethink our present ability to manage for change rather than stability. This need became particularly poignant following the shock of the 2004 Indian Ocean tsunami, the 2011 Fukushima nuclear accident, Hurricanes Harvey, Irma and Maria in 2017 in the Atlantic Basin, recent landslides and flooding, and the 2008 financial crisis, just to mention a few. The recent works of Simon Thrush and colleagues in New Zealand and that of Henrik Österblom at the Stockholm Reliance Centre in Sweden are used to support the points made here.[8] As noted by Thrush, from a natural science perspective, regime shifts tend to be unwanted and many ecologists focus their efforts on understanding the factors responsible for maintaining system integrity. Likewise, in the policy realm, the 'governors and the governed' strive for an environment that assures stability rather than uncertainty and change. Yet the evidence from the interconnected social and natural world is that we need to expect and be able to make decisions that robustly deal with surprises. More so than those living inland, coastal populations whether in urban or rural settings are at the forefront of having to deal with the surprises and shocks that are becoming the new reality.

Reminding us of the imperfect nature of knowledge and the unpredictability of multidimensional socio-ecological systems due to as yet unknown interconnected pressures, Thrush's and Österblom's work serves as a siren call

7 E. Mann Borgese, *Sustainable Development in the Oceans* (Halifax: International Oceans Institute, n.d.), at 15.

8 S.F. Thrush et al., "Addressing Surprise and Uncertain Futures in Marine Science, Marine Governance, and Society," *Ecology and Society* 21, no. 2 (2016): 44; H. Österblom et al., "Marine Ecosystem Science on an Intertwined Planet," *Ecosystems* 20 (2017): 54–61.

to expect more uncertain futures. Preparing for the unexpected requires scientists as well as policy-makers and practitioners to be aware of shocks that "may originate outside traditional marine ecosystem science, and make this 'unknown' part of the wider research and policy agenda."[9] This will require existing ICOM governance processes to not only become more participatory, but for the tools being used to explicitly address issues of power imbalances and inclusivity in order for decisions to be robust.

This brings me to the second example highlighting the need to reassess the consequences of the tools being used today to potentially deal with current and near future surprises in coastal and marine socio-ecological systems. While more attention is being paid to the challenges and opportunities of using new technologies such as remote sensing, geo-visualization, and big data analytics to contribute to ICOM solutions spanning across scales of governance,[10] this example focuses on the growing acceptance of marine spatial planning (MSP) as *the* tool to manage conflicts and assure a level of predictability in a marine area being managed.[11]

Apart from the potential mismatch in designating zones for marine-based activities given the previously discussed increasing prevalence for surprises in socio-ecological systems, an issue warranting attention is the process surrounding what and how data are included to provide data layers used in decision support. Given the already mentioned need for governance processes to be more participatory, inclusive, and aware of power imbalances to help mitigate increasing shocks, current MSP practices need rethinking. As noted by Boucquey and colleagues,[12] due to the close relationship between ecosystem-based management and MSP, deciding what data are collected is generally skewed towards those characterizing the natural ecosystem and the socio-economic

9 Id. (Österblom et al.), at 58.

10 W. Ouellette and W. Getinet, "Remote Sensing for Marine Spatial Planning and Integrated Coastal Areas Management: Achievements, Challenges, Opportunities and Future Prospects," *Remote Sensing Applications: Society and Environment* 4 (2016): 138–157; R. Newell et al., "Visualizing Our Options for Coastal Places: Exploring Realistic Immersive Geovisualizations as Tools for Inclusive Approaches to Coastal Planning and Management," *Frontiers in Marine Science* 4 (2017): 290; A. Rumson et al., "Coastal Risk Adaptation: The Potential Role of Accessible Geospatial Big Data," *Marine Policy* 83 (2017): 100–110.

11 A.O. Tuda et al., "Resolving Coastal Conflicts Using Marine Spatial Planning," *Journal of Environmental Management* 133 (2014): 59–68; C.M. Botero et al., "An Indicator Framework for Assessing Progress in Land and Marine Planning in Colombia and Cuba," *Ecological Indicators* 64 (2016): 181–193.

12 N. Boucquey et al., "The Ontological Politics of Marine Spatial Planning: Assembling the Ocean and Shaping the Capacities of 'Community' and 'Environment'," *Geoforum* 75 (2016): 1–11.

activities that are taking place in order to determine the effect on the system through the use of models. This exercise of power by MSP experts can potentially reduce the diversity of interpretations by which different actors experience the natural system, leaving stakeholders involved in MSP with "little opportunity to initiate particular self-characterization or to suggest different modes of representation."[13]

Conclusion

This essay has attempted to provoke discussion on the readiness of ICOM practitioners, scholars, and decision-makers to effectively address the increasing prevalence of surprises and shocks that have become the new reality for coastal and marine socio-ecological systems. It does so by first questioning our acceptance of ICOM assumptions from the past and calling for a rethinking of our current approaches for dealing with the future. What is not in question is the promise of ICOM to help address the challenges and seize opportunities at a time of great change in marine ecosystems and in our use of the sea and its resources. This is the 'new reality' facing coastal and marine socio-ecological systems.

13 Id., at 7.

Coastal and Marine Spatial Planning: Balancing the Ecosystem Approach and the Sustainable Blue Economy

*Scott Coffen-Smout**
Fisheries and Oceans Canada, Bedford Institute of Oceanography, Halifax, Nova Scotia, Canada

Theory and Practice

The concept of coastal and marine spatial planning (CMSP) originates from the 1970s term 'sea-use management and planning' to address growing problems of multiple ocean-use conflicts.[1] A comprehensive approach to the governance of maritime affairs was proposed by academics, including controlling human use interactions and related data requirements. It recognized the challenges of developing integrated management frameworks and data and information systems for decision-making. The post-2006 concept of CMSP developed at a UNESCO workshop that year adopted pivotal ecosystem approaches to management as the basis for its implementation.[2] While interpretations of CMSP vary globally, it is generally defined as "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that usually have been specified through a political process."[3] In fact, CMSP processes are as important as the plan itself in building trust, understanding, and political acceptance. CMSP has become an international tool for ocean space management,

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* Comments given here are in a personal capacity.

1 E.D. Brown, "Sea Use Planning in the North Sea: The Legal Framework," *Proceedings of the Annual Conference of the Law of the Sea Institute* (The Hague, 1978); E.L. Miles, "Concepts, Approaches, and Applications in Sea Use Planning and Management," *Ocean Development & International Law* 20, no. 3 (1989): 213–238; H.D. Smith and C.S. Lalwani, *The North Sea: Sea Use Management and Planning* (Cardiff: Centre for Marine Law and Policy, UWIST, 1984).

2 F. Douvere, "The Importance of Marine Spatial Planning in Advancing Ecosystem-based Sea Use Management," *Marine Policy* 32, no. 5 (2008): 762–771.

3 C. Ehler and F. Douvere, *Visions for a Sea Change. Report of the First International Workshop on Marine Spatial Planning*, IOC Manual and Guides No. 46, ICAM Dossier, 3 (Paris: UNESCO, 2007); C. Ehler and F. Douvere. *Marine Spatial Planning: A Step-by-Step Approach Toward Ecosystem-based Management*, IOC Manual and Guides No. 53, ICAM Dossier No. 6 (Paris: UNESCO, 2009).

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involving multiple ocean use sectors to support economic development and marine conservation. In theory, this requires science-based evidence to balance the Blue Economy, as guided by sustainable economic development principles, and marine environmental protection. This balancing act plays out in the complex political economy of negotiated trade-offs for economically and ecologically sustainable outcomes.[4] The outcome of CMSP is the co-ordinated planning and management of all human activities in a marine planning area to anticipate, prevent, and mitigate human-ecosystem and human-use conflicts. This essay prescribes CMSP content beyond UNESCO's definition above.

Reasons for the adoption of CMSP approaches include reducing or avoiding use conflicts, clarifying multiple jurisdictions, increasing option values for marine conservation, and enhancing ecosystem services. CMSP practices have been implemented in competing use areas and advanced to varying degrees in Australia (Great Barrier Reef), Belgium, Germany, Israel, the Netherlands, Norway, Portugal, Sweden, the United Kingdom, and the United States.[5]

Spatial allocations of activities through zoning and political process drivers are central to CMSP. It requires (1) a shared vision of ocean space that is ecosystem-based, integrated, area-based, adaptive, strategic, anticipatory and participatory; (2) data, information, analytical assessment, monitoring, and reporting that supports informed decisions and actions; and (3) a central planning blueprint that sets direction for decision-making that may contain zones, permitting, temporally dynamic measures, and activity restrictions analogous to urban land-use planning strategies.[6]

CMSP in practice requires the development of an integrated management plan with shared goals and actions based on collaborative input of stakeholders and regulators. The purpose of CMSP includes (1) a rational use of marine space to balance the Blue Economy, as guided by sustainable economic development principles, and marine conservation and environmental protection; (2) achieving social and economic objectives[7] by strategic action planning; (3) managing conflicting and future uses; and (4) addressing cumulative effects.

4 S.E. Lester et al., "Evaluating Tradeoffs Among Ecosystem Services to Inform Marine Spatial Planning," *Marine Policy* 38 (2011): 80–89.

5 J.S. Collie et al., "Marine Spatial Planning in Practice," *Estuarine, Coastal and Shelf Science* 117, no. 20 (2013): 1–11; S. Jay et al., "International Progress in Marine Spatial Planning," *Ocean Yearbook* 27 (2013): 171–212.

6 T. Agardy, *Ocean Zoning: Making Marine Management More Effective* (London: Earthscan, 2010).

7 J. Walmsley et al., "Development of a Human Use Objectives Framework for Integrated Management for the Eastern Scotian Shelf," *Coastal Management* 35 (2007): 23–50; T. Hall et al., "Advancing Objectives-based, Integrated Ocean Management through Marine Spatial

Plans range from a legally binding, regulatory-based zoning plan with a detailed blueprint prescribing where, when, and how activities occur, to a spatial characterization of human use and ecological sensitivity for voluntary management guidance, codes of practice, and decision support. The differences between these plan types are significant on many levels, but particularly in terms of governance agreements and the requirements for stakeholder engagement. In a spatial characterization-based plan, CMSP is a tool for collating data and information for assessment, monitoring, and reporting that supports informed decisions and actions, leaving industry sectors to implement the shared vision via sectoral decision-making. In a legally binding, regulatory-based plan, however, decision-making is centralized with a management authority and adhered to by each industrial sector. Regardless of the type of plan, CMSP requires whole-of-government political will, strong leadership, and direction for effective ocean management. CMSP places higher standards of accountability on industry sectors, but it also provides greater certainty for their activities, albeit potentially creating winners and losers.[8]

In some jurisdictions, CMSP potentially overrides existing divisions of constitutional and sector-based authority through a governance structure that supports communication among ocean regulators, industry sectors, and stakeholders, with a unified decision-making authority. In nations where CMSP planning and implementation authority is not explicitly stated in law and policy, a collaborative approach is essential among multi-jurisdictional authorities. Given the multi-jurisdictional context at play in Canada, a collaborative governance approach is necessary and joint planning and management authorities (i.e., federal, provincial, and First Nations) with unified control may be required to achieve successful CMSP outcomes.

Data Drivers and Supporting Tools

Marine geospatial data and information at appropriate planning scales are core elements in the development of knowledge products for effective planning, management, and decision support. Spatial knowledge products are valuable and include maps, geographic information system (GIS) data layers, analytical methodologies, data inventories, digital atlases, and fact sheets.

Planning: Current and Future Direction on the Scotian Shelf off Nova Scotia, Canada," *Journal of Coastal Conservation* 15, no. 2 (2011): 247–255.

8 W. Flannery et al., "Exploring the Winners and Losers of Marine Environmental Governance/ Marine Spatial Planning: Cui bono?," *Planning Theory & Practice* 17, no. 1 (2016): 121–151.

Data and information collection, analysis, and sharing are essential in the planning process. Data collation for assessment, monitoring, and reporting supports informed decision-making and management actions. When using ecological and socio-economic geospatial data and information, it is important to depict data consistently and at appropriate scales to build trust and confidence among users. Interactive and analytical GIS-based decision-support tools engage stakeholders and ensure data accessibility and transparency. While these tools help develop options for spatial management, GIS analyses and spatial solutions still require politically acceptable decisions by governmental authorities.

CMSP depends on spatial management tools and effective information and databases to conduct geospatial assessments and to map and share biological, physical, social, and cultural information on open data portals. Important elements include (1) a map or survey of marine cadastral information on legally defined rights and responsibilities; (2) valuation methods to assess ecological, economic, social, and cultural importance; (3) intensity of use metrics and compatibility matrices to characterize pressures, effects and interactions, including cumulative effects analysis; and (4) risk assessment tools to provide management and mitigation advice and scenario planning. Data needs are determined by planning goals, and spatially relevant baseline information may include

- fisheries management, conservation and licensing zones, and catch and effort distributions;
- oil and gas management zones and infrastructure;
- ocean dumping and disposal zones;
- marine transportation management and monitoring zones;
- maritime vessel traffic densities and patterns;
- military operational and training exercise areas;
- marine protected and conservation areas;
- ecologically and biologically significant areas;
- species at risk range distributions and critical habitat;
- shoreline and subtidal habitat classifications;
- remotely sensed earth observations;
- scientific research and monitoring zones;
- ecotourism and recreational use;
- cultural, archeological and traditional use zones;
- priority use areas determined by area-specific physical habitat and oceanographic characteristics;
- navigational safety zones for submarine cables, pipelines, and drilling rigs/ships; and

– inshore zones for aquaculture and seaweed leases, shellfish harvesting closures, port/harbor authority anchorage areas, and private water lots.

CMSP should proceed with the best available data, information and knowledge, but with awareness of the spatial and temporal realities of ocean management. Expectation of perfect data is unrealistic, and the dynamic and complex marine environment creates planning limitations. However, a data gap is no excuse for inaction, nor is an incomplete understanding of ecosystem structure, function, connectivity, and ecological sensitivity. Gaps can be supplemented by targeted data acquisition based on inventoried management needs and by local ecological knowledge from coastal communities and aboriginal traditional knowledge from indigenous communities. The unpredictable effects of climate change-based drivers such as ocean acidification and species range shifts may also affect CMSP implementation. Planning with such uncertainty requires flexibility and adaptiveness, particularly for range shifts in commercial fish species and coastal communities at risk from sea level rise and storm surges.

Governance and Capacity Development

Intergovernmental communication and co-ordination of CMSP-related matters require a multilateral governance platform to engage multi-sectoral regulatory authorities. These platforms benefit from the willingness of all parties to engage fully and broadly in marine planning and to not allow departmental mandates favoring economic development or marine conservation to obfuscate intergovernmental planning processes. Where multilateral governance processes fail due to conflicting mandates, interests, and capacity, bilateral engagement arrangements between authorities may be more productive, but may never be the preferred option. Intergovernmental engagement requires clearly stated objectives, benefits, and outcomes of CMSP, as well as a co-ordinated whole-of-government approach rather than a single departmental mandate-based approach. Reluctance to participate by partners and stakeholders may result if CMSP proceeds without long-term funding, policy development, supporting governance frameworks, or if the initiative is cast as a 'pilot' without long-term government commitment.

The development of coastal and marine spatial plans requires good governance advice such as:

– Use transparent planning processes so stakeholders see how input is used.

- Plan at a regional scale to maximize opportunities for meeting plan objectives.
- Minimize socio-economic impacts on resource users.
- Use the best available science in management decision-making.
- Seek areas where uses are appropriate rather than focus on areas where to avoid activities.
- Use areas nominated by communities and resource users for marine conservation planning.
- Minimize the total area protected while meeting objectives of the plan.
- Build on and enhance existing conservation measures where possible.
- Use appropriate management tools and protection levels for the conservation needed.
- Respect existing uses where compatible with plan objectives and promote sustainable uses.
- Develop operational codes of practice on the 'how' and 'when' conditions for ocean activities.

Interdisciplinary expertise enhances development and implementation of coastal and marine spatial plans. Planning team members with such skills play honest broker roles in multi-stakeholder planning processes and have the best prospect of successful plan implementation. Recommended CSMP-related capacity development includes spatial data management, spatial analysis for decision support and risk assessment, cumulative impact assessment, marine management and ocean governance, and leadership capacity and negotiation skills development.

Future CMSP Considerations

CMSP processes may be biased where strong single sector industries are involved. For example, aquaculture or marine renewable energy may advocate a sectoral Blue Economy driver to launch broadly based spatial planning. However, the outstanding governance and decision-making challenges for future effective CMSP processes relate to broader issues such as global protein production and demand via aquaculture, or offsetting carbon dioxide emissions through marine renewable energy development. CMSP may also be driven by internationally agreed marine conservation targets achieved through related processes for marine protected area network planning. Partnerships among industry sectors and the marine conservation community will need promotion to meet these competing challenges. As Elisabeth Mann Borgese wrote, "It is quite possible … that radical innovation in economic thinking will come from 'ocean economics' rather than from land-oriented resource or environmental economics."[9] CMSP approaches need to foster radical thinking and innovations so that Blue Economy drivers generate the oceans' goods, resources, and services necessary for future human development, while sustaining ocean health using the ecosystem approach. Balancing these complexities through CMSP may ensure future ocean sustainability.

9 E. Mann Borgese, "The Economics of the Common Heritage," *Ocean & Coastal Management* 43, no. 8–9 (2000): 763–779.

Information Matters: Global Perspectives about Communication at the Science-Policy Interface

Suzuette S. Soomai and Bertrum H. MacDonald
School of Information Management, Faculty of Management,
Dalhousie University, Halifax, Canada

The 1972 United Nations Conference on the Human Environment and the 1992 Earth Summit in Rio de Janeiro marked major turning points in international environmental politics with endorsed multilateral agreements, and conservation and protection placed on many national agendas.[1] Subsequent global environmental assessments have systematically assembled scientific information intended for decision-making regarding sustainable development. Now, over forty years later, governmental and intergovernmental organizations continue to produce a diverse range of scientific publications containing information aimed at guiding public policy-making for coastal and ocean management. Today, much of this large volume of information is accessible through numerous communication methods. Recently, improving information flow at the science-policy interface has become a priority in the urgent need to achieve sustainable development globally. At the Rio+20 Conference in 2012 many countries agreed to support actions to strengthen provision and access to timely and accurate scientific information, and to promote use of the information and communication technologies in decision-making.[2]

Since 2002, the interdisciplinary Environmental Information: Use and Influence research program at Dalhousie University has been studying characteristics of the science-policy interface. This research shows that scientific information fulfills an important role in decision-making, and the process of generating scientific information may be as important as the publications themselves.[3] We have concluded that building understanding of how information is produced, communicated, and used within governmental organizations is central to strategies for ensuring information reaches decision-makers effectively. Our case studies on the awareness, communication, and use of information produced by governmental organizations engaged in coastal and ocean

1 P.S. Chasek, D.L. Downie, and J.W. Brown, *Global Environmental Politics* (Boulder, CO: Westview Press, 2016).
2 United Nations General Assembly, *The Future We Want*, UN Doc. A/66/L.56 (24 July 2012).
3 Environmental Information: Use and Influence (EIUI), http://www.eiui.ca.

management have highlighted the complexity of the science-policy interface in environmental governance.[4] In fact, many interfaces exist in relation to different decision-making contexts. The contexts may be influenced by many factors: the environmental or resource management issue, the spatial and temporal scale of such issues, societal and political factors, diverse subjects and knowledge, available information products and framing of issues, uncertainty, organizational structures and cultures, and the involvement of multiple actors and related networks.[5] Information flow between producers and users of information is seldom linear or unidirectional, contributing to the complexity of interactions at the science-policy interface. Furthermore, information needs for decision-making are often multifaceted. Our studies are providing empirical evidence to understand characteristics of the interface, particularly with regard to the range of factors noted above.

How information is utilized and with what effect varies considerably. The terms 'use' and 'influence' of information are often used interchangeably and the method chosen to measure these concepts is determined by the selected benchmark and the time scale of use and influence. Metrics of use and influence may also differ for stakeholders with competing interests in decision-making processes. Evidence of indirect use of information, e.g., increased awareness, typically is unnoticed or not fully appreciated compared to direct use, e.g., information incorporated into policies or legislation, because it is simply easier to measure direct use of information. State of the environment reports, for instance, those produced by the Food and Agriculture Organization of the United Nations[6] and the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection,[7] increase general awareness of the status of resources and environmental issues, and may influence changes in behavior of managers and the public that is only noticeable long after release of the publications. In contrast, the acceptance of annual fisheries scientific advice by fisheries managers, the fishing industry's recognition of quotas, and the subsequent sustainability of fisheries are examples of direct and immediate use of information in decision-making contexts.

4 B.H. MacDonald, S.S. Soomai, E.M. De Santo, and P.G. Wells, eds., *Science, Information, and Policy Interface for Effective Coastal and Ocean Management* (Boca Raton, FL: CRC Press, Taylor & Francis Group, 2016).

5 Id.

6 For example, Food and Agriculture Organization of the United Nations (FAO), *State of the World Fisheries and Aquaculture 2016* (Rome: FAO, 2016).

7 For example, IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), *A Sea of Troubles*, Report No. 70 (Nairobi: GESAMP, 2001).

What makes information 'useable'? Research over the past decade has shown that three key attributes—credibility, relevance (or salience), and legitimacy—influence the uptake of information in decision-making.[8] With each environmental issue, credibility refers to the perceived validity of the information used, in the eyes of the stakeholders; relevance reflects the extent to which work carried out is related to the context of the policy process, i.e., to the needs of decision-makers; and legitimacy reflects fairness and political acceptability of the outputs, e.g., it includes the views and values of all stakeholders. Reports commissioned by government departments and agencies (grey literature) are often more useful to policy-makers as the information in these reports is more likely to be policy-relevant than that found in academic research papers. Similarly, established internal processes for producing scientific advice and making management decisions—as seen in fisheries management organizations, such as Canada's Department of Fisheries and Oceans and the Northwest Atlantic Fisheries Organization—are key factors in producing credible, relevant, and legitimate information for decision-making.[9] Furthermore, policy-makers and advisors frequently make decisions based on in-house policy briefs that summarize available scientific information in less technical language than in many research publications.

Today, governance at various levels espouses evidence-based policy-making where scientific advice is expected to inform decisions. However, while scientific information may inform policy-making, it may not necessarily influence policy outcomes.[10] This point underlies a distinction between evidence-based and evidence-informed policy-making. Typically, policies address diverse agendas simultaneously. Trade-offs or compromises often come into play when multiple sources of information are available for decision-making and many stakeholder groups are involved. Consequently, socio-economic and political factors can eclipse the use of scientific information and advice. Nonetheless, information can be used to set the scope, as well as to inform issues.

Identifying the challenges in the communication of information and its use in decision-making is beneficial for mitigating problems at the science-policy

8 W.C. Clark, R.B. Mitchell, and D.W. Cash, "Evaluating the Influence of Global Environmental Assessments," in *Global Environmental Assessments: Information and Influence*, eds., R.B. Mitchell, W.C. Clark, D.W. Cash, and N.M. Dickson (Cambridge: MIT Press, 2006), 1–28.

9 S.S. Soomai, "Understanding the Science-Policy Interface: Case Studies on the Role of Information in Fisheries Management," *Environmental Science & Policy* 72 (2017): 65–75.

10 P. Gluckman, "Science Advice: A Bastion against the Post-truth/Post-trust Torrent?," Keynote address, Annual Conference of the Joint Research Centre of the European Commission, Brussels, 26 September 2017, http://www.pmcsa.org.nz/wp-content/uploads/17-09-26-European-Commission-Joint-Research-Centre.pdf.

interface. Five years after Rio+20, an apparent disconnect was noted between the information and knowledge produced by scientists and the information and knowledge used by policy-makers, and concern about the disconnect continues to grow largely because declining environmental trends are still evident in spite of the availability of many research reports. Publication of *The First Global Integrated Marine Assessment* (*World Ocean Assessment I*) in 2016 is a recent example of significant continuing efforts to produce and synthesize current information on the oceans.[11] But this massive report is not the first of its kind as comprehensive reporting on the state of the marine environment has occurred since the 1970s. Why is such repetition needed? What information-related questions still need to be addressed?

Prioritizing production and dissemination of reports such as *World Ocean Assessment I*, and evaluation of their use and influence is required, especially in light of the extensive fiscal and personnel resources required to undertake such work. Mandates from government often direct scientific research; such mandates are usually policy-specific and are based on legislative initiatives and availability of funding. When government budgets tighten, both new and established information products may be undervalued or cut as an austerity measure. Governmental organizations may reduce production of publications or, once produced, not optimize their use. Responsible organizations, however, will want to know how their information is being used and whether their publications contribute in any way to coastal and ocean management. In the absence of evidence of impact, it may no longer be viable to produce expensive synthesis publications on the assumption they will positively influence coastal and ocean management. Despite continued effort to increase knowledge about the oceans, better understanding is needed of how to use existing information for making policies and decisions that are aimed at solving many of today's serious coastal and ocean problems.

While effective communication of information is recognized as vitally important at the science-policy interface, dissemination methods may need to be reconsidered to ensure that all appropriate audiences are reached. Many current methods only succeed in information reaching interested individuals or groups, who typically respond to governmental and non-governmental requests for input in decision-making. Because such individuals and groups are already active in coastal and ocean conservation issues, they may be better able to contribute to policy development. Initiatives to bring new networks

11 United Nations, Division for Ocean Affairs and the Law of the Sea, *The First Global Integrated Marine Assessment* (*World Ocean Assessment I*) (Regular Process Global Reporting and Assessment of the State of the Marine Environment, including Socio-economic Aspects, 2016), http://www.un.org/depts/los/global_reporting/WOA_RegProcess.htm.

into decision-making activities require understanding the communication behaviors of many groups. For example, the rapid rise in social media use over the past decade means that communication through these channels is more likely to engage wider audiences, such as younger members of a population, in environmental issues. While non-governmental organizations (NGOs) increasingly rely on social media (e.g., Facebook and Twitter) in their advocacy campaigns in policy arenas, governments' use of social media is limited for reasons of security and privacy.

Although the production and communication of information has been the focus of many studies, understanding of information use from the perspective of decision-makers is incomplete. To build understanding of the use and influence of information at the science-policy interface requires gaining access to managers and policy-makers at various levels of government bureaucracies, as well as decision-makers. Decision-makers commonly seek information outside of the formal communication channels in governmental organizations, and their advisors may rely on the knowledge and advice of peers and other contacts, rather than directly consulting published material. Studies on information seeking and sharing behaviors of decision-makers can show relationships and tensions between the "push" of scientific information on one side and the 'pull' of policy on the other. Policy-making often extends beyond scientists, managers, policy-makers, and politicians to include a wide range of stakeholders, e.g., international groups, NGOs, industry, journalists, think tanks, and the interested and general public. Research on the roles that these multiple actors play in decision-making is contributing to growing understanding of the science-policy interface. Recently, in this context, our attention has turned to examine the place of environmental NGOs in decision-making, particularly in relation to the designation of marine protected areas.

For the production of credible, relevant, and legitimate information, the involvement of multi-stakeholder partnerships is often encouraged. To facilitate co-production of information, networks of excellence and communities of practice can enable scientists to collaborate with various groups, including industry, in multidisciplinary research projects. Such initiatives often recognize the need for data and information management expertise, and a requirement to translate the resulting information into accessible language for the benefit of various users in research partnerships. This solution-oriented approach is illustrated in our studies of the Gulf of Maine Council on the Marine Environment where managers from Canada and the United States have formally collaborated in coastal environmental programs for over 25 years.[12]

12 Gulf of Maine Council on the Marine Environment, http://www.gulfofmaine.org.

In today's post-truth society, policy-making can easily be influenced by whose 'truth' is more popular or more pervasive, and the most convenient fit for decision-making.[13] Further, the same information used by different organizations in different contexts can lead to divergent outcomes. In many contexts, boundary organizations and persons playing a bridging role between scientists and policy-making groups can be instrumental in enhancing communication at the interface.

As we look ahead, world-wide environmental governance is being led by the United Nations' 2030 Agenda for Sustainable Development and the 17 Sustainable Development Goals (SDGs). Experts on global environmental politics have stated quite categorically that successful implementation of the 2030 Agenda will depend on "effective and robust science-policy interfaces at the global, regional and (sub-) national levels."[14] Furthermore, "viable science-policy interfaces are not only important for monitoring the progress of the SDGs, …they will also be indispensable for regular assessment and as early warning systems to identify new challenges."[15] The consequences of not acting on available information in the face of serious environmental issues, such as climate change, will be disastrous.

What can be done, going forward? For one, in marine policy and decision-making we can use more effectively and more rigorously what we already know about the oceans and about the production, communication, and use of marine scientific information. Increased understanding of information pathways and the science-policy interface can raise the visibility of information and guide many interested individuals and groups to determine the most appropriate entry point in policy-making processes. Likewise, issues related to climate change or ecosystem approaches to management can be more effectively resolved or facilitated through transparent and accountable information production and communication, coupled with open access to information by all actors involved in public policy decisions.

Good environmental governance of the oceans is a dynamic, multidisciplinary, iterative, and participatory process. It involves frequent interactions between scientific and decision-making groups and various stakeholders to enable efficient uptake of information for effective decisions. Information does matter.

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13 Gluckman, *supra* note 10.

14 United Nations Department of Economic and Social Affairs, Division for Sustainable Development, "The Role of the Science-Policy Interface for the National Development of the 2030 Agenda," Sustainable Development Knowledge Platform (2016), https://sustainabledevelopment.un.org/index.php?page=view&type=20000&nr=780&menu=2993.

15 Id.

Geospatial Data Infrastructures and Ocean Governance

James Boxall
GIS Centre (University Libraries) and Marine Affairs Program,
Dalhousie University, Halifax, Nova Scotia, Canada

As trite as it may sound, everything has a location. The issue with geospatial information and technologies is that more locations and applications relate to the Earth's brown and green surfaces, and built environments, rather than to the blue ocean. This fundamental issue of disproportionate data collection, analysis, and use is at the heart of a tremendous growth in new applications and data created within the ocean domain. From a marine spatial planning perspective, it also forms the need for ocean governance through data sharing and scientific communication.

The driving forces of the new era of ocean geospatial development are climate change, resource use/depletion, and geopolitical conflicts. The greatest benefit of geospatial technology and analysis is that these forces can be viewed as they occur in reality, as interconnected and overlapping problems that have spatial extents, as well as spatial causes and solutions. Ocean governance happens somewhere, within situations having locations, movements, and interactions. Whether it be political, technical or natural, location is central, and so location-based technologies and geospatial data must be at the core of any analysis or policy associated with governance.[1]

Geospatial data infrastructures are expressions of policies and products. Data management is the essential, but not sole, product component. Within this are related issues of connectivity (bandwidth), security, metadata, software, storage, preservation, open access, privacy, and cloud computing, to name a few. Processes of collecting, sharing, and communicating geospatial data are changing radically, thereby forcing a reflection on the policies and products. This will continue to have an enormous impact on ocean governance as it gets to the core of management issues preceding decision-making.

The entire system of geospatial data and technology has for some time been defined as spatial data infrastructures (SDI). From data collection to metadata, format integration, distributed computer interaction, software, storage,

1 S.M. Maxwell et al., "Dynamic Ocean Management: Defining and Conceptualizing Real-time Management of the Ocean," *Marine Policy* 58 (2015): 42–50.

DOI:10.1163/9789004380271_047

archiving, processing, analysis and communication (mapping display), the entire system has been viewed as something that should work harmoniously as one positive feedback system. For over three decades now, the SDI *ideal* has been held up as a goal.[2]

A focus on bathymetric data at one kilometer resolution was perhaps the first example of geospatial infrastructure that could express spatial dimensions of ocean features, as well as allowing for integration of data into other products and visualization tools. This has given way to new products at finer resolution in tens of meters or better. While these tend to be spatially limited (small areas), the technology has achieved a maturity where the only barrier to mapping the entire seafloor at such fine resolution is cost.

One should also note that disasters still drive data collection and mapping, exemplified by the Deep Water Horizon oil spill in the Gulf of Mexico, the MH370 air crash in the Indian Ocean, and recent Atlantic Basin hurricanes. Moreover, significant efforts have been undertaken to align/combine data types and sources for a more fulsome view of an active ocean in all its dimensions, and not simply features derived from bathymetry.[3]

Data fuels geospatial infrastructures and this has created a shift to 'open data', with better standards and formats that are interchangeable between proprietary systems. Data policies in the past (i.e., cost recovery, security/privacy concerns) created barriers to access and use of ocean-based geospatial data. Ocean data managers and funding agencies are looking toward open data as a solution to their needs for innovation, data sharing, and the development of better tools and shared analysis.[4]

Open ocean data holds the promise of more knowledge translation and refined data for decision-making, rather than merely enormous quantities of data stored on massive servers that never see the light of day. Models and analytical techniques that are too complex and take too long when data is sequestered by only one organization can now be shared and improved upon quickly. Actual costs are lowered when data is made available to the community.

The exponential growth in the collection of ocean-based geospatial data is changing the level of detail with which we can visualize the ocean.

2 D.J. Wright, "Spatial Data Infrastructures for Coastal Environments," in *Remote Sensing and Geospatial Technologies for Coastal Ecosystem Assessment and Management*, ed., X. Yang (New York: Springer, 2009), 91–112.

3 R.G. Sayre et al., "A Three-dimensional Mapping of the Ocean Based on Environmental Data," *Oceanography* 30, no. 1 (March 2017): 90–1-3, doi.org/10.5670/oceanog.2017.116.

4 C. Kalyvas et al., "A Survey of Official Online Sources of High-quality Free-of-Charge Geospatial Data for Maritime Geographic Information Systems Applications," *Information Systems* 65 (2017): 36–51.

Wave gliders, autonomous vehicles on or below the surface, remotely controlled submersibles, drones, telemetry tracking of fish and mammals, buoy arrays, satellite platforms with better sensors and more data collection, and more platforms, are collecting data at finer resolutions, with more accuracy, and in near real-time. Access to better sensors and data collection in the atmosphere and on land means a greater ability to develop integrative models of the Earth.[5] There should be no end in sight for more and better data collection.

If we have so much data, then surely we must be able to address geospatial ocean issues more adequately. Herein is the opposing side of the geospatial infrastructure. More data does not necessarily translate into more information and knowledge or better decision-making. Research and development in the areas of artificial intelligence and machine learning, combined with cloud computing and big data, will be needed more than ever.

And yet, with the advent of these new tools to deal with vast quantities of data, we are creating new governance problems that we must attend to in the ocean geospatial community, especially as it relates to the complexities of a three/four-dimensional ocean. What this has led to is a greater need for computational models, algorithms, geospatial statistics, and other computer science approaches to deal with ever larger quantities of spatially referenced big data.[6]

An interesting set of solutions to these problems is coming from advances in augmented and virtual reality systems that provide the opportunity to visualize data about the ocean in multiple dimensions and temporal scales (past, present and future). In some ways, this is creating a situation where we can visualize spatial representations akin to movies. Computer graphics turn the unreal or imagined into near realistic explorations of the environment. *Finding Nemo* is no longer a cartoon, but the future of how we will see our data.

The software we use is about comfort and exposure; what one learns is usually what one uses. In the past, such software was strictly in the domain of the expert, as well as expensive and heavily reliant upon more powerful computers and mass data storage devices. Analytical programs and data visualization tools that have built-in spatial tools for experts and non-experts are becoming the norm. The days of exclusive geospatial technologies are fast coming to an

5 J. Casas, "The Importance of Earth Observations and Data Collaboration within Environmental Intelligence Supporting Arctic Research," NASA Marshall Space Flight Center (2017), https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20170008157.pdf.

6 J.C. Wallis, E. Rolando, and C. Borgman, "If We Share Data, Will Anyone Use Them? Data Sharing and Reuse in the Long Tail of Science and Technology," *PLoS ONE* 8, no. 7 (2013): e67332, doi.org/10.1371/journal.pone.0067332.

end, which will open geospatial data visualization into new ocean applications from non-ocean communities.[7]

When the geographic information system (GIS) was invented in the late 1960s by Roger Tomlinson, the size and power of computers were such that the memory and capacity to process data was very low. Hardware is now so fast, small, and inexpensive that we are almost at a point where it is disposable. A server with 10 terabytes of storage and multiple core processors is within reach of almost any laboratory or ocean scientist. Storage, processors, and Internet connectivity, while still an issue for remote areas, have become fast enough to stream massive quantities of video, data, and imagery. It would have been unthinkable to be able to live-stream video from an underwater submersible a few years ago. Now we expect it. The days of the expensive mainframes to do GIS and spatial analysis of mass quantities of data are either over, or close to it.

While numerous developments have taken place with respect to geospatial technologies and data, ever-more changes in the technology landscape are lining up to radically alter how we analyze, model, explain, and communicate ocean complexities and our uses of that precious resource. Mobile computing has matured to a stage where devices such as smartphones, GPS units, laptops, and data collection platforms like drones have created expectations that data collection and access is a given. We are now used to the idea that our mobile devices can pinpoint our location within meters. This cannot be overstated in terms of implications for ocean geospatial technology and governance. We now see projects around the world where fishers and citizens alike collect and provide access to real-time data within a mobile computing environment.[8]

The final, perhaps most exciting, aspect of geospatial technologies impacting our ocean sciences and governance are the systems allowing us to collect data remotely, via satellites and/or tracking systems that mix fixed assets, that allow for accurate positioning, along with sensors gathering data from moving through the ocean or above through new and much more accurate space-based platforms. This necessitates a return to some of the most essential and oldest elements of geospatial data infrastructures. Making certain that our descriptions of the data and collection methods used (metadata and ontologies) are robustly utilized ensures data sharing is both efficient and correct.

7 S. Liua et al., "A Framework for Interactive Visual Analysis of Heterogeneous Marine Data in an Integrated Problem Solving Environment," *Computers & Geosciences* 104 (2017): 20–28.

8 D. Wright, V. Kouyoumjian and S. Kopp, "Towards a Community 'Playground': Connecting CyberGIS with Its Communities," in *CyberGIS: Fostering a New Wave of Geospatial Discovery and Innovation*, eds. S. Wang and M.F. Goodchild (New York: Springer, 2016).

These core, pre-use, data challenges test (perhaps exceed) our ability to collect and visualize the data we need.[9]

Communicating spatial relationships always comes back to the map. Maps have been central to our understanding and use of the ocean for centuries. In terms of ocean governance, marine spatial planning is about communicating science and policy through maps. The creation of stable and easy to use web-based mapping tools, accessible anywhere, and with the ability to do live updates, is an exciting development.[10] Ocean governance may not, therefore, be hampered by a lack of much-needed data. The future is one where creativity in how we visually communicate will change the nature of the governance issue.

Among numerous gifts, Elisabeth Mann Borgese instilled in us a belief that the ocean should be open to all, while protected for today and the future. Directions within the geospatial community reinforce these ideals through the sharing of geospatial data in an open environment, protected for the future, and from more advanced and numerous data sources. It allows us to communicate how we see the ocean, its use, the issues it faces, and the future we wish to create for the protection of the blue planet.

The current and future of how we map the ocean and communicate its nature in geospatial forms differs from the past. Even so, it is still the same as before because we are expressing geospatial 'reality' as best we can to communicate both issues and solutions. The driving forces facing our efforts in ocean governance—climate, resources, and conflict—require the best we can offer. Integrated technologies and geospatial data within an infrastructure should allow for the notion of 'geo-spatial' to become more inclusive as 'mare-spatial'.

9 J. Pearlman, D. Schaap and H. Glaves, "Ocean Data Interoperability Platform (ODIP): Addressing Key Challenges for Marine Data Management on a Global Scale," OCEANS 2016 MTS/IEEE, Monterey, California, 19–23 September 2016, doi.org/10.1109/OCEANS.2016.7761406.

10 J. Patterson and A. Bickel, "Communicating Local Relevance of Ocean Observations: Integrating Real-time Ocean Sensor Data Visualizations, Online Communications, and Ocean Issues to Engage Public Audiences," OCEANS 2016 MTS/IEEE, Monterey, California, 19–23 September 2016, doi.org/10.1109/OCEANS.2016.7761325.

Marine Protected Areas: Ensuring Effective Conservation while Pursuing Global Targets

Maxine C. Westhead
Fisheries and Oceans Canada, Bedford Institute of Oceanography, Halifax, Nova Scotia, Canada

Introduction

The topic of marine protected areas (MPAs) is complex and multi-faceted. This essay attempts to summarize contemporary issues in the field of marine conservation and draws on recent Canadian experience. To set the stage, here are some current global facts and figures related to MPAs from ProtectedPlanet.net, managed by the United Nations Environment World Conservation Monitoring Centre, as of November 2017:

– Over 23 million km² (6.35 percent) of the ocean is covered by over 15,000 MPAs, a ten-fold increase since 2000 when the area covered by MPAs was approximately 0.7 percent or 2 million km².
– MPA coverage has increased by approximately 14 million km² since 2010, driven in a large part by the expansion of existing sites, and the creation of very large new sites (100,000 km² and larger).
– The ten largest MPAs contribute over 50 percent of the area covered by marine protected areas, and the 20 largest MPAs contribute 70 percent of the total. This is in stark contrast to the median size of MPAs globally at less than 5 km².
– The recent accelerated designation of MPAs globally is focused on exclusive economic zones (EEZs at 39 percent of the global ocean), with only 0.25 percent of the high seas currently covered by MPAs.

It is well understood that MPAs are not a panacea for the many problems facing our oceans and are limited in what they can achieve. There are very real and serious threats that MPAs alone cannot solve such as ocean acidification, climate change, and pollution and plastics. What MPAs *can* do, though, is allow ocean space to 'rest'. Given a chance to recover either unencumbered by human interference through no-take MPAs, or with limited human interference through sustainable use MPAs, these areas can be left to flourish and better support overall ecosystem resilience.

Within existing MPAs, active management, monitoring, and reporting are critical elements for success. Proper management of MPAs once they are designated and ensuring that they do not become 'paper parks' are also critical. Other key factors for MPA effectiveness are funding, compliance, and enforcement. MPA managers need to stay active by understanding and tracking the threats to each of their sites. Site managers should also have proper funding for monitoring the threats and the capacity to actively address or even prevent them.

Calls for Action

Most recently, the Fourth International Marine Protected Areas Congress culminated in a call to action in September 2017 that stressed the importance of "ensuring appropriate financial mechanisms for MPAs; integrating climate change considerations into MPAs; and engaging with women, youth and local communities to enhance MPA creation and management."[1] In 2014, *The Promise of Sydney* was released at the end of the IUCN World Parks Congress that was supported by over 6,000 participants from 170 countries.[2] This document recommended to "urgently increase the ocean area that is effectively and equitably managed in ecologically representative and well-connected systems of MPAs or other effective conservation measures by 2030; these should include strictly protected areas that amount to at least 30% of each marine habitat and address both biodiversity and ecosystem services."

The Promise of Sydney generated the Nature Needs Half movement and accelerated the discussion of target-based conservation. A motion was passed regarding a post-2020 strategy to protect 30 percent of our oceans at the IUCN World Conservation Congress in 2016. Targets will continue to increase, as many leaders in the field of marine conservation continue to stress that while ten percent protection is better than the current status, it is severely inadequate as the final target.

The Aichi Targets: Problem or Solution?

Aichi Target 11[3] is a well-known and popular target that is driving many decisions and fueling the political will to make new MPAs faster than ever before in many countries, including Canada. Target 11 states:

1 "Call for Action," International Marine Protected Areas Congress, Viña del Mar, Chile, 9 September 2017, http://www.impac4.org/wp-content/uploads/2017/02/20171005_CALL-FOR-ACTION-IMPAC4-FINAL.pdf.

2 "The Promise of Sydney," IUCN World Parks Congress 2014, http://www.worldparkscongress.org/about/promise_of_sydney.html.

3 Convention on Biological Diversity (CBD), "Strategic Plan for Biodiversity 2011–2020 and the Aichi Biodiversity Targets," CBD/COP 10 Decision X/2 (2010).

> By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Measuring success, though, should not be solely about ticking off percentage points in the race to increase MPA coverage of our global ocean.

While this drive is a welcome change from the historically slow pace of MPA creation globally, it is important to remember that Target 11 is just one of 20 targets nested under five strategic goals. This broader context for Target 11 is rarely mentioned in the national dialogue about reaching Target 11 by 2020. For example, who is working to reduce by half the loss of all natural habitats (Target 5), ensure that all fish and invertebrate populations and aquatic plants are managed and harvested sustainably (Target 6), or preventing the extinction of known threatened species and improving or sustaining their declines (Target 12)? If we are to succeed globally, the other 19 targets need to be addressed at the same frenetic pace that countries are setting to reach the 10 percent target.[4]

Ensuring MPAs are Effective

MPAs have been shown to 'work' around the world. But what does it mean for an MPA to 'work'? Edgar has demonstrated that to be effective, MPAs should be no-take, enforced, old (> 10 years), large (> 100 km^2), and isolated.[5] They should also have year-round restrictions rather than seasonal.[6]

The difficulty in evaluating MPA effectiveness globally or generically is that every MPA is different and unique in that they are established for different reasons. Each site has unique 'conservation objectives' and ultimately different prohibitions to address them. Best practice suggests that based on individual site conservation objectives, each MPA should be specifically designed to best

4 See S.M. Hagerman and R. Pelai, "As Far as Possible and as Appropriate: Implementing the Aichi Biodiversity Targets," *Conservation Letters* 9 (2016): 469–478, doi.org/10.1111/conl.12290.

5 G.J. Edgar et al., "Global Conservation Outcomes Depend on MPAs with Five Key Features," *Nature* 506 (2014): 216–220, doi.org/10.1038/nature13022.

6 For opinions on MPA effectiveness, see a recent International Council for the Exploration of the Sea (ICES) publication: L.H. Pendleton et al., "Marine Protected Areas: All Articles," *ICES Journal of Marine Science* (2017), doi.org/10.1093/icesjms/fsx178.

meet those conservation objectives. It is not uncommon for MPAs to have social, economic, management, or research objectives.

Given this wide variety of MPA design it is difficult to make sweeping statements about their effectiveness. Many studies have shown that MPAs increase fish biomass, abundance, and diversity; however, many of these studies focus on tropical waters. If done properly, MPAs can even enhance local economies (e.g., Galapagos Islands and Bonaire Marine Park). More dedicated research focused on MPA effectiveness and outcomes in open-ocean ecosystems, specifically in polar and northern temperate waters, is needed.

Much of the recent global focus has been on making new and larger MPAs, and rightfully so given the slow pace to date. However, many are not even considered fully implemented as they do not yet have management plans in place. A recent study by Gill et al. looking at MPA performance globally found that of all factors examined, staff and budget capacity were the best predictors of conservation impact.[7] That is, MPAs that had adequate staff were found to have positive ecological effects 2.9 times greater than those with inadequate capacity. Even though we are still only at 6.3 percent coverage globally and efforts to increase protection are still needed, we must be sure to look equally at proper management to optimize conservation impacts of these new, young MPAs.

Size Matters

Most MPAs are very small, with nearly fifty percent of the 10,000 MPAs in the online MPAtlas database less than 10 km^2.[8] Research shows that both small and large MPAs can achieve important conservation benefits if well-managed, however, it is generally thought that larger MPAs will produce more benefits to a wider range of species than smaller MPAs. Small MPAs can allow targeted protection of species or habitats, and can be important generators of economic benefits based on small-scale fisheries or tourism.

When the Republic of Kiribati announced the Phoenix Islands Protected Area (PIPA) in 2008 at 408,250 km^2, the global race to designate the largest MPA began. PIPA is now the fifteenth largest MPA in the world. With more emphasis being placed on very large marine protected areas, has the pendulum swung from too small to too big? The most recent designations are extremely

7 D.A. Gill et al., "Capacity Shortfalls Hinder the Performance of Marine Protected Areas Globally," *Nature* 543 (2017): 665–669, doi.org/10.1038/nature21708.

8 Marine Conservation Institute (2017), MPAtlas [Online], Seattle, WA, http://www.mpatlas.org.

large at well over one million km^2. One of the greatest threats to these large and largely unmonitored MPAs is overfishing and illegal, unregulated and unreported (IUU) fishing. Properly enforcing these MPAs will be the greatest challenge moving forward; however, new tools available to managers of large MPAs such as Global Fishing Watch, DigitalGlobe, and Project Eyes on the Seas will certainly help in this regard.

Residual MPAs

In efforts to achieve conservation largely driven by percent coverage targets, Devillers et al. found a 'strong global pattern' whereby MPAs were established in remote areas with limited human activity or low promise for future extraction.[9] This approach will ultimately fail to protect areas that are significant from an ecological or biological perspective, and important species, habitats, or features may be overlooked. Residual MPAs are a real concern. Ultimately, designating MPAs while allowing 'business as usual' for most ocean users will come at a cost. The greatest cost will likely be that ecological monitoring and evaluation of residual MPAs will show no conservation benefits or ecosystem improvements because of designation, further fueling opposing arguments that MPAs are not needed or effective. Moving forward, MPAs that limit activities and are not business as usual will need creative solutions to address displacement of fishing effort and socio-economic impacts.

Networks of MPAs

Years of systematic conservation planning exercises around the world have helped develop global best practices for MPA network design. Sophisticated conservation planning and optimization tools such as Marxan[10] can help explore the complex issues of trade-offs between ecological and socio-economic considerations. These spatial tools can help practitioners design strategic, comprehensive, representative, and adequate MPA networks rather than resorting to the 'low hanging fruit', site-by-site, or a residual approach to site selection.

9 R. Devillers et al., 2014. "Reinventing Residual Reserves in the Sea: Are We Favouring Ease of Establishment Over Need for Protection?," *Aquatic Conservation: Marine and Freshwater Ecosystems* 25 (2014): 480–504, doi.org/10.10002/acq.2445.

10 Marxan is the most widely used decision support software for conservation planning. See http://marxan.net.

MPAs in the High Seas

EEZs cover approximately 39 percent of the global ocean. The remaining 61 percent are areas beyond national jurisdiction (ABNJ). The target of ten percent by 2020 currently applies to EEZs. There is no global agreement to protect this amount in ABNJ.

Some regional fisheries management organizations have already put conservation areas and fisheries closures in place to protect vulnerable marine ecosystems (mostly corals, sponges, and seamounts), and many have developed 'move-on' rules or 'encounter protocols' for coral and sponge bycatch. However, major concerns remain about the lack of MPAs, overfishing, and IUU fishing on the high seas.

A new international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction (BBNJ) is currently in development. The most recent report of the Preparatory Committee established by General Assembly Resolution No. 69/292 was adopted on 21 July 2017, and provides a full outline of the current proposal.[11] Moving forward, this will be an important mechanism to address the current gap of high seas MPAs.

Looking to the Future

As progress continues toward meeting the ten percent target and beyond, MPA practitioners should remain focused on the Convention on Biological Diversity's guidance for identifying ecologically and biologically significant areas (EBSAs) and designing networks of MPAs.[12] That means protecting areas of high conservation value (i.e., EBSAs) and ensuring representation, connectivity, adequacy, and replication. Instead of placing MPAs in *ad hoc* residual areas where there are fewer conflicts with human use, focus should be on protecting areas that are ecologically and/or biologically significant, as well as ensuring protection of a wide range of ecosystem types in EEZs and ABNJ, from coastal bays to continental shelves, to deep-sea abyssal plains and seamounts.

The Marine Conservation Institute's newly established Global Ocean Refuge System provides a new and unique way to incentivize MPA practitioners to

11 United Nations, *Report of the Preparatory Committee established by General Assembly resolution 69/292*, UN Doc. A/AC.287/2017/PC.4/2, 31 July 2017, http://www.un.org/ga/search/view_doc.asp?symbol=A/AC.287/2017/PC.4/2.

12 CBD, "Marine and Coastal Diversity," CBD Decision IX/20 (2008), Annex 1.

make strong MPAs that offer real protection.[13] The award criteria are based on both biodiversity value and effective management and compliance. The first round of awards to three MPAs was granted in 2017. This is the type of positive initiative needed to help the global community to ensure that MPAs are properly placed and well-managed.

13 See Global Ocean Refuge System website, https://globaloceanrefuge.org/.

Is Canada Protecting Its Marine Species at Risk?

Sean Brillant
Canadian Wildlife Federation, Halifax, Nova Scotia, Canada

Definitions and Legislation

Global extinction of a species is an irreversible condition—a permanent alteration of our unique world. It cannot be corrected. It cannot be mitigated. Efforts to compensate for extinction are ineffective excuses for a failed responsibility. As a result, the only solution is to prevent species from becoming locally extinct or extirpated.

Under natural conditions, some species are common and some are rare. This can be a result of a variety of factors, e.g., the abundance of food, habitat, mates, and the inherent rates of birth and death for the species. Human activities, however, affect all of these variables. Thus, rareness and extinction are not only a result of human activities, but humans are very good at creating both conditions.

If a species is 'rare', it generally means that there are only a small number of individuals in the population or that they only occur in a relatively small area, or both. Rare species are generally also considered at risk of becoming extinct (hereafter referred to as 'at risk'). Regardless of the abundance of a species, it may also be considered at risk if its population is (a) drastically declining, (b) exposed to severe mortality, or (c) losing an excessive amount of habitat (or a reducing quality of habitat). Furthermore, many agencies (e.g., national governments, the International Union for the Conservation of Nature) use categories of risk to indicate the magnitude of likelihood that a species will become extinct; e.g., in order of increasing likelihood: 'vulnerable', 'threatened', and 'endangered'.

There can be many reasons a society becomes interested in avoiding the extinction of a species. For example, the species may be an important natural resource that must be managed to ensure it continues to be plentiful enough to be harvested (and profitable), or there may be a need to demonstrate that a particular human activity is being managed responsibly, such that it is not causing inadvertent damage to living organisms. The species may also have inherent value to society that is not linked to any particular need, service, or measureable benefit.

Many societies have developed laws that are intended to prevent species from becoming extinct. In Canada, several pieces of legislation manage

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activities that influence the abundance of organisms living within oceans. The *Fisheries Act* addresses the conservation and protection of species (predominantly fish) and their habitats, the control and management of their harvest, and the prevention of pollution.[1] The *Oceans Act* aims to manage all activities within oceans through an integrated approach to maintain biological diversity and productivity.[2] The *Species at Risk Act* (SARA) is specifically intended to prevent the extinction of wildlife.[3] It is noteworthy that as a part of the Act, SARA explicitly recognizes the intrinsic value of wildlife and the integral role of wildlife to Canada's national identity and history. This establishes an important position of Canada's view of species at risk and it may set an important perspective that can influence situations beyond the implementation of SARA.

SARA is often considered a 'last-ditch' law because, as a result of its application, it may ultimately protect species that were initially considered under other laws (e.g., *Fisheries Act*), but that continue to face an increasing likelihood of extinction. Thus, in some cases, this may be due to other acts being implemented inadequately. If a species is granted protection by SARA (i.e., becomes listed under), several laws come into force. Most notably, it becomes illegal to harm, harass, capture, or kill the listed species (s. 32), and it becomes illegal to damage or destroy their 'residences' (s. 33), and critical habitats (s. 58). Although these regulations are potentially very effective, attaining this protection and implementing and enforcing these laws under SARA are problematic.

Case Studies and Evaluation

In order to determine if Canada is protecting its marine species at risk, three distinct case studies are presented to provide insight.

Case Study 1

In 2012, the Royal Society of Canada produced an Expert Panel Report that evaluated Canada's efforts to sustain marine biodiversity.[4] Among the large number of features it considered in its evaluation, the report identified that there were reduced population biomasses for many marine species, and very little evidence of recovery. This was especially evident for marine fish, and

1 *Fisheries Act*, R.S.C., 1985, c. F-14, as amended.

2 *Oceans Act*, S.C. 1996, c. 31, as amended.

3 *Species at Risk Act*, S.C. 2002, c. 29, as amended.

4 J.A. Hutchings, et al., *Sustaining Canadian Marine Biodiversity: Responding to the Challenges Posed by Climate Change, Fisheries, and Aquaculture*, Expert Panel Report prepared for the Royal Society of Canada (Ottawa, 2012).

some, but not all, marine mammals and bird populations at risk. The report recognized the potentially strong enabling tools (e.g., adoption of the precautionary approach, the *Oceans Act*, and SARA) that exist to allow Canada to meet its commitments to protect biodiversity, but concluded that Canada has made poor progress. Within its evaluation of Canada's failure to protect marine biodiversity, the Expert Panel indicated that (a) SARA had not been established to its full capacity, (b) there was regulatory conflict within the federal department responsible for marine biodiversity (Fisheries and Oceans Canada),[5] and (c) there was an unwarranted level of discretion for the federal government to side-step its own legislation related to conservation.

Case Study 2

McDevitt-Irwin et al. evaluated the use of Canadian laws (i.e., *Fisheries Act* and SARA) to conserve marine fish at risk.[6] They showed that once a species of marine fish was established as being at risk within Canada by the scientific committee responsible for making these assessments (the Committee on the Status of Endangered Wildlife in Canada), there was a substantial delay in the decision by the federal government on whether or not to protect the species under SARA. Furthermore, species that were considered of greater risk of extinction (i.e., endangered and threatened species) had relatively longer delays in decisions (often due to prolonged consultation periods), and a greater rate of denial for protection. The authors also note that during these delays, subsequent evaluations of 'at risk species' occasionally moved them into higher ranks of risk (e.g., from threatened to endangered). Among the conclusions of this study, the authors determine that SARA delayed conservation efforts for marine fish, and that the *Fisheries Act*, as it was currently being implemented, was failing to meet its obligation to protect Canada's marine fish stocks.

Case Study 3

North Atlantic right whales (NARW) are one of the most endangered large whales in the world. The population estimate in 2015 was 458 individuals,[7] and

5 The Canadian Wildlife Service of Environment and Climate Change Canada is mandated to protect marine birds.

6 J.M. McDevitt-Irwin, S.D. Fuller, C. Grant and J.K. Baum, "Missing the Safety Net: Evidence for Inconsistent and Insufficient Management of At-risk Marine Fishes in Canada," *Canadian Journal of Fisheries and Aquatic Sciences* 72 (2015): 1596–1608.

7 R.M. Pace III, P.J. Corkeron and S.D. Kraus, "State–Space Mark–Recapture Estimates Reveal a Recent Decline in Abundance of North Atlantic Right Whales," *Ecology and Evolution* (2017): 1–12, doi.org/10.1002/ece3.3406.

the greatest threats to them are ship strikes and entanglement in fishing gear.[8] Current knowledge indicates that most NARWs swim into Canadian waters every summer. The whale has been listed as an endangered species under SARA since 2005. A SARA Recovery Strategy for NARWs was produced in 2009, and a partial SARA Action Plan was proposed (though not as yet finalized) in 2016. Otherwise, until very recently there have been few actions by Canada to actively protect this species. During the summer of 2017, an extraordinary number of NARWs were killed or harmed by human activities in Canada's Gulf of St. Lawrence.[9] Twelve individual NARWs were found dead, and seven others were observed entangled in fishing gear. Detailed necropsies were carried out on seven of the dead animals. The expert veterinarians concluded that four died as a result of blunt force trauma, and two were killed due to entanglement. Although little was known about how much of the NARW population uses the Gulf of St. Lawrence, and where specifically they aggregated, their presence had been reported there for many years. It is clear the species could have benefited from efforts to reduce the risk of harm from human activities. In August 2017, ships were required to comply with a 10-knot speed limit and a summer snow crab trap fishery closed early.

Summary

These three case studies, and many other reports, point to the conclusion that Canada is not adequately protecting its most endangered marine species. Fortunately, these reports provide recommendations for how this situation can be improved, so as to correct this deficiency in protection. There may also be evidence that the federal government is willing and able to act on these recommendations. In the 2017 NARW mortality event, there was a remarkable response by the federal government to protect NARWs. Immediately following the initial discovery of dead whales, the federal government acted quickly to close the local, active snow crab fishery and impose mandatory speed restrictions on commercial vessel traffic traveling through the area of the Gulf of St. Lawrence where the whales were most densely aggregated.

8 M.W. Brown et al., *Recovery Strategy for the North Atlantic Right Whale* (*Eubalaena glacialis*) *in Atlantic Canadian Waters* [*Final*], Species at Risk Act Recovery Strategy Series (Fisheries and Oceans Canada, 2009).

9 P-Y. Daoust, E.L. Couture, T. Wimmer and L. Bourque, *Incident Report: North Atlantic Right Whale Mortality Event in the Gulf of St. Lawrence, 2017* (Charlottetown, PEI: Canadian Wildlife Health Cooperative, Marine Animal Response Society, and Fisheries and Oceans Canada, 2017).

Although implemented in reaction to the disastrous situation, these direct changes to protection by the federal government for the benefit of a species at risk were unprecedented. It is hoped therefore, that in the future, Canada will take similar actions to proactively prevent harm to this species, and to advance the conservation of its marine species at risk.

Keeping the Noise Down: Approaches to the Mitigation and Regulation of Human-Caused Ocean Noise

Lindy Weilgart
OceanCare, Switzerland, and Dalhousie University, Halifax, Nova Scotia, Canada

Most marine animals, including marine mammals, fish, and invertebrates, use sound for almost all aspects of their life, including reproduction, feeding, predator and hazard avoidance, communication, and navigation. In the marine environment, vision is only useful over tens of meters, whereas sound can be heard for thousands of kilometers. The potential area impacted by even one noise source can extend to millions of square kilometers. Ocean background human-caused noise levels have doubled every decade for the last several decades in some areas, mainly from commercial shipping.

So, how should a transboundary pollutant such as noise be regulated? Interestingly, the 1982 United Nations Convention on the Law of the Sea includes the word 'energy' to define 'pollution of the marine environment', as in "the introduction by man … of substances or energy into the marine environment … which … is likely to result in … harm to living resources…."[1] Energy in this context can include both thermal and acoustic or noise pollution.[2] Thus, the United Nations General Assembly (UNGA) in paragraph 107 of its resolution 61/222 on 'Oceans and the law of the sea', adopted on 20 December 2006: "Encourages further studies and consideration of the impacts of ocean noise on marine living resources…."[3] Further, UNGA resolution 70/235 adopted on 23 December 2015

> [n]otes with concern that human-related threats, such as … underwater noise … may severely impact marine life … and calls upon States and competent international organizations to cooperate and coordinate their

1 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3, art. 1(4).

2 H.M. Dotinga and A.G. Oude Elferink, "Acoustic Pollution in the Oceans: The Search for Legal Standards," *Ocean Development & International Law* 31, no. 1–2 (2000): 151–182, doi.org/10.1080/009083200276102.

3 United Nations General Assembly, "Oceans and the Law of the Sea," UN Doc. A/Res/61/222, 16 March 2007, para. 107.

> research efforts in this regard so as to reduce these impacts and preserve the integrity of the whole marine ecosystem...[4]

The nineteenth meeting of the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea, in 2018, is dedicated to the theme of ocean noise pollution. Other international fora recognizing ocean noise as a threat include the Convention on Biological Diversity, the European Union's Marine Strategy Framework Directive, the Convention on Migratory Species (CMS), the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area, the Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas, the Convention for the Protection of the Marine Environment of the North-East-Atlantic, the International Maritime Organization (IMO), the International Whaling Commission, and the International Union for Conservation of Nature.

The main sources of human-caused ocean noise are shipping, seismic airgun surveys to detect oil and gas reservoirs under the seafloor, anti-submarine warfare naval sonar, and pile driving such as used for offshore windfarms. Various mitigation approaches have been used by countries. For some proposed noise-producing projects, environmental impact assessments (EIAs) are required, especially since the CMS ratified and endorsed guidelines on EIAs for marine noise-generating activities in 2017. Depending on the country, EIAs sometimes must include an alternatives analysis, examining a range of suitable alternatives (including a 'no action' alternative) and their estimated environmental impact. Some of the most common weaknesses of EIAs are the lack of serious, quantitative risk analyses of cumulative or synergistic impacts (where various threats accumulate in a multiplicative rather than additive way). Power analyses are also often absent from EIAs. Scientific studies of noise impacts should include the statistical probability of finding an effect if one is indeed present. Would there need to be a dramatic, wholesale die-off of a population to detect any effect? Even subtle, hard-to-observe effects can have irreversible, serious impacts. Proof of mitigation effectiveness is also generally missing from EIAs. Frequently, there is not enough basic information on species' distribution and abundance in the proposed area or other baseline biological data before an EIA is produced, hamstringing the usefulness of an EIA.

Common mitigation tools include safety zones together with marine mammal observers. Marine mammal observers generally search a 500-m radius

4 United Nations General Assembly, "Oceans and the Law of the Sea," UN Doc. A/RES/70/235, 15 March 2016, para. 246.

around a noise source for marine mammals and turtles. If animals are detected within the safety zone, the sound source is powered or shut down until the animals leave. The large drawback here is that marine mammals spend a great deal of time underwater where they are out of sight, and turtles are hard to spot unless very close. Moreover, unless the ocean is very calm, without fog or rain, it is difficult to sight marine mammals or turtles. Disturbingly, many noise sources are allowed to operate even at night. Passive acoustic monitoring (PAM) is often used in such situations, deploying underwater microphones (hydrophones) to detect marine mammal sounds. Some species are very vocal, such as sperm whales and beaked whales, but others, less so. Furthermore, it can be difficult to determine the species, bearing (relative to the noise source), and distance of the calling animal. PAM shows some promise, especially when used with gliders, a type of autonomous underwater vehicle that moves slowly forward while going up and down through the water column. Gliders can be outfitted with hydrophones to survey an area for whales and dolphins ahead of a noise-producing project or military exercise. Theoretically, if an area is 'clear', the project can proceed with less risk of noise impact. 'Ramp-ups' or 'soft starts' are also used, whereby sound sources are gradually increased in volume, to theoretically allow animals time to move away. There is limited proof that animals actually do so. Some may be curious and approach the noise at quieter levels only to be hit with the full volume when they are close by. Similarly, acoustic deterrents are sometimes employed to chase animals away before the louder noise source begins operating. All of these mitigation tools are probably better than doing nothing, but generally not highly effective in preventing environmental degradation of an ecosystem through noise.

By far one of the most effective mitigation tools is spatio-temporal restriction on noise activities. Avoiding areas or times of year which are particularly sensitive, such as breeding, spawning, migration, feeding, or resting, is likely to reduce noise impacts. Area-based noise mitigation can also employ marine protected areas (MPAs). MPAs have the advantage that various other (non-acoustic) kinds of stressors or threats are restricted, so that cumulative or synergistic impacts should be minimized. MPAs, however, must be managed with noise in mind, which may require noise buffer zones. Low-frequency noise which generally travels furthest, is most difficult to mitigate, because of the large areas required to keep noise out, compared with mid- and high-frequency noise. Nevertheless, lowering noise levels in MPAs is better than not regulating noise around MPAs at all. After a series of fatal mass strandings involving mainly beaked whales coincident with naval exercises using sonar around the Canary Islands, the Spanish government declared a ban on naval exercises in the Canary Islands within 93 km of shore, in 2004. There have been no mass strandings in the Canaries since that moratorium began.[5] Another approach, albeit still theoretical, is to set aside still-quiet habitat now, knowing that vulnerable populations require it to recover. These 'acoustic refuges' would be designated in habitat that is vital to noise-sensitive populations and has remained quiet, in contrast to much of the rest of their habitat.

The other mitigation tool that is highly effective is reducing the noise levels through, for instance, quieting technologies. One noise source that does not lend itself very well to most of the above-mentioned tools, such as ramp-ups or safety zones, is commercial shipping, which is currently unregulated relative to noise. It falls into a separate category since the noise is unintentional and of no benefit to the noise producer. However, the IMO has agreed to voluntary guidelines to reduce propeller noise from cavitation and engine noise, for instance. Good maintenance and designing ships with noise in mind can cut noise levels, with the possibility of some attendant increases in fuel efficiency. A 2017 study showed that commercial ships retrofitted for energy efficiency also were 6 to 8 dB quieter.[6] Except for use by the military and sometimes fisheries science, ships are not designed to be quiet. If at the design stage, the hull is matched to the propeller design, so that a uniform wake field is produced, cavitation noise can be reduced. Some ports, such as the Port of Vancouver, are incentivizing quieter ships by cutting docking fees for them by up to 47 percent.[7] Green certification programs, such as Green Marine, are starting to include underwater radiated noise as one of the measures used for calculating the environmental rating of a ship. The IMO also uses Particularly Sensitive Sea Areas and Areas To Be Avoided as ways to change shipping routes to avoid sensitive marine life, which can also help with noise levels.[8] Shipping noise levels can, depending on the propulsion system, be reduced by simply slowing down. Often, but not always, slower ships are quieter. If ships avoid running along the continental shelf break, they could reduce the amount of noise entering the deep sound channel, a horizontal duct at depth in the ocean that transmits noise very efficiently over large distances. If ships could instead pass perpendicular over

5 A. Fernández, M. Arbelo and V. Martín, "Whales: No mass strandings since sonar ban," *Nature* 497 (16 May 2013): 317. doi:10.1038/497317d.

6 M. Gassmann et al., "Underwater Noise Comparison of Pre- and Post-Retrofitted MAERSK G-Class Container Vessels," MPL TM-616 Unpublished report, 30 pp.

7 M. Meuse, "Port of Vancouver to cut docking fees for quieter ships by nearly half," *CBC News*, 26 January 2017, http://www.cbc.ca/news/canada/british-columbia/vancouver-port-noise-incentives-1.3953522.

8 See "Particularly Sensitive Sea Areas," International Maritime Organization, http://www.imo.org/en/OurWork/Environment/PSSAs/Pages/Default.aspx.

the shelf break or at greater distance parallel to it, this might minimize the background shipping noise in the ocean.

Aside from reducing shipping noise, other quieting technologies have emerged. An alternative to seismic airguns is Marine Vibroseis, which uses the same energy as an airgun, but spread out over a longer duration, so that the amplitude (loudness) of the airgun shot is reduced. Although airguns produce sound up to 150 kHz, geophysicists only record sound below 200 Hz. Everything above 200 Hz is, in effect, 'wasted energy'. Marine Vibroseis is largely able to cut out these unnecessary frequencies, thus sparing mid- or high-frequency hearing whales and dolphins, like beaked whales, harbor porpoises, dolphins, killer whales, belugas, and narwhals. Marine Vibroseis helps even low-frequency hearing whales, such as the baleen whales, as overall levels are substantially lower.[9] Moreover, with Marine Vibroseis there is no injurious sharp onset, like a gunshot, where the levels rise almost instantaneously from zero to high. Marine Vibroseis prototypes are currently being tested, but are not yet commercially available. There are a wide variety of quieting technologies used for pile driving, such as bubble curtains and cofferdams. Innovation of these quieting technologies was mainly brought about by the German government's noise limits, the only country to legislate underwater noise in this way.

Overall, however, underwater noise is particularly deserving of precautionary management. Noise impacts on whales are especially difficult to document, particularly the most critical impacts on their populations.[10] The ocean is not a controlled laboratory; prey distributions change for unknown reasons, whale population estimates are very imprecise so population changes are hard to detect and moreover, to link to noise alone and not some other stressor. For these reasons, and because marine animals are highly dependent on sound and the potential area of impact is so large, the burden of proof should be on the project proponents, not those trying to preserve the environment from degradation through noise.

9 A.J. Duncan, et al., "A Modelling Comparison between Received Sound Levels Produced by a Marine Vibroseis Array and Those from an Airgun Array for Some Typical Seismic Survey Scenarios," *Marine Pollution Bulletin* 119 (2017): 277–288.

10 L.S. Weilgart, "The Need for Precaution in the Regulation and Management of Undersea Noise," *Journal of International Wildlife Law and Policy* 10, no. 3 (2007): 247–253.

Ecological Economics and the Ocean

Gabriela Sabau
Memorial University of Newfoundland,
Corner Brook, Newfoundland and Labrador, Canada

Introduction

Ecological economics was born as a transdisciplinary field of enquiry in the 1980s out of some ecologists' and economists' desire to work together to explore the intricate interactions between natural and economic systems. A principal aim was to find practical solutions for a sustainable economy. Unlike mainstream economics, ecological economics sees the human economy as an open subsystem of the larger but finite, closed, and non-growing global ecosystem. Consequently, its functioning should be governed by the same immutable physical laws—the first and second laws of thermodynamics—and biological principles, explained in terms of energy and material flows.[1] This implies that there are objective limits to the biophysical throughput of resources from the ecosystem, through the economic subsystem, and back to the ecosystem as waste. It also implies that a steady-state economy, which deliberately minimizes throughput rather than maximizing consumption,[2] is more 'natural' than the current unlimited growth economy that has exceeded planetary boundaries.[3]

The main goals of ecological economics are efficient allocation of resources, just income and wealth distribution, as well as sustainable scale of the macroeconomy. While competitive markets through relative prices are the policy instrument for efficient resource allocation, just distribution and an optimal scale are social priorities that must be collectively decided on, based on science and ethical judgements rather than on subjective willingness-to-pay calculations. Their implementation requires policies designed to match means to alternative ends. Ecological economics assumes that there are ultimate means and ultimate ends, and that humans make choices along the entire ends-means spectrum (Figure 1). The ultimate means, which are scarce and

1 N. Georgescu-Roegen, *The Entropy Law and the Economic Process* (Cambridge: Harvard University Press, 1971), 457.
2 H.E. Daly, *Toward a Steady-state Economy* (San Francisco: W.H. Freeman & Co, 1973), 332.
3 J. Rockström et al., "Planetary Boundaries: Exploring the Safe Operating Space for Humanity," *Ecology and Society* 14, no. 2 (2009): 32, http://www.ecologyandsociety.org/vol14/iss2/art32/.

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FIGURE 1 The ends-means spectrum
SOURCE: R. COSTANZA ET AL. 2016. USED WITH PERMISSION.

should not be wasted, are low entropy matter-energy that humans extract from nature; the ultimate ends of economic activity can be many, from more individual material consumption, to achieving "sustainable, equitable and prosperous wellbeing."[4]

The Ocean, the New Frontier

Until relatively recently, the focus of ecological economics was mostly terrestrial, perhaps due to an early theoretical inheritance from the physiocratic school of economic thinking, which believed that land and labor were ultimate sources of wealth. In a seminal 1997 article, Costanza et al. calculated that oceans (coastal and marine ecosystems) are also sources of wealth. They contributed approximately US$22.6 trillion that year to human welfare, a not insignificant amount compared to that year's global GDP of US$25 trillion.[5] A book advocating for an ecological economics of the oceans and coasts was published in 2008,[6] in which the authors argued that an ecological economics approach would move the management of oceans from the damaging 'frontier economics' paradigm currently dominating marine management to a sustainable governance of the oceans. Frontier economics assumes that biophysical limits do not exist and that oceans are more or less up for grabs through "reckless, exploitative, romantic, and violent behavior" of the "cowboys on

4 R. Costanza et al., "Modeling and Measuring Sustainable Wellbeing in Connection with the UN Sustainable Development Goals," *Ecological Economics* 130 (2016): 350–355.

5 R. Costanza et al., "The Value of the World's Ecosystem Services and Natural Capital," *Nature* 387 (1997): 253–260.

6 M. Patterson and B. Glavovic, eds., *Ecological Economics of the Oceans and Coasts* (Cheltenham: Edward Elgar, 2008), 372.

illimitable plains."[7] This behavior constantly pushes the frontier with help from technology. A frontier economics philosophy of ocean use has led to the depletion of global wild fish stocks starting in the 1950s, as larger vessels using advanced technologies (e.g., trawling, sonar equipment) coupled with government subsidies led to overfishing and high levels of pollutants, with devastating impacts on marine life. As well, about 88 million tons of plastic litter is now in the oceans and about 8 million more plastic items are added every day.[8] The rate of ocean acidification due to unchecked carbon dioxide emissions is at least 100 times faster than at any other time in 20 million years. These human impacts threaten not only life in the ocean, but also the functioning integrity of the ocean, disturbing its global biogeochemical cycles, its complex spatial patterns of marine photosynthesis, and its ability to provide ecological services. An ecological-economics approach can change the way we view and treat the ocean, by addressing the issues of sustainable scale and just distribution.

Sustainable Ocean

Oceans cover approximately 71 percent of the Earth's surface and hold about 97 percent of the Earth's water. They are essential for regulating the planetary system by driving the climate and weather systems and by influencing the global carbon cycle. Oceans capture and store 54 times more carbon dioxide than the atmosphere, absorbing more than a quarter of the carbon dioxide humans emit,[9] thus being our best ally in fighting climate change. They also provide ecological services like coastal protection, nutrient cycling, and degradation of organic wastes (toxin neutralization). Oceans supply numerous biotic and abiotic resources from fish and marine biotechnology to minerals, oil and gas, and renewable energy. It is assessed that the global capacity of wave and tidal energy systems could exceed that of about 120 nuclear reactors, as 80 percent of the potential kinetic energy from waves can be converted into electricity.[10] Oceans also provide social and economic goods and services like tourism,

7 K.E. Boulding, "The Economics of the Coming Spaceship Earth," in *Environmental Quality in a Growing Economy*, ed., H. Jarrett (Baltimore: Johns Hopkins University Press, 1966), 3–14.

8 T. Juniper, *What's Really Happening to Our Planet? The Facts Simply Explained* (New York: DK Publishing, 2016), 164.

9 Global Ocean Commission Report, *From Decline to Recovery: A Rescue Package for the Global Ocean*, June 24 2014, 5, https://www.mpaaction.org/sites/default/files/Global%20Ocean%20Commission_2014_From%20Decline%20to%20Recovery.pdf.

10 *Supra* note 8, 59.

recreation, and marine transportation for both goods and people. Thousands of ships are crossing the ocean daily carrying 90 percent of all internationally traded goods, according to the International Maritime Organization. In the Netherlands, where already floating houses exist, an aquatic architecture firm DeltaSync is working to design and develop the first self-sufficient floating city in the world. What is the optimal scale of economic and social activities that can take place in the ocean?

In ecological economics, optimal scale is identified relative to the ecosystem's boundaries. It is the point where the marginal (extra) cost of increasing an activity equals the marginal benefit of the increased activity. When the marginal costs exceed marginal benefits, uneconomic growth happens—growth whose opportunity cost does not justify the additional benefits of increased activity. For instance, when intensified farming discharges too much nitrogen- and phosphorous-rich fertilizers and livestock waste into the sea creating hypoxia zones in coastal waters, the scale of farming is not sustainable and needs to be curtailed to eliminate uneconomic growth. Currently, there are 405 dead zones in coastal waters worldwide that cause many damaging effects, from loss of wildlife biodiversity to the collapse of fisheries.[11] This is the consequence of seeing the ocean as merely an extractive and waste disposal sector of the economy and not as part of the biophysical planetary whole that supports the economic subsystem and sets ecological limits to economic activity. In order to calculate the optimal scale of economic activities in the ocean we need to define its ecological sustainability. If ocean ecological sustainability is defined as a "social or collective limit on aggregate throughput to keep it within the absorptive and regenerative capacities of the ecosystem,"[12] global restrictions can be calculated and imposed both on the input flows from the ocean (depletion) and on the output flows (pollution) going into the ocean. Elements of ocean-critical natural capital, which perform vital and irreplaceable functions, need to be identified and protected. These are monumental tasks that require a clear vision and collaboration of many stakeholders, scientists (marine biology, oceanography, ocean engineering, fisheries and aquaculture, and sustainability science etc.), policy- and decision-makers, ocean users, and other public interest representatives. The ecological sustainability of the ocean is an objective collective value determined not by subjective personal preferences, but by the deep understanding of the need to preserve the long-term integrity of the ocean.

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11 Id., 163.

12 H.E. Daly and J. Farley, *Ecological Economics Principles and Applications* (Washington, DC: Island Press, 2011), 417.

A Fair Use of the Ocean

Unfortunately, the ocean, especially the deep sea, remains largely unexplored. Moreover, it is difficult to assign use and property rights to the ocean, which is a vast, common property asset, non-excludable and rival. The 1982 United Nations Convention on the Law of the Sea (UNCLOS) started to address the issue of open access to the ocean by establishing rights, duties, and responsibilities of coastal states to use ocean space and resources up to a distance of 200 nautical miles from coastal baselines. UNCLOS opened the possibility for further regulation of the use of the ocean by coastal states, especially through management of their fisheries, but also of the ocean under their jurisdiction. Canada was the first country in the world to adopt an *Oceans Act* in 1996.[13] The Act is now being amended to speed up the process of protecting at least 10 percent of Canada's oceans by 2020.

Beyond coastal states' exclusive economic zones, there is a vast ocean representing 64 percent of the total global ocean area of international waters or 'high seas' over which there is little, fragmented, or no institutional control. As a consequence, the once 'free' high seas area, which used to be pristine, beautiful, and extremely rich in biodiversity, is now overexploited by mostly unregulated users. A biodiversity loss crisis is unfolding on the high seas threatening vulnerable marine species of fish, corals and sponges. This use of the ocean is neither sustainable nor socially and ecologically just. If we define justice as equal opportunity to access the ocean resources and to develop the capabilities needed for a good life,[14] we understand the urgency of a plan to free up the open ocean from its stressors and predators. The 2014 report of the Global Ocean Commission[15] identified the main drivers of ocean decline and proposed actions that are starting to bear fruit: a 2015 United Nations General Assembly resolution (69/292) established a process for developing a new international legally binding agreement under UNCLOS for protection of high seas biological diversity. Of special importance, from an ecological economics perspective, is the proposal to turn, by 2020, the high seas into a 'regeneration zone' where industrial fishing is forbidden, should insufficient actions be taken by then and should the state of the ocean continue to decline. Such a zone, equivalent to a huge marine protected area, could have a significant impact on restoring the health and functions of the ocean, as demonstrated by the

13 S.C. 1996, c. 31.

14 A. Vatn, *Environmental Governance: Institutions, Policies and Actions* (Cheltenham, UK: Edward Elgar, 2015), 444.

15 *Supra* note 9.

first high seas marine protected area established in 2010 in the South Orkney Islands in the South Atlantic under the Commission for the Convention on Conservation of Antarctic Marine Living Resources. According to researchers, this area is a significant carbon sink, providing negative feedback to climate change.[16]

The global ocean is the common heritage of humankind, an invaluable gift of nature that needs to be responsibly used and that demands fair access to its wealth. Through its scientific and ethical assumptions, ecological economics could lead to sustainable governance of the ocean, a gift to be enjoyed not only by this generation, but by future ones too.

16 D.K. Barnes et al., "Why is the South Orkney Island Shelf (the World's First High-seas Marine Protected Area) a Carbon Immobilization Hotspot?," *Global Change Biology* 22, no. 3 (2016): 1110–1120.

Sustainable Tourism: The Long View

Deirdre P. Shurland
DestiSist, Brunswick, Maryland, United States

When the history of tourism is written in its encyclopedic detail, it will recount the influences of ancient civilizations, empires, and dynasties (e.g., Persian, Egyptian, Chinese, and Roman). Their relics are the antecedents of today's great cities, with road and infrastructure networks, centers of learning, culture, language, religion and architecture, systems of law and government. Particularly in Europe and Asia, this heritage endured over centuries and is today's tourism attractions that draw intense visitor curiosity.

Tourism is commonly reflected through history as movements of people across neighboring towns, regions, and countries. Some researchers mark the beginning of tourism from the late seventeenth century when the classic 'Grand Tour' reached its pinnacle led by the British aristocracy, landed gentry, and wealthy European citizens, as 'tour-ists' pursuing experiences in European classics and culture.[1] Grand touring via horse-drawn carriage took months and years, and Italy and France were the most popular destinations.

Over time as the steamboat and railway opened up once impenetrable frontiers, so too the automobile and airplane eventually became modes of transportation that facilitated quicker travel through contiguous states and from lower societal strata. These transit modes would move people over greater distances, in larger numbers and in progressively shorter times, eventually making business, leisure, or holiday travel commonplace.

On the demand side and in the current digital age, advances in Internet and mobile technologies brought travel planning literally to the palm of the hand, where an entire vacation can be decided in a matter of minutes. The immediate consequence was a reduced need for intermediary travel agents and a continued explosion of booking websites that ensured wide access to digital tools best exemplified by the Airbnb accommodation- and Uber ride-sharing platform applications. Described as the 'sharing economy', these sites are most amenable to today's twenty-first century traveler—the younger, upwardly mobile millennials (ages 18 to 37), who are already reshaping current and future tourism demand, behaviors and trends.

1 U. Gyr, "The History of Tourism: Structures on the Path to Modernity," European History Online, 12 March 2010, http://ieg-ego.eu/en/threads/europe-on-the-road/the-history-of-tourism/ueli-gyr-the-history-of-tourism/?searchterm=history%20of%20tourism&set_language=en.

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On the supply side, the 1960s and 1970s saw surges of mass tourism in European countries like Spain[2] as part of economic policy that brought rapid investment and development, growth, and prosperity, especially to high-valued real estate locations along Spain's east coast and in Mediterranean regions with their beaches and agreeable climates. The higher the arrival numbers, the more successful the destination was considered. Mass tourism, however, eventually caused overcrowding that disrupted livelihoods and impaired landscapes, quality of life, and services.[3] Once entrenched it was difficult to reverse. While overcrowding was a phenomenon observed in eighteenth century Spain and Italy, today's 'overtourism' at the most popular of European city destinations, i.e., Barcelona, Amsterdam, Dubrovnik, and Venice, bears the same hallmarks,[4] with high numbers of visitors that have spawned protests and complaints by residents.

The term 'sustainability' evolved from early usage in the eighteenth century forestry industry[5] when foresters warned of the threats to long-term commercial logging from overconsumption of timber resources. In the 1960s, sustainability was associated with objectives to arrest the poisoning effects of manufacturing process discharges in the environment, which had devastating consequences for human health and ecosystem integrity. In the first decade of the twenty-first century, sustainability was associated with the social and environmental consequences of high rates of production of goods and services driven by higher levels of consumption, which depleted resources and perpetuated a vicious cycle. In that respect, the focus was on industries such as tourism with its high growth and consumption rates. Most recently a portmanteau of terms has emerged (e.g., ecotourism, geotourism, and responsible tourism) to promote more ethical objectives for tourism development,[6] yet with little clarity of concept. As noted below, confusion in the use and multiplicity of terms presents a significant barrier to sustainable tourism.

The core issue is the scale of depletion of land, water, energy, and raw material resources with consequent impacts. Coastal and waterfront areas are

2 F. Almeida Garcia, "Tourism Policy and Territorial Imbalances in Spain (1)," *Bulletin of Geography. Socio–economic Series* no. 22 (2013): 7–19.

3 Id.

4 See "Barcelona Approves New Law to Limit Tourist Numbers," *Condé Nast Traveler*, 27 January 2017; "How Much Tourism is Too Much?," *The New York Times*, 29 June 2017; E. Becker, "The Revolt against Tourism," *The New York Times*, Sunday Review, 17 July 2015.

5 *World Ocean Review 4: Sustainable Use of Our Oceans—Making Ideas Work* (Hamburg: maribus, International Ocean Institute, and mare, 2015), 10, http://worldoceanreview.com/wp-content/downloads/wor4/WOR4_en.pdf.

6 "The Case for Responsible Travel: Trends & Statistics 2017" (Washington, DC: Center for Responsible Travel, n.d.), http://responsibletravel.org/docs/The%20Case%20for%20Responsible%20Travel%202017_Final%20for%20Release.pdf.

pressured by high-valued tourism development. Forest and marine ecosystems and their inherent ecosystem services (e.g., provisioning, regulating, prevention, and recreation)[7] are affected by hotel and resort development, cruise operations, construction of service roads, and other infrastructure. Water and energy use by hotels and resorts have often compromised the reliability of local supply sources. Inefficient or outdated appliances and equipment, and inefficient or wasteful processes have emitted polluting gases and generated solid wastes. Airplanes emit significant greenhouse gases. Increased visitor numbers are testing the patience of residents. Collectively, all these threaten to overwhelm national and local government capacity to manage, accommodate, and control tourism impacts.

The prospects for managing tourism impact are discouraging. The World Tourism Organization indicates that tourism currently generates 1.2 billion arrivals—projected to increase to 1.8 billion by 2030—accounts for 10 percent of global GDP, one in ten jobs, and 7 percent of global exports. This makes tourism an attractive development strategy for countries. UN Environment, however, is cautioning about pursuing high-consumption forms of tourism development. If left uncurbed, current rates of tourism energy and water consumption could double by 2050 along with the costs of remedial action, particularly for least developed and developing countries.[8]

The problem lies in the unknown size of the tourism value chain, unchecked visitor arrival numbers and unmitigated consumption. Tourism is also now a contributor to major global issues such as global warming, increased disaster impact, and biodiversity loss. Climate change is exacerbating these issues by amplifying geographic and environmental risks,[9] which are reverberating in increased local conflict and disruption. This is unwelcomed news for destinations.

Since 1972,[10] the United Nations' involvement in sustainable development has done much to elaborate the concept of sustainability and to advance related thought, practice, and knowledge. Progress was made on the tenets of

7 See "Ecosystem Services," IUCN, https://www.iucn.org/commissions/commission-ecosystem-management/our-work/cems-thematic-groups/ecosystem-services.

8 United Nations Environment Programme and World Tourism Organization, "The Sustainable Tourism Programme of the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns," http://cf.cdn.unwto.org/sites/all/files/docpdf/brochure10yfpstpenupdated17oct2016.pdf.

9 World Economic Forum, *The Global Risks Report, 2016* (Geneva: World Economic Forum, 2016).

10 The first major United Nations conference on international environmental issues, the UN Conference on the Human Environment, convened in Stockholm, Sweden, from 5 to 16 June 1972.

sustainable development (1992 Agenda 21), control of air pollutants (1987 Montreal Protocol), and global warming (1997 Kyoto Protocol), and reducing disaster risks (2005 Hyogo Framework), among other issues. Decades later and with agreement from over 190 countries, these UN-led actions culminated in the 2015 Paris Agreement to reduce global warming; the 2030 Sustainable Development Goals promoting prosperity, equality and justice for all; and the 2030 Sendai Framework for Disaster Risk Reduction. Through these and other UN programmes, countries are transforming their major impacting and consuming sectors.

A range of tourism actors has also been collaborating for decades (public and private sector, non-profits, international and regional agencies) to develop sustainability approaches, design and implement management systems, and co-ordinate action through partner networks. Hotels, as leading targets of these actions, achieved savings in water and energy consumption and land resources (percentage set aside for conservation), while also improving staff capability and community benefits. Many participants touted the advantages of saving money and being market leaders. These initial successes yielded best practice and case study publications that proved the sustainability business advantage. However, to overcome continued criticism of a lack of sustainability, the majority of tourism actors must participate, which is not the case today. Among many barriers cited, particularly by small- and medium-sized businesses, are lack of financial capacity to absorb improvement costs, limited know-how, and poor understanding of sustainability concepts, with perhaps the most daunting being the comparatively low return on investment.

With the recent spectacle of extreme events flooding city centers and devastating island communities, sustainability has once again been placed at the top of the international tourism agenda. Although rebuilding of destinations is projected to last decades, tourism services will gradually recover as infrastructure systems are restored. As tourism businesses face repeated cycles of business interruption from extreme events, they can no longer disconnect their operations from the destination's vulnerability or the rising costs of climate resilience.

Large global businesses in financial, manufacturing, and retail sectors have organized to reduce value chain risks and decarbonize their operations, thus meeting investor demands for corporate social responsibility. They are also among a growing list of companies undergoing rapid digital transformation.[11]

11 Sectors leading the digital transformation include financial services, retail, health care, government, and technology. See "Connectivity Benchmark Report 2017," MuleSoft, https://www.mulesoft.com/lp/reports/2017-connectivity-benchmark.

Notably absent, or at best underrepresented from these groups, are tourism businesses. This suggests that as one of the world's leading economic sectors,[12] the tourism economy is lagging behind other global sectors in its advancement.

While the destination's sustainability should be considered a collective goal among its stakeholders, its management needs an altered viewpoint. Tourism is a dynamic, people-centered system characterized by varying needs interacting at the destination, with its available resources and attractions. The destination should satisfy visitor needs through quality services but in a reciprocal exchange that balances with those of resident communities. Viewing tourism as an 'industry' is to misunderstand its nature, managing it as a 'sector' is to miscalculate its consequence. Such a dynamic system requires agile, people-centered management approaches to address tourism impacts and to build a culture of service quality and innovation.

Moreover, the typical destination management agency, e.g., the tourism ministry or department has not, to date, been able to provide all the requisite skills to manage tourism's organic nature, complexity and scale. They are traditionally under-resourced and frequently hampered by management processes that are unable to keep pace with the ever-changing demands of tourism stakeholders. In addition, these agencies are now increasingly tasked with responding to a global agenda and coping with fast-emerging, sometimes unanticipated local situations. At best, their response times may be described as excruciatingly slow or constrained by outmoded processes.

For countries where tourism is the leading economic sector therefore, there are three practices that need to be mastered:

Long-Range Planning

Developing long-range aspirational strategies with 20 to 30-year time horizons[13] are important for presenting the tourism development objective in the context of national and local priorities, and to addressing the major global development issues and agreements discussed above. As a consensus document

12 The World Travel and Tourism Council (WTTC) describes tourism in terms of absolute size, growth, and share of exports, as one of the most important industries in the world. See "The Comparative Economic Impact of Travel & Tourism," WTTC (November 2012), https://www.wttc.org/-/media/files/reports/benchmark%20reports/the_comparative_economic_impact_of_travel__tourism.pdf.

13 For example, Spain adopted a longer-range view of planned tourism, Turismo 2020, after experiencing difficulties with its mass tourism strategies. See "Plan del Turismo Español Horizonte 2020," http://statistics.unwto.org/sites/all/files/pdf/spain.pdf.

it would be elaborated in partnership with a range of tourism stakeholders, which would ensure that its long timeframe remains impervious to changes in political administration. Co-ordinated by a lead agency, the strategy will be achieved through a succession of short-term, more adjustable action plans (3–5 years) by the co-operating public and private sector organizations that will sequentially accomplish the main goal. This is the fundamental purpose for building common support and sharing the burden of tourism management. Achieving the destination's long-term strategy would be monitored via a digital platform that locks in tourism stakeholder commitment and action. This approach affirms the importance of planning as a continuous vertical and horizontal process and the use of digital technology as an enabling solution for speeding up achievement of the defined goal.

Engaging Tourism Stakeholders

The participation of a wide range of actors organized and communicating vertically and horizontally at the destination is needed to match the complexity of the tourism economy. This implies that public and private stakeholders and civil society groups are steadily engaged in planning, marketing, operating, and managing tourism, with the most agreeable outcomes. This also speaks to a tourism governance organization that is transparent, accountable, and guided by clear delineation of institutional roles and responsibilities, with resources shared and allocated to effectively accomplish the goal. The lead co-ordinating agency must have a clear mandate, vision, and institutional prowess to galvanize co-operation across sector agencies and ensure participation of businesses and civil groups, and also be accountable for outcomes.

Measuring, Monitoring, and Reporting

Building functional networks of participation across the tourism value chain also provides the co-operating infrastructure for measuring, monitoring, and reporting on sustainability outcomes. The use of digitized processes will instill discipline, spur innovation, and speed up advancement toward sustainability goals. Without digitization, destinations will remain forever reliant upon moribund systems ill-suited to today's expanding traveller needs and global challenges.

In summary, sustainable tourism is fundamentally about destination stakeholders building up habits of excellence, continuous improvement, achieving, and resetting new goals. These are tourism's traditional management weaknesses, which may gradually be remedied in cycles of repeated planning, doing, achieving, and learning. Advancement in sustainability requires a culture of innovation, good decision-making, and quality data managed through smart and available technologies. If these values and technology use are ingrained into management processes, twenty-first century tourism destinations are certain to offer innovative and competitive tourism services for the foreseeable future.

Ocean and Climate Change Action: Opportunities for Economic and Environmental Sustainability

Peter J. Ricketts
Acadia University, Wolfville, Nova Scotia, Canada

The year 2017 was a major one for highlighting the impacts of climate change on the world's oceans and the subsequent effects upon the global population. For decades rising sea levels, intensification of storms, continued melting of Arctic sea ice and permafrost, and deterioration of coral reefs have been increasing the vulnerability of our coasts to erosion, flooding, and salt water intrusion. Scientists have been warning of the catastrophic impacts that climate change is having upon the world's oceans and that these impacts are cumulative over time and will continue to increase in severity.[1] Such studies, together with more journalistic attempts to raise public alarm (e.g., Alanna Mitchell's cry for help in her book *Sea Sick*[2]) have raised awareness but done little to galvanize decision-makers into more resolute action. True, the oceans were finally included in the United Nations Framework Convention on Climate Change (UNFCCC) in the Paris Agreement in 2015, but it seems to take disasters for people to realize that significant change is happening. If earlier storms such as Hurricanes Katrina in 2005 and Sandy in 2012, and Typhoon Haiyan in 2013 were not warning enough, the well-publicized impacts of the 2017 hurricane season on the Caribbean islands and coastal cities and communities across the Gulf and Atlantic coasts of the United States have made it clear that the effects of climate change are becoming ever more obvious. Not only do they represent event-specific challenges to emergency management at local or regional scales, but the extent, severity, and frequency are also challenging from an ocean and coastal governance perspective.

In Canada, many coastal communities, including important population centers like Vancouver and Richmond, Toronto, Charlottetown, and Tuktoyaktuk are at risk of serious inundation as a result of rising sea levels, increased storm surge penetration, and high lake levels due to changes in precipitation

1 See, e.g., R. Schubert et al., *The Future Oceans: Warming Up, Rising High, Turning Sour* (Berlin: German Advisory Council on Global Change, WGBU, 2006); P.J. Ricketts, "State of Fear or State of Oblivion? What Coastal Zones Are Telling Us About Global Change and Why We Need Integrated Ocean and Coastal Management on a Global Scale," in *Integrated Coastal Zone Management*, eds., E. Moksness, E. Dahl, and J. Stttrup (Wiley-Blackwell, 2009), 1–23.
2 A. Mitchell, *Sea Sick: The Global Ocean in Crisis* (Toronto: McClelland & Stewart, 2009).

patterns. In some cases, entire provinces are facing significant impacts. In Prince Edward Island, both the provincial capital and significant low-lying coastal areas and islands are at risk of being submerged. Nova Scotia faces the very real prospect of becoming an island if the Tantramar marshes on the border with New Brunswick are inundated by tidal waters. As I expressed at the time of the Sustainable Ocean Summit in Halifax in 2017, "there is no doubt that in Canada and around the world we are seeing real and tangible impacts of climate change that are causing loss of life and livelihood, as well as inflicting billions of dollars in damages to buildings, harbours and infrastructure in coastal zones."[3]

Beyond Canada, the threat to large coastal cities and smaller communities along the eastern seaboard of the United States (especially those on barrier islands and low-lying coastal plains such as in Maryland, Virginia, North Carolina, and South Florida), the Gulf of Mexico, and the northwestern coastlines of the United States is also increasing. It is estimated that 13 million Americans will be at risk of displacement. Places like Jekyll Island in Georgia, Isle de Jean Charles in Louisiana, and Newtok and Shishmarek in Alaska are now looking for safer locations. As the experience of New Orleans during and after Hurricane Katrina clearly demonstrates, poorer communities are especially at risk. A new study by the Center for Progressive Reform emphasizes that many of the most vulnerable are Native Americans. The report even provides a guidebook for coastal communities looking to relocate.[4]

Of course, none of this compares with the catastrophic impacts being faced by low-lying small island developing states (SIDS), which are facing the prospect of complete submergence and in some cases the necessity of evacuating their entire population to another country. It is predicted that for the world's 52 small island states, sea level rise is as much as four times the global average, and increasing levels of vulnerability means trillions of dollars in annual economic losses.[5] If present rates of sea level rise continue, the list of islands that will be either entirely or substantially submerged by the end of this century is truly alarming. It includes iconic destinations like the Maldives, the Seychelles,

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3 P.J. Ricketts, "Opinion: The World's Oceans Desperately Need Our Help," *The Chronicle Herald*, 28 November 2017, http://thechronicleherald.ca/opinion/1524578-opinion-the-world%E2%80%99s-oceans-desperately-need-our-help.

4 M. Burkett, R. Verchick and D. Flores, *Reaching Higher Ground: Avenues to Secure and Manage New Land for Communities Displaced by Climate Change* (Washington, DC: Center for Progressive Reform, 2017).

5 United Nations Environment Programme (UNEP), *Emerging Issues for Small Island Developing States: Results of the UNEP Foresight Process* (Nairobi: UNEP, 2014), https://sustainabledevelopment.un.org/content/documents/2173emerging%20issues%20of%20sids.pdf.

French Polynesia, the Solomon Islands, and New Caledonia. Kiribati has already taken the precaution of purchasing 6,000 acres of land in Fiji as a place to relocate its population, and Fiji itself is facing catastrophic consequences from climate change, including the loss of vital coral reefs and the potential displacement of large portions of its population.

Recognition of the need for action is growing among the parties to the UN climate convention. At the 2016 Conference of Parties (COP 22) in Morocco, Fiji emerged as a voice for the small island and coastal states most at risk. The Pacific nation sought to give a higher profile to the ocean in future climate negotiations through the introduction of the Ocean Pathways Initiative.[6] Opportunities to push forward on this front came the following year when Fiji assumed the presidency of COP 23 in November 2017, in Germany. By then, a UN conference on oceans in New York in June and the European Union's *Our Ocean Conference* in Malta in October had put climate-related ocean issues high on the agenda. Oceans Action Day at COP 23 brought together over 220 high-level representatives, including heads of state, from 60 countries and from governments, intergovernmental organizations and international agencies, non-governmental organizations, industry, donors, and scientific institutions.

More Progress Required

The primary focus of Oceans Action Day 2017 was a review of progress on the Roadmap to Oceans and Climate Action (ROCA), a comprehensive set of policy recommendations developed by the Global Ocean Forum, a multi-agency initiative based at the University of Delaware. The so-called 'ROCA Initiative' addresses the central role of oceans in climate and climate change and identifies policy recommendations under six critical areas of concern: mitigation, adaptation, Blue Economy, displacement, financing, and capacity development.[7] A number of startling conclusions emerged from the review.

Global concentrations of carbon dioxide (CO_2) in the atmosphere are now above 400 parts per million (ppm), long considered to be the tipping point at which climate impacts will continue to increase even if emissions are reduced. The hottest year on record, 2016, beat previous records set by 2015 and 2014,

6 "The Ocean Pathway: A Strategy for the Ocean into COP23," Marrakesh Partnership, 8 November 2017, https://cop23.com.fj/wp-content/uploads/2017/11/The-Ocean-Pathway-Strategy-8.11.2017.pdf.

7 M. Kurz and B. Cicin-Sain, *Assessing Progress on Ocean and Climate Action: 2016–2017: A Report of the Roadmap to Oceans and Climate Action (ROCA) Initiative*, ROCA, https://rocainitiative.files.wordpress.com/2017/11/roca-progress-report-email-november-41.pdf.

and 2017 was on track to be in the top-five hottest years on record, perhaps even the hottest year ever without an El Niño event. It was also the most intense hurricane and typhoon year on record.

The ocean is absorbing 93 percent of the extra heat energy and has taken up 27 percent of total CO_2 emissions. The combined impacts of ocean warming, deoxygenation, acidification, and sea level rise are causing major adverse impacts on marine species and on the lives of millions of people in coastal regions around the world. In short, the oceans are warming, rising, souring, and asphyxiating as they have for the past few decades, but now at a more alarming rate than ever. The physical, economic, and food security of populations living in coastal and ocean locations are at unprecedented risk.

What can be done? The ROCA Initiative stresses the need for stronger global action by all countries in four important areas:

1. Develop and implement measures to reduce warming trends, such as so-called 'Blue Carbon' policies that use the ocean and its ecosystems to store and absorb (CO_2) and reduce emissions at least enough to reach the 'less than 2°C' target of the Paris Agreement and ideally not get beyond 1.5°C;
2. Increase scientific research into the ocean's response to global warming, the impact on human populations, and the best remedial options;
3. Develop and implement measures to adapt to the new norms of a warmer climate, especially ones that utilize natural techniques to reduce the vulnerability and increase resilience of coastal ecosystems and populations; and
4. Develop, promote and apply Blue Economy approaches that recognize the capacity of the oceans to sustain economic activities and promote low-carbon techniques to increase economic diversity and ensure sustainable management of ocean and coastal resources.

In addition to these four action areas, the importance of addressing population displacement, financing and capacity development for SIDS were also identified as critical areas where immediate action is required.

Work Together for Good and Gain

Canada's *Oceans Act*[8]—proclaimed more than 20 years ago—provides a federal framework for addressing many of the issues raised at COP 23 and many aspects of the ROCA Initiative's proposed actions on climate adaptation. The Act

8 S.C. 1996, c. 31.

has yet to be implemented in any way close to its potential or its promise,[9] but the current federal government has re-committed to moving forward and has allocated significant resources to its Oceans Protection Plan and the Disaster Mitigation and Adaptation Fund.[10] Many provinces also are taking action to address the increased impacts they are facing from climate change. We need, however, more effective collaboration between federal and provincial governments to implement those sections of the *Oceans Act* that specifically speak to ecosystem-based management and integrated coastal and ocean management. In addition, the active engagement of First Nations, local governments, industry and business, and coastal communities must be incorporated into this integrated approach.

In the United States, federal legislation on coastal management and oceans has resulted in a great deal of progress over the past 45 years. Despite the current White House announcing its intent to pull out of the Paris Agreement, much of the groundwork being done is at the state level. However, there is no doubt that without the support of the federal government, efforts by American states to combat climate change and implement effective management strategies will be more difficult, and the accelerated impacts will continue to result in increasing losses of life and infrastructure, and escalating costs to the American economy.

Despite the desperate need to deal with the negative impacts of climate change, the ROCA Initiative also points to enormous economic opportunities presented by a new approach to ocean and coastal management. The "Blue Economy" component of the Initiative identifies the potential to increase economic diversity and ensure sustainable management of ocean and coastal resources through emphasizing low-carbon solutions. Although the Roadmap discusses this primarily in the context of small island developing states, the applications for a developed country like Canada are substantial. A recent Organisation for Economic Co-operation and Development report on the ocean economy, of which the Blue Economy is a component, estimates that even on a business-as-usual forecast, the value of ocean-based industries will double in value to over US$3 trillion by 2030.[11]

9 P.J. Ricketts and P. Harrison, "Coastal and Ocean Management in Canada: Moving into the 21st Century," *Coastal Zone Management Journal* 35, no. 1 (2007), 5–22.

10 See "Oceans Protection Plan," Transport Canada, last revision 22 December 2017, http://www.tc.gc.ca/eng/oceans-protection-plan.html; Office of the Auditor General of Canada, *Reports of the Commissioner of the Environment and Sustainable Development, Report 2: Adapting to the Impacts of Climate Change* (Ottawa, Fall 2017), para. 2.11.

11 Organisation for Economic Co-operation and Development (OECD), *The Ocean Economy in* 2030 (Paris: OECD Publishing, 2016), 13.

Canada must be a major contributor to and beneficiary from this new global ocean economy but developing and implementing an appropriate framework for inter-governmental co-operation to address the impacts and opportunities of climate change is essential. Without strategic collaboration from all levels of government, we will never be able to coordinate the balance between mitigation, adaptation, and science needed to start turning the tide in our management of climate change and its inevitable impacts on humanity, let alone reaping the potential benefits of the new ocean economy.

PART 6

Fisheries and Aquaculture

The sea, like a mother, provided nourishment to infant humanity which possibly fished before it hunted. The inventiveness of primitive humankind in fish-catching has amazed many an anthropologist ... The earliest cave dwellers in the Mediterranean region in Mesolithic times had become fishermen by the seventh millennium B.C. Large numbers of fishbones were found in their caves. ... Homo erectus, the only human species living in Southeast Asia 800,000 years ago, was a seafarer, capable of piloting a vessel over at least 600 km of deep fast-moving waters, from Java to the Indonesian island of Flores ... And since the stone age, fisheries have constituted the basis of the economies of coastal communities. Fishing encouraged ship-building and enhanced the spirit of science and exploration, international trade and naval power.

Elisabeth Mann Borgese*

* *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 48–49.

Fisheries management, even in the most advanced countries, quite simply, has been a failure. ... Reliance on the precautionary approach appears to be the common-sense alternative, but it is difficult to reach political agreement on when, where, and how to apply it.

Elisabeth Mann Borgese*

* *Ocean Governance and the United Nations* (Halifax: Centre for Foreign Policy Studies, Dalhousie University, 1995), 112.

Introduction

Editor: Anthony Charles

A little known aspect of Elisabeth Mann Borgese was her passion and support for small-scale fishing peoples of the world. Certainly, she is known for her achievements on the global stage, forging the law of the sea and other major international instruments. But from her coastal home, outside Halifax, Canada, she could see the fishing people heading out to sea, and later returning to their families and their community. That day-to-day life of coastal communities mattered to Elisabeth, and was, I think, important in grounding her big-picture global work.

The quotations from Elisabeth on the opposite page reflect the range of her analysis. First, a sense of history, and a poetic ability to capture the importance of fisheries over the course of millennia. Second, a profound concern for sustainability, and a practical sense of the new approaches needed to achieve that, through better fishery and ocean governance. Third, a view to the future, and how the human use of the ocean might develop over time. Fourth, an enduring and unshakeable holistic vision—one that brings humans and nature together, and brings humans together with one another.

A striking line by Elisabeth is this: "Fisheries management, even in the most advanced countries, quite simply, has been a failure."[1] Note that she wrote this just following one of the world's most dramatic and significant fishery collapses, the Canadian cod fishery.[2] Indeed, that collapse deeply affected the fishers near Elisabeth's home, and affected her as well. After the collapse, Elisabeth wrote about some positive changes emerging, ones continuing to this day. Has it been enough? Have we 'found' sustainability? Are we at least on the path to sustainability? The essays in this chapter evaluate the most prominent among those changes, as well as some enduring challenges we continue to face.

When we look to foundational change in fisheries, there are perhaps no greater shifts in recognized need for improvement than (a) the governance direction of better involving fishers, and others, in the decision-making process, and (b) the need to look more broadly and holistically at the 'fishery system'.[3]

1 E. Mann Borgese, *Ocean Governance and the United Nations* (Halifax: Centre for Foreign Policy Studies, Dalhousie University, 1995), 112.

2 A. Charles, "The Atlantic Canadian Groundfishery: Roots of a Collapse," *Dalhousie Law Journal* 18 (1995): 65–83.

3 A. Charles, *Sustainable Fishery Systems* (Oxford: Wiley-Blackwell, 2001); A. Charles, "People, Oceans and Scale: Governance, Livelihoods and Climate Change Adaptation in Marine Social–Ecological Systems," *Current Opinion in Environmental Sustainability* 4 (2012): 351–357.

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This part highlights these two shifts, at least in aspiration, toward participatory co-management and ecosystem based management,[4] that is, the ecosystem approach.

A third foundational change in recent years has been international recognition of the crucial importance of small-scale fisheries, particularly with the Small-Scale Fisheries Guidelines.[5] A fourth major change is the increasing prominence of market-based approaches—both a controversial use of the market to allocate fishery access and catch[6] and use of the consumer market as an incentive for more sustainable fishing, as covered in this part.

Turning to enduring challenges in fisheries, this part explores three key aspects: the need to connect science and other forms of knowledge with management decision-making, the need to balance natural resource sustainability and economic development, and the need for strong institutions that can effectively work at the necessary spatial scales. For each of these, we can say that progress has been made, but challenges remain. On the third of the challenges, a shining light of progress has been in tackling illegal (IUU) fishing through new global enforcement and compliance measures.

Finally, Elisabeth was prominent throughout her career in looking to the future, and in doing so, she predicted a greatly expanded role for aquaculture. This part closes with two essays on aquaculture—focused on sustainability and on the offshore areas of the ocean.

As Elisabeth Mann Borgese illustrated so well, the ocean's wealth, and particularly its living resources, have been crucial historically, as they are today, and into the future. Continuing to create livelihoods from the living resources of the sea, sustainably, remains a fundamental requirement of humanity.

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4 R.D. Long, A. Charles and R.L. Stephenson, "Key Principles of Ecosystem-based Management: The Fishermen's Perspective," *Fish and Fisheries* 18 (2016): 244–253, doi.org/10.1111/faf.12175.

5 Food and Agriculture Organization of the United Nations (FAO), *Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication* (Rome: FAO, 2015).

6 P. Copes and A. Charles, "Socioeconomics of Individual Transferable Quotas and Community-based Fishery Management," *Agricultural and Resource Economics Review* 33, no. 2 (2004): 171–181.

Scientific Basis for Fisheries Policy and Management

Jake Rice
Department of Fisheries and Oceans, Ottawa, Canada

Empirical Foundations

The science foundations of fisheries policy and management have a history of over a century. By the 1920s there was already concern about fisheries that had failed at least on local and sometimes larger scales, and a desire to avoid such failures. From the outset the science foundations were strongly empirical and at best weakly theoretical. This emphasis on empirical approaches was not because fisheries science was necessarily anti-theoretical. Rather, potentially relevant theoretical areas, such as ecology and oceanography, were themselves in their infancy. Established theoretical principles were few, and their relevance to applied problems was largely unexplored. Nevertheless some of the applied problems of unsustainable practices in fisheries were already urgent, and the scientists of the day were seeking ways to use available information to address practical problems.

To illustrate, the early work that eventually led to concepts such as maximum sustainable yield (MSY) came from empirical observations that as unexploited fish populations were reduced in abundance by a fishery, in many cases somatic growth rates increased, and recruitment to the fisheries at least did not decrease, and in some cases, such as many Pacific salmon, actually increased. These empirical observations began to be systematized into concepts like optimal yield and surplus production by the 1930s. Scientists of the day did explore theoretical concepts like the Verhulst equation in applied contexts, but as efforts to find increasingly powerful mathematical expressions to capture patterns emerging from the empirical data available on how fish populations changed with exploitation. From the beginning, progress was captured in mathematical equations to represent patterns in the information available, facilitating the ability to apply case-specific advances in knowledge to much wider ranges of similar problems.

This did not mean the advances in fisheries science were incompatible with evolving fields of ecological, oceanographic, and economic theory. As concepts like carrying capacity and density dependence were elaborated in ecological theory, they enhanced the ability to explain *why* the empirically-based tools that were being developed in applied fisheries science could be expected to work. The important point was that the developments in fisheries science were not derived from the theoretical ecological concepts, only subsequently to be applied to real-world problems. Practice *used* theory as it became available, but did not *wait for* theory to be developed before exploring the empirical evidence as far as their creativity and experience allowed.

This pattern of a strong degree of empiricism has continued to characterize fisheries science. A powerful illustration is that increasingly strongly from the 1970s through the 1990s, severe declines or collapses occurred in several high-profile fisheries. In some cases, such as sardines and anchovies in the eastern Pacific and cod in the Northwest Atlantic, these were not the first times the stocks had shown large declines. However, after extension of jurisdiction and implementation of (for the time, cutting-edge) fisheries science as a basis for policy and management, another round of such declines, due to rapid drops in stock productivities, occurred unexpectedly. Policy and management wanted practical explanations for this new round of 'fishery failures', not additional theoretical concepts.

Flexible Problem-Solving

The hunt for explanations converged on ecosystem- and decadal-scale changes in physical oceanographic conditions and impacts of ocean physics on marine productivity. The investigations were based primarily on empirical studies of patterns in the fisheries and oceanographic datasets. Oceanographic and marine food web theory was quick to catch up, but ideas of regime shifts emerged from the empirical studies, not the reverse. The theory did not come first, prompting empirical investigations that would not otherwise have happened.

This continued importance of empirical problem-solving approaches to fisheries science, using theory when available but not waiting for it, and instead relying on information itself when theory is not yet available, has many consequences. Some consequences provide advantages for fisheries science, others may be limitations. Many of these advantages and limitations may actually be linked as co-benefits and trade-offs that characterize the science foundations for fisheries policy and management. Seeing how these co-benefits and trade-offs interact can provide insights into where fisheries 'science' may be heading in the near future.

Perhaps of greatest value, by not being locked into any single theoretical framework, fisheries science has retained great flexibility. The challenges to fisheries sustainability can come from many sources—environmental changes in ocean climate or in abundance of predators or prey, technology changes, expanding or cutting back on fisheries targeting other species in the same ecosystem, changes in markets or consumer patterns, and other sources. Regardless of how comprehensive a theoretical approach to fisheries science might be, challenges will arise that are outside the scope of the theory. An empirically-based approach to fisheries science has no conceptual problem in simply shifting focus as needed to address new challenges as they arise (there may be other limitations, discussed below). Were fisheries science strongly constrained by any particular theory, addressing problems out of that scope could be either resisted or require a major retrenching of thinking.

Limitations—Integration and Forecasting

The limitation of this great flexibility in the ability of fisheries science to shift focus as new applied problems arise is that there is no obvious pathway to integrate new knowledge with currently established knowledge, as new things are learned. Integration is usually possible, but often ends up being approached in an *ad hoc* way because no single pathway for integration emerges in the absence of a coherent theoretical framework. This can result in inherent incompatibilities co-existing within the general science framework being used by fisheries policy and management. For example, a well-managed fishery on a species with a typical groundfish life-history reaches MSY at about 40 percent of unexploited biomass (B_0), whereas the International Union for Conservation of Nature (IUCN) criteria for risk of extinction interpret a population reduced to 30 percent of its starting numbers in three generations as 'threatened';[1] most assessments would have sufficient uncertainty that a 95 percent confidence interval on biomass would be wide enough to include both values. These apparent incompatibilities, due to different piece-wise theories, pose real challenges to policy and management of fisheries.

A second limitation of the lack of any comprehensive theory of fisheries science is that the ability to forecast is limited. When a single theory is applied to a fisheries science question, it is possible to develop predictive equations that can extrapolate the trajectories of the fish population as far into the future as the independent variable(s) in the equation can be forecast. This is occurring, for example, with predictions of future distributions and productivities of fish

1 The IUCN Red List of Threatened Species, 2001 Categories & Criteria (version 3.1), http://www.iucnredlist.org/static/categories_criteria_3_1.

populations under various scenarios of climate change. Such forecasts can be highly valuable in planning adaptive strategies for fisheries in a changing climate.

The above limitation means that such predictions explicitly do not take into account the many other factors that affect fish population dynamics, because they are explicitly not part of the basis for these predictions. This has a co-benefit that users of these forecasts can be readily informed of the limitations in the forecasts, and encouraged to consider them at best as partial answers to the policy questions of concern. The need to consider additional information in planning is obvious. Were the models used in forecasting presented as comprehensive and inclusive, policy-makers and management might be more vulnerable to pressures to treat the forecasts as predictive rather than illustrative.

On the other hand, keeping forecasting limited by primarily empirical relationships also limits the scope for forecasting in time and space. Empirically-based predictions are inherently strongly influenced by the initial conditions, and within a biological generation or two, or a decade of ocean climate, the dynamics of these systems mean that initial conditions have low influence and users are looking at projections of previously projected values. Without theoretical constraints on projections, uncertainty is likely to escalate and be increasingly unhelpful to policy-makers.

Co-Benefits—Use of Data and Knowledge Systems

An important aspect of the strong foundation of fisheries science in empirical approaches is that it highlights the dependence of progress on data quantity and quality. Limitations of this dependence are obvious. Whether done through research surveys or monitoring of fisheries, collection of data at sea or in remote freshwater sites is demanding of human and financial resources. These costs are being reduced by technological advances, but similar technological advances are being made in other applied science fields as well, leaving fisheries science still a comparatively costly endeavor.

Countering those limitations, the fact that improved data for fisheries science does get used to improve fisheries policy and management means that it is possible to show direct benefits flowing from investments in monitoring fisheries and the ocean environment. Monitoring is often an unpopular item in budgeting, so documenting the benefits can strengthen support. In addition, by relying on evidence from monitoring, science has strong incentives to watch for deviations in the data streams, and give early attention to changing conditions. Complex and integrative theoretical models may buffer unexpected trajectories of individual input data streams, and if the science inputs to policy and management are primarily from such models, the new information in the individual data streams may not receive timely attention.

Two of the points made in this essay combine to comprise possibly the greatest strength of the empirical focus of science foundations for fisheries policy and management. When new problems emerge in a fishery—or long-standing problems rise in priority—the importance of the data streams to the capacity to advise on immediate and longer-term issues means that the adequacy of existing data streams to support advice gets scrutiny. In cases when it appears that existing data streams do not cover the new priority concern adequately, the lack of dominance of any single theoretical framework in fisheries science allows the science community to look very broadly at sources of information that can fill the voids.

This has allowed fisheries science to be receptive to other knowledge systems in cases when 'science' monitoring streams were not available to fill an advisory need. This broadening of the inclusion of the knowledge of local communities and Indigenous peoples with conventional science has not always been embraced quickly nor progressed smoothly. However, there have been significant advances, in some locations, to bring holders of local, Indigenous and/or community knowledge into science-based data collection systems. An example was Canada's Atlantic Coast groundfish sentinel fisheries program, which brought together fishers' knowledge and science following the cod fishery collapse. Successes in such syntheses of knowledge systems are accumulating quickly, and actually becoming a norm for many fisheries. Particularly when accompanied by advances in co-management of the fisheries themselves, acknowledging the value of co-creation of knowledge for co-management is a logical step. The flexibility of the science foundations for policy and management has made these steps easier for both institutions and experts to take.

A final parallel benefit is also appearing in fisheries science. Just as the flexibility of a strongly empirical approach to fisheries science facilitated 'empirical' being interpreted broadly as 'knowledge-based' rather than narrowly 'science-based', the lack of any single dominant theoretical framework for fisheries science is facilitating an increasingly broad interpretation of 'science'. If rigid theoretical frameworks were to be built, these would draw on established biological, physical, and chemical theory, with little scope to incorporate social sciences. This would accordingly impede placing fisheries policy and management into a full socio-ecological system. Instead, the flexibility of the science foundations are allowing bridges to be built between the 'natural' and social sciences, making the foundations of policy and management both broader and stronger. Together these two pathways—broader use of the plurality of knowledge systems and greater inclusiveness of social as well as natural sciences in support of policy and management—mean the best years for fisheries science may still lie ahead.

Legitimacy and Effectiveness through Fisheries Co-Management

Evelyn Pinkerton
School of Resource and Environmental Management,
Simon Fraser University, Burnaby, British Columbia, Canada

Introduction: Co-Management and Legitimacy in Oceans Governance

It is timely to consider the key importance of co-management institutional arrangements in successful fisheries management. Co-management is power-sharing between government agencies charged with the responsibility of governing one or more natural resources and the place-based communities, organizations, or regions that are most affected by the agency's decisions.[1] Feit prefers to call such arrangements 'co-governance',[2] but it can be useful to reserve this term for high levels of power-sharing in joint policy-making, while operational decisions such as how, when, and where to take actions are termed 'co-management'. Co-management and even co-governance often begins as an 'incomplete' arrangement in which the scope and geographic scale of the power of the non-government party is fairly limited.[3] Although such arrangements often evolve, it is seldom to the point of joint policy-making. Authentic co-governance is usually driven by court decisions or unique policy situations.

Legitimacy is essential in fisheries co-management. Both the legitimacy of senior governments and the legitimacy of local authorities who are working with these senior governments are important. Although it is desirable to have both types of legitimacy, local legitimacy is indispensable and can make a system work, even if senior government legitimacy is lacking. There is high

1 E. Pinkerton, "Attaining Better Fisheries Management Through Co-Management: Prospects, Problems, and Propositions," in *Co-operative Management of Local Fisheries: New Directions for Improved Management and Community Development*, ed. E. Pinkerton (Vancouver: University of British Columbia Press, 1989), 3–33.

2 H. Feit, "Re-cognizing Co-management as Co-governance: Visions and Histories of Conservation at James Bay," *Anthropologica* 47, no. 2 (2005): 267–288.

3 E. Pinkerton, "Toward Specificity in Complexity: Understanding Co-management from a Social Science Perspective," in *The Fisheries Co-Management Experience: Accomplishments, Challenges and Prospects*, eds., D.C. Wilson, J. Raakjaer Nielsen and P. Degnbol (Dordrecht: Kluwer, 2003), 61–77.

agreement among social scientists that legitimacy plays a major role in compliance with regulations, so management is problematical if legitimacy is lacking at both levels.

This essay focuses particularly on the importance of establishing legitimacy through including local Indigenous voices in management decisions. The value of legitimacy is currently under-appreciated because of an increasing emphasis on efficiency and neoliberal values related to reducing the role of government and relying on the market to achieve desirable outcomes.

A Legitimate Co-Management System

Legitimacy in fisheries management is examined here through a fishery example in British Columbia, on the Pacific coast of Canada. In this region, the federal government and its Department of Fisheries and Oceans (DFO) faces the problem of conflicting demands on fisheries access from sport, commercial, and Indigenous parties, as well as from sub-divisions of all of these. In addition, DFO has suffered progressive budget cuts and lacks the capacity to monitor and enforce its regulations, especially in the many rural areas where DFO presence might exist for only a few days a year. Therefore, incentives exist to co-manage with local organizations, but there is little guidance for DFO regarding how and when to work with local parties.

This essay considers key components of what that guidance might look like if social scientists were consulted, using an example from the West Coast of Vancouver Island where I have worked with Indigenous and non-Indigenous communities since the late 1980s. Kyuquot Sound/Checkleseht Bay (Area 26), on the northwest coast of Vancouver Island (Canada), is one of the traditional territories that are home to 14 Nuu-chah-nulth First Nations. The essay focuses on the components of a legitimate clam co-management system in this location.[4]

Prior to establishment of the system, the initial situation could be called a worst-case scenario because of the complete lack of local regulations or respect for DFO regulation. The Indigenous community of Kyuquot-Checkleseht (KC) hated DFO because they interpreted DFO's actions since state regulation of fisheries began as evidence that the agency was deliberately trying to hurt them, and that its regulations had nothing to do with conserving fish. This

4 E. Pinkerton and L. John, "Creating Local Management Legitimacy: Building a Local System of Clam Management in a Northwest Coast Community," *Marine Policy* 32, no. 4 (2008): 680–691.

interpretation was partially a response to government policies and actions that had marginalized the community and resulted in the loss of virtually all their finfish licenses, and partially awareness that government regulations were not based on local knowledge. Thus, when the area was closed to clam fishing because of government belief or precaution that there was paralytic shellfish poison or fecal coliform in the area, residents ate the clams, did not get sick, and considered government regulations ill-founded.

But over a 20-year period of 1986–2006, a community member who became the KC Fisheries (KCF) manager, Leonard John, built a local management and co-management system that was based on scientific, regulatory, political, and moral legitimacy. The process and its components are summarized below.

(a) *Scientific legitimacy* was first built through volunteer community participation in clam stock assessment led by a fisheries biologist from the Nuu-chah-nulth Tribal Council and later by John. Because the community had seen local clam stocks overfished by diggers from the entire west coast of Vancouver Island and then closed, they understood the importance of stocks rebuilding sufficiently to sustain a harvest.

(b) *Regulatory legitimacy* was achieved because John enforced the regulations that diggers hold a valid commercial license, dig only during a commercial harvest opening, not dig on beaches that were closed due to water quality concerns, and deliver real and legal-size clams to buyers. If government closures of supposedly contaminated beaches were not enforced, the entire area might be closed, so diggers recognized that it was in their self-interest to follow government regulations and have an orderly fishery and credibility with buyers.

(c) *Political legitimacy* was gained when KCF was perceived as being able to act effectively and decisively as a local authority that could protect community fishing rights when DFO questioned the boundary of an open area, and when John applied for clam licenses for community members who had missed the deadline. The political legitimacy it gained by these actions put John in a stronger position to assert regulatory authority.

(d) *Regulatory capacity* was built when DFO created the communal license, allowing KC as a successful applicant community to exclude outsiders and regulate its own members' activities. KCF's community meetings to make and revise access and other rules were well attended; rules were revised annually and attendees were required to sign a paper that they had attended and agreed to these rules, and could lose their license if they broke them. Offenders were warned privately and respectfully over coffee that they could not repeat the offence and were given a chance to indicate their acceptance of this privately, but lost their license and were publicly shamed if they did not. The respectful manner in which rules were thus enforced was consistent with traditional local values.

(e) *Moral legitimacy* was gained because local regulation was open, accountable, democratic, and consistent with the values of the community. Management systems based on moral authority perform at a much higher level than those run on legal, political, scientific, or regulatory authority alone. The local management system met a number of criteria for moral legitimacy that are broadly accepted by social scientists: (1) there were objective standards in the system; (2) the standards were visible, transparent, and culturally appropriate; (3) the outcomes were effective and perceived as fair; and (4) the use of natural science in the context of a co-operative and highly communicative relationship played a key role in legitimacy creation.

Public trust in local resource management because of moral authority resulted in a virtuous cycle of further growth of scientific and regulatory authority. Economist Samuel Bowles, remembering the importance that economist Adam Smith accorded to 'moral sentiments', has made the case that well-designed laws and public policies can harness self-interest for the common good only if they do so by appealing to these moral sentiments.[5] His study showed that incentives that appeal to self-interest are likely to fail when they undermine the moral values that lead people to act in other-regarding or public-spirited ways.

This highly legitimate local management system was also a co-management system because it depended on DFO regulations to legitimize local enforcement of the exclusion of outsiders from beaches with communal licenses and also to regulate local license use. There were also some management activities that senior government agencies required local managers to perform, such as water quality testing delegated by Environment Canada (now Environment and Climate Change Canada) and the Canadian Food Inspection Agency, or stock assessment surveys that had to be reported to DFO. The existence of a competent and legitimate local manager raised the confidence level of government agencies that these activities were being carried out effectively.

This local system also benefited from favorable conditions in the clam resource and in the community. Clams are more easily monitored than many other species because they are non-mobile and located on a limited number of known beaches with specific clear boundaries where diggers are highly visible because they require a boat to get to a beach. The community is small,

5 S. Bowles, "Policies Designed for Self-Interested Citizens May Undermine 'The Moral Sentiments': Evidence from Economic Experiments," *Science* 320 (2008): 1605–1609, doi.org/10.1126/science.1152110.

remote, and culturally cohesive with high rates of seasonal unemployment, high dependence on clams for employment, and hold clams in high regard as a culturally important resource. These conditions make monitoring and management in general easier, and a more feasible foundation upon which to build legitimate management and co-management.

Conclusion

A local management system based on the scientific, regulatory, political, and moral components described above can be highly effective, and certainly far more effective than a government system working alone. Senior governments do not have the capacity to enforce their regulations, or often even to devise ones that could work in areas they cannot regularly monitor. In such situations, government acceptance of and support of local management should be based on an awareness that the alternative is, without a local authority, substantial poaching and overexploitation, the situation that existed before the KC local authority developed effective local management. Local authority, which contained the appropriate components, demonstrated effectiveness in making and implementing its own regulations as well as those of government agencies; it kept the system functional, orderly, and acceptable to government agencies so that closures were not threatened.

The KC situation benefited from the existence of a highly experienced senior DFO clam manager whose headquarters were located on the east coast of Vancouver Island, and who was willing to work with a highly competent local manager as the situation evolved into one in which local management could be fully developed. Since this situation also benefited from favorable conditions in the nature of the community and the clam resource, which cannot always be guaranteed, government managers should be aware of the need for a social scientist to assist in the recognition of necessary elements for effective co-management. A social scientist would be able to identify missing elements and the need for specific kinds of support to allow a potentially effective situation to become fully operational. Evaluations could be made about which situations offered the most promise and were worth considerable time investment or monetary support. Situations that lacked any of the scientific, regulatory, political, and moral components could be addressed with specific attention to those components. Building on favorable conditions in the government agency, in the clam resource, and in the community, plus the elements of a highly legitimate system, would give co-management initiatives a good chance of success.

Turning Aspiration to Action: Challenges of Making the Ecosystem Approach Operational in Fisheries

Mark Dickey-Collas
International Council for the Exploration of the Sea,
Copenhagen, Denmark

Introduction

Fisheries are a major impactor on the marine system and also a major provider of wealth, security, identity, and food to humanity. At its core, the ecosystem approach acknowledges that these two axes (impact and services) need to be reconciled. This should be done through informed management that explores the space between these axes in an equitable manner following what have been described as 'fuzzy' principles.[1] The ecosystem approach to fisheries management is an accepted societal objective.[2] Many around the world are working to make this aspiration a reality through iterative steps; an evolution of ideas, processes, and structures. These steps have highlighted challenges and some of these are explored here.

Many natural scientists see ecosystem based management as a rationale to demand more resources for their science. The idea that more knowledge automatically means better management is prevalent, 'we just need to know more to manage better'. In the fisheries realm this seems to be about knowing more about energy flow and trophic interactions. The problem is that an understanding of the entire fisheries system is an afterthought. Policy development, institutional change, and reconciling economic and social objectives in an equitable manner all require something different than just more knowledge of whom eats whom. This is clear from the principles of the ecosystem approach described by the Convention on Biological Diversity and the advice on operational implementation in fisheries by the Fisheries and Agriculture Organization of the United Nations.

1 S.M. Garcia and K.L. Cochrane, "Ecosystem Approach to Fisheries: A Review of Implementation Guidelines," *ICES Journal of Marine Science* 62 (2005): 311–318.

2 K.J. Sainsbury, P. Gullestad and J. Rice, "Design of Operational Management Strategies for Achieving Fishery Ecosystem Objectives," *ICES Journal of Marine Science* 57 (2000): 731–741; J. Rice, "Evolution of International Commitments for Fisheries Sustainability," *ICES Journal of Marine Science* 71 (2014): 157–165.

But are we developing a fisheries system that can deliver these principles by adjusting existing management and governance structures to achieve the ecosystem approach? An analysis of the European Union (EU) fisheries management system found an institutional gap between fisheries and environmental policy frameworks.[3] This gap results in limited integration of broader environmental concerns leading to a standoff between decision-makers, creating frustration for the involved agencies. When executing ecosystem based fisheries management, some of the anthropogenic pressures from fishing may not be managed by the fisheries agencies, and conversely the consequences for the environment of fishing may fall under the remit of non-fisheries agencies. The need for co-ordination in management and governance structures is clear.

Further, policy developers and regional managers are generally reluctant to acknowledge the need to reconcile multiple objectives across multiple interests,[4] as found in a range of local, national, and regional legislation. An example is the 'horrendogram' of United Kingdom marine legislation.[5] Implications of this for implementing the ecosystem approach arise in terms of the tools to inform management, including management strategy evaluations, trade-off tools, and decision-support tools. In many of these, there is an underlying assumption of a central decision-making body, or event, where independently derived evidence can be weighed up and consequences explored, leading to an agreed prioritization of management objectives. In reality, though, many knowledge brokers are unaware of the dynamics in governance frameworks and are not ready for the diplomatic role of working with agencies with their own differing power, objectives, and rationales. There is an assumption by tool developers that the governance system likes making decisions, that the decision-making process is linear, and consensus building is part of the knowledge provision process.

A further challenge in implementing the ecosystem approach lies in the inertia of many existing fisheries management frameworks. They use quantitative engineered evidence for decision-making, applying decision frameworks

3 P. Ramírez-Monsalve et al., "Institutional Challenges for Policy-making and Fisheries Advice to Move to a Full EAFM Approach Within the Current Governance Structures for Marine Policies," *Marine Policy* 69 (2016): 1–12.

4 R.L. Stephenson et al. "Practical Steps toward Integrating Economic, Social and Institutional Elements in Fisheries Policy and Management," *ICES Journal of Marine Science* 74 (2017): 1981–1989; A. Rindorf et al., "Moving beyond the MSY Concept to Reflect Multidimensional Fisheries Management Objectives," *Marine Policy* 85 (2017): 33–41.

5 S.J. Boyes and M. Elliott, "Marine Legislation—The Ultimate 'Horrendogram': International Law, European Directives and National Implementation," *Marine Pollution Bulletin* 86 (2014): 39–47.

and risk thresholds, with the consequences of actions explored in relation to targets or limits. Ecosystem based fisheries management, representing the convergence of resource exploitation and conservation policies,[6] challenges this well-oiled machine. In considering socio-ecological trade-offs, often a clear decision framework with targets and limits is yet to be established, and options with likely consequences are explored in a less structured manner. Practitioners in this system, building on the integrated ecosystem assessment cycles, acknowledge the need for participatory tool development to inform management, for an iterative and consultative process, and for monitoring and adaption.[7] This challenges the roles played by actors in the system with demands to maintain saliency, credibility, and legitimacy in an evolving framework.[8]

Faced with the above set of challenges, where are we now in terms of turning aspiration into action? If we take three issues—maintaining biodiversity, provision of knowledge, and reference points (approaches to optimize catch)—are management systems delivering?

Biodiversity

In considering biodiversity, both in terms of habitat and species, management plans tend to be as a result of local concerns (with the exception of the Commission for the Conservation of Antarctic Marine Living Resources), resulting in few generic frameworks for fisheries management plans that account for biodiversity. Certainly, fishing at traditional maximum sustainable yield (MSY) will not deliver objectives in terms of securing biodiversity.[9] There are good examples in some locations, such as successful local and fleet-based approaches in Australia, and the use of a cap on total removals of fish, as an ecosystem conservation method, as in Alaska.

However, while many systems around the world manage through impacts on assessed fish stocks, experience shows us that biodiversity concerns are

6 J. Rice and P. Mace, "Bio-ecological Dimensions of Fisheries Management, Biodiversity and Governance," in *Governance of Marine Fisheries and Biodiversity Conservation: Interaction and Coevolution*, eds., S.M. Garcia, J. Rice and A. Charles (Chichester: John Wiley & Sons Ltd., 2014), 55–67.

7 M. Dickey-Collas, "Why the Complex Nature of Integrated Ecosystem Assessments Requires a Flexible and Adaptive Approach," *ICES Journal of Marine Science* 71 (2014): 1174–1182.

8 C. Röckmann et al., "The Interaction Triangle as a Tool for Understanding Stakeholder Interactions in Marine Ecosystem Based Management," *Marine Policy* 52 (2015): 155–162.

9 B. Worm et al., "Rebuilding Global Fisheries," *Science* 325, no. 5940 (2009): 578–585.

often related to specific fleets or gears, rather than impacts on stocks. Yet, in the EU, where some types of gear are associated with fleets from specific countries (e.g., demersal and pelagic fisheries in the Baltic Sea, beam trawling in the North Sea), the idea of differentially managing gear types or fleets would suggest preferential treatment of certain countries, and also challenge relative stability (the system of allotting catch shares between member states of the EU).

In the Northwest Atlantic Fisheries Organization and North East Atlantic Fisheries Commission (NEAFC) areas of the North Atlantic, we see an evidence-based approach to spatially define and conserve vulnerable marine ecosystems (VMEs) from fishing impact that is transparent and accepted by stakeholders. The NEAFC VMEs provide a rare example of fisheries and environment agencies working together as they have been established in partnership with the OSPAR Commission to protect the environment of the North-East Atlantic. The European Commission recently asked the International Council for the Exploration of the Sea to examine the trade-offs between benthic impact of fishing gear with weight and value of the catch,[10] which occurred with stakeholder engagement and consultation with regional sea environmental conventions.

Knowledge

The knowledge being used in fisheries management is also changing. Concerns about the impact of fishing on food web dynamics and bycatch of sensitive species has hit the headlines in locations such as Australia, South Africa, the Americas, and Europe, which has led to questions about the social license of fisheries to operate. It has also led to a great improvement in the quantity and quality of the science being made available to decision-makers. While that improvement in the credible knowledge base has not necessarily resulted in an informed decision process, it has improved the awareness of knowledge brokers of the arena into which their evidence flows. This is accompanied by the realization that feelings and lobbying are as powerful a tool in fisheries management as the science, and despite best efforts, the lobbying and science often become intertwined.

10 International Council for the Exploration of the Sea, "EU request on indicators of the pressure and impact of bottom-contacting fishing gear on the seabed, and of trade-offs in the catch and the value of landings," *ICES Special Request Advice* sr.2017.13, http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/Special_requests/eu.2017.13.pdf.

There is also momentum to increase the knowledge base using traditional knowledge, fishers' knowledge, or citizen science. Local and regional initiatives have illustrated the value of a range of approaches. The boundaries of what is credible information are changing. Knowledge brokers, however, need to ensure credibility of knowledge provision emphasizing that all actors act responsibly and in good faith. They should not be naïve to the influence of interest or the need to show the data trails leading to transparent decision-making.

Reference Points

The nature of MSY is also changing. Starting as a tool for United States' foreign policy,[11] it has encountered difficulties. While driving necessary reductions in fishing mortality around the world, the idea that biomasses can be fixed independently and managed on an individual stock-by-stock basis has been discredited.[12] The need for variable reference points that respond to environmental variability is widely recognized. Likewise a recognition that not all fish stocks can be fished at MSY simultaneously due to species interactions and mixed targeting by fleets has led to the concept of 'pretty good yield', where yield can be forfeited to ensure that more stocks are fished closer to MSY than previously.[13] This concept is now at the center of the EU multi-annual plans for the Baltic and North Seas.

In Europe, MSY is being further adapted, with target fishing mortality (Fmsy) now being assessed for impact on biomass; the Fmsy reference points include consideration of preventing biomass falling below limit reference points. In the future, the discussions about evolutionary effects of fishing, size of fish in populations, and balanced harvesting are likely to have consequences for fishing targets.

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11 B. Mesnil, "The Hesitant Emergence of Maximum Sustainable Yield (MSY) in Fisheries Policies in Europe," *Marine Policy* 36 (2012): 473–480.

12 National Research Council, Committee on Evaluating the Effectiveness of Stock Rebuilding Plans of the 2008 Fishery Conservation and Management Reauthorization, *Evaluating the Effectiveness of Fish Stock Rebuilding Plans in the United States* (Washington, DC: National Academies Press, 2014).

13 A. Rindorf et al., "Food for Thought: Pretty Good Multispecies Yield," *ICES Journal of Marine Science* 74 (2017): 475–486.

Summary

In summary, despite not all the developments being labeled as the ecosystem approach to fisheries management, the aspiration is turning into action, and beginning to deliver. Fisheries management approaches need to incorporate fleet management in addition to stock-focused approaches as it is the way that fisheries operate that determines their impact on the ecosystem. Actors across the system also need to appreciate that multiple objectives and interests need to be reconciled. The dominance of the biology focus in fisheries needs to be tempered to address community, institutional, and governance challenges. The evidence base should encompass multiple forms of available knowledge, and the operational gap between fisheries and environmental policy frameworks needs to be addressed.

What Is the Role of the Market in Contemporary Fisheries Governance?

*Megan Bailey**
Marine Affairs Program, Dalhousie University,
Halifax, Nova Scotia, Canada

With the United Nations Convention on the Law of the Sea and the declaration of extended jurisdiction, the nation state became the main focus of fisheries management interventions, and subsequent critiques, in the 1980s and 1990s. But it wasn't long before practitioners and scholars turned their attention to the role of the market in governing fisheries practices. Using the market is part of a larger business-led approach to sustainability: corporate social responsibility (CSR). CSR is dynamic and relational, in that it is continually redefined based on the relationship between business and society, and the role and responsibility that society chooses to place on businesses in pursuit of environmental and social justice.[1] This means that the market and what is sustainable seafood are always changing. The theory of change here is that by providing a market signal, for example a price premium for a certified product, fish harvesters and seafood processors will be incentivized to voluntarily alter their production practices to comply with that certification. We now have about thirty years of experience trying to operationalize market-based governance through the sustainable seafood movement. What and how have we done? What is likely to be the role of the market in contemporary fisheries management?

The sustainable seafood movement began with the launch of Earth Island Institute's Dolphin Safe certification as a response to high levels of dolphin mortality in the eastern Pacific Ocean tuna purse seine fishery. The Dolphin Safe logo communicated to consumers that their canned tuna was not sourced from a fishery that set nets on dolphins. The impact was huge. Dolphin mortalities dropped by about 98 percent, but in recent years the credibility of the

* I would like to thank a number of colleagues for great conversations and insight related to many of the points raised in this essay: John Burton, Simon Bush, Eric Enno Tamm, Keith Flett, Jennifer Jacquet, Fred Le Manach, Alice Miller, Helen Packer, Laurenne Schiller, Michèle Stark, Josh Stoll, and Michael Tlusty.

1 M. Bailey et al., "The Role of CSR in Creating a Seussian Approach to Seafood Sustainability," *Fish and Fisheries* (2018) 00:1–9 https://doi.org/10.1111/faf.12289.

certification has been called into question,[2] and in the intervening years, other standards, recommendations, and certifications have followed. In 1997, Unilever and the World Wildlife Fund for Nature joined forces to create the Marine Stewardship Council (MSC), which today is by far the most pervasive capture fisheries certification and eco-label in the world.

The MSC is based on three ecological principles with the first pertaining to the target fish stock, the second pertaining to ecosystems, non-target species, and habitats, and the third pertaining to fisheries management and governance systems. About 12 percent of global wild capture fisheries production is currently MSC-certified. When the MSC's self-declared 'best environmental choice' slogan became recognizable to major retailers in Europe and the United States, environmental non-governmental organizations (ENGOs) campaigned hard to influence retailers to make sourcing commitments. In 2010, Walmart famously committed to sourcing only MSC seafood by 2015, but demand far outstripped supply, and commitment dates came and went. To increase the supply of 'sustainable seafood', two major things happened. The first was that Monterey Bay's Seafood Watch Program changed their categorization of yellow seafood from 'avoid' to 'good alternative', freeing up a plethora of fish and seafood that could now be argued to be sustainable. Second, fisheries improvement projects (FIPs) became normalized. Fisheries that cannot meet the MSC standard, but are committed to improving production practices toward sustainability, can become recognized as a FIP, again freeing up more supply of 'sustainable' products. For example, Walmart has now committed that by 2025 they will source all of their fish and seafood from certified fisheries or from improvement projects.[3]

The sustainable seafood movement has by and large not facilitated large-scale transformational changes for myriad reasons, including its lack of accessibility to developing world fisheries, questionable credibility, corporate agendas, and an exclusively ecological focus. Central to all of the criticisms and challenges is the assertion that certifications like the MSC have not led to continual improvement, in part because they have only created a market for sustainable fish and not sustainable fisheries.[4] I argue that coercion, commodification, and conformity are three central issues to the permanency

2 A.M.M. Miller and S.R. Bush, "Authority Without Credibility? Competition and Conflict between Ecolabels in Tuna Fisheries," *Journal of Cleaner Production* (2014): doi:10.1016/j.jclepro.2014.02.047.

3 See "Walmart Policies and Guidelines, Seafood Policy," Walmart, https://corporate.walmart.com/policies.

4 M.F. Tlusty and Ø. Thorsen, "Claiming Seafood is 'Sustainable' Risks Limiting Improvements," *Fish and Fisheries* (2016): doi:10.1111/faf.12170; S. Ponte, "The Marine Stewardship Council

of the continual improvement challenge, and thus are major barriers to achieving seafood sustainability.

The entire raison d'être for market-based governance, and CSR more broadly, is that it is supposed to be voluntary. It goes above and beyond regulation to allow a business to choose to do more. Fishing businesses and fish harvesters are supposed to be incentivized (or 'nudged' as 2017 Nobel Prize winner in economics, Robert Thaler, calls it) into adopting market-based approaches. Yet increasingly, we hear talk of fish harvesters being bullied into applying for MSC certification, being blindly led into the assessment process by downstream actors, or ultimately coerced into it by buyers who demand that they become certified in order to remain a client.[5] This immediately taints the transformative potential of a voluntary program. Second, the sustainability attribute has been commodified, and only becomes a business goal if there is market value attached to it. This links sustainability to profit, and brings about questions about the extent to which CSR more broadly should be marketized,[6] and the role that we afford corporations in defining sustainability. Third, consumers are offered an overwhelming quantity of labels and certifications on food products generally, but in seafood, these choices actually all conform to one sustainability norm, ecological sustainability, ignoring other issues.

To move away from coercion, commodification, and conformity we have to prioritize provenance, pre-competitiveness, and people in our pursuit of seafood sustainability. The next generation of market-based tools needs to encourage and allow fish harvesters to be part of the process of developing place-based sustainability criteria, and of designing market-based incentives that actually bring benefit to their operation. Second, there is talk of moving sustainability away from a commoditized attribute, i.e., something that is bought and sold on the market. Instead, groups like Sea Pact,[7] an amalgamation of mid-supply chain seafood companies, are postulating that sustainability should be pre-competitive, something that you don't try to use to one-up your competitors. And finally, a conversation about what sustainability really means needs to be forthcoming. While we must recognize the boundaries of our ecological system, so too must we recognize human rights, and make sure we operate in a space where the needs and rights of fish harvesters and others

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(MSC) and the Making of a Market for 'Sustainable Fish'," *Journal of Agrarian Change* 12 (2012): 300–315.

5 Personal communication with fish harvesters in Alaska, fishing associations in Canada, and with processors and traders in Indonesia.

6 H. Packer et al., "Corporate Social Responsibility in the Seafood Industry: A Review of the Top 150 Grossing Companies and Outlook on Future Research," *Fish and Fisheries* (In press).

7 See Sea Pact website, http://www.seapact.org/.

operating in seafood supply chains are respected. For decades, students have been told that fisheries management is not about managing fish, but about managing people. Let us then put people back into it, by focusing on market-based tools that ensure fishing as a livelihood opportunity is maintained and is safe.

So what does the next generation of market-based approaches look like? Seafood provenance, seafood transparency, and socially-responsible fish are good places to start. In Alaska, the salmon fishery went through extensive consultation regarding recertification, with industry asserting that the brand 'Alaskan salmon' with or without the MSC should be good enough. The same conversation has been happening in Iceland, and even in Nova Scotia, Canada, where the province is starting to brand itself as a source for high quality seafood.[8] Focusing on provenance, i.e., where the seafood is coming from, could help to facilitate participation by fish harvesters and companies themselves. In promoting all fish from a certain place, the benefits of sustainability may be shared by all producing in that locale, not just those who have signed up for a private certification, meaning coercion toward certifications would not be needed.

An issue with provenance becomes verification: How do you know your fish comes from Nova Scotia? This leads us to our second interesting trend: the move towards transparency. Seafood traceability is a current buzzword in seafood sustainability, but traceability is only a tool to verify claims made. It is not information, but a system to help information flow.[9] So my suggestion is that it should not be sustainability that is the tradeable attribute, but rather information or transparency. No matter what you are doing, whether it is sustainable or not, you should be rewarded for credibly informing the market about your practices. By committing to transparency, companies can support a race to the top where all production practices, ecological, social, etc., are communicated.[10] The market then moves away from demanding verification of certain sustainability attributes, getting away from sustainability as a tradeable commodity, to demanding and rewarding transparency more broadly.

Finally, the development of socially responsible fisheries, like that operationalized through Fair Trade USA, Naturland, and the Responsible Fishing Scheme, is an interesting evolution in certifications. It will likely face the same

8 See Iceland Sustainable Fisheries website, http://www.icelandsustainable.is and Nova Scotia Seafood, https://nsseafood.com.

9 M. Bailey et al., "The Role of Traceability in Transforming Seafood Governance in the Global South," *Current Opinion in Environmental Sustainability* 18 (2016): 25–32.

10 M. Bailey and N. Egels-Zandén, "Transparency for Just Seafood Systems," *Solutions* 7 (2016) 66–73.

challenges that the MSC has in terms of ensuring it is used where it is needed most, and not just where good things are already happening. Additionally, it faces the challenge of trying to use the market to address the very issues of inequity that the market has brought to bear on fisheries producers in the global South. But these certifications move us away from conforming to one sustainability norm, and rather focus on people as much, if not more than, the ecological basis of sustainability. Additionally, it has the benefit of aligning better with the guidelines of the Food and Agriculture Organization of the United Nations for securing small-scale fisheries.[11]

The sustainable seafood movement has certainly brought to light less than ideal fisheries practices, and has worked to reward those whose practices are considered sustainable, at least sustainable by some standards. Some of the potential ideas reviewed here may help us to do a bit better, but what is becoming increasingly clear is that the market on its own cannot save our seas or our seafood. By trying to work at the business or company level, the sustainable seafood movement has forgotten where fisheries governance all started: the nation state. Sustainability issues in seafood value chains may have more to do with the country of origin than any one company or one product type. If we do not try to improve the capabilities of all countries to internally govern their fisheries production practices towards sustainability, we will remain in an era of transactional, not transformational, change. The markets and certifications are no replacement for good state governance, and assuming so risks ignoring the entire cultural politics of the sustainable seafood movement.[12] The role of the market in contemporary fisheries governance then needs to address its challenges of coercion, commodification, and constriction, by prioritizing provenance, pre-competitiveness, and people in accordance with larger international and national frameworks.

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11 M. Borland and M. Bailey, "A Tale of Two Standards: A Case Study of the Fair Trade Certified Maluku Handline Caught Tuna (*Thunnus albacares*) Fishery," *Marine Policy* (forthcoming).

12 L.H. Gulbrandsen, "The Emergence and Effectiveness of the Marine Stewardship Council," *Marine Policy* 33 (2009): 654–660; P.A. Shelton, "Eco-certification of Sustainably Managed Fisheries: Redundancy or Synergy?," *Fisheries Research* 100 (2009): 185–190; J.J. Silver and R. Hawkins, "'I'm Not Trying to Save Fish, I'm Trying to Save Dinner': Media, Celebrity and Sustainable Seafood as a Solution to Environmental Limits," *Geoforum* 84 (2017): 218–227.

Small-Scale Fisheries: Too Important to Fail

Ratana Chuenpagdee
Memorial University of Newfoundland,
St. John's, Newfoundland and Labrador, Canada

Svein Jentoft
UiT—The Arctic University of Norway, Tromsø, Norway

The Importance of Small-Scale Fisheries

According to some estimates,[1] small-scale fisheries constitute at least one-quarter of the world's catches. When considering the number of people employed in fisheries, more than 90 percent of approximately 120 million people, including men and women in the South as well as in the North, involved in full-time and part-time harvest and post-harvest activities, are associated with small-scale fisheries.[2] Unlike large-scale fisheries, where a large portion of catches goes into reduction (e.g., for fishmeal production) and for non-consumptive uses, about 95 percent of small-scale fisheries catches are destined for human consumption. Thus, small-scale fisheries contribute significantly to global and local food security, employment both directly and indirectly related to fisheries, and to viable livelihoods. The importance of small-scale fisheries extends to culture and heritage, and in many instances, they offer a way of life to many people besides employment. Small-scale fisheries values include, among other things, community cohesion, social safety net, and resource stewardship.[3] A recent trend in many places around the world is for small-scale fisheries to offer education and recreational opportunities for the general public as they visit fishing villages and enjoy the experience of being in fishing communities and eating locally caught fish. Because not all of the diverse values of small-scale fisheries are quantifiable, they are often underappreciated and easily dismissed, which could lead to eroding of communities and social safety net.

1 See the Sea Around Us Project website, http://seaaroundus.org.
2 Food and Agriculture Organization of the United Nations (FAO), *Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication* (Rome: FAO, 2015).
3 D. Johnson, "The values of small-scale fisheries," in *Social Wellbeing and the Values of Small-scale Fisheries,* eds., D. Johnson, T.G. Acott, N. Stacey and J. Urquhart (Switzerland: Springer, 2018).

In effect, small-scale fisheries are not just about the sector, but a system of interlinked activities and interdependent relationships, which provide diversity, stability, and flexibility for the communities in which they are embedded. The linkage goes both ways. Maintaining communities also provides an essential condition for small-scale fisheries to function and prosper. This is also important for sustaining the values and norms on which stewardship rests, and which makes it possible for communities to manage fisheries without external inputs from central governments or environmental organizations. When the moral fabric of communities dissolves, unsustainable fishing practices may occur and conflicts arise, and the collective action of communities is undermined. For communities to thrive through sustainable fisheries, trustful relationships must exist among small-scale fishers and other members of the communities whose contributions also count.

Some small-scale fishing communities follow a 'sufficiency principle' rather than a capitalistic logic of profit accumulation, thus expressing their awareness about the need to protect resources for the future. However, for many small-scale fisheries, having open access to fisheries resources and engaging in informal and unregulated employment provide people with a crucial safety valve. Neither of these should be seen only in negative terms, as something undesirable and that we should get rid of. In fact, they suggest that a blanket approach to control capacity in small-scale fisheries is not attuned to their characteristics and the diversified local situations. Rather than seeing fishing as an act of greed in the former case or as an illegal activity in the latter, small-scale fisheries operate according to the need for people to survive in situations where their livelihoods and food security are at stake. After all, one should keep in mind that pressure on resources is not all of their doing, but comes mostly from the uncontrolled development of industrialized fisheries around the world. If there is overfishing by numbers, closing the fisheries or reducing access may be necessary. But it should not be the first step. Many things can be done to curb overall fishing effort, such as re-distributing resources from large-scale to small-scale, which will not affect food security. Such a decision also aligns with the subsidiarity principle, which suggests that the people closest to the resources should be the one exploiting them.[4]

Despite their impressive contribution and importance, small-scale fisheries are often in marginalized and disadvantaged situations. The conditions under which they are working are not always favorable to sustain their overall

4 M. Bavinck and S. Jentoft, "Subsidiarity as a Guiding Principle for Small-scale Fisheries," in *World Small-Scale Fisheries: Contemporary Visions*, ed., R. Chuenpagdee (Delft: Eburon Academic Publishing, 2011), 311–322.

position within the value chain. For the most part, small-scale fishing people face issues with insecure access to resources and their tenure rights are not recognized. As a consequence, they are displaced from their workplace, both on land and at sea. They are, in many cases, simply not able to 'defend the beach'. Small-scale fisheries are also vulnerable to environmental change and other large-scale processes that affect their socio-economic conditions. They usually have little capital investment and assets that can help them in times of crisis. Moreover, they are often victims of unfair competition with industrial fisheries, in terms of supply chain and markets, and are often taken advantage of by moneylenders and traders who control prices.

From the governance perspective, small-scale fisheries are not only ignored in policy-making, but also have to bear the consequences of erroneous rules and regulations that discriminate against them in a way that makes their demise a self-fulfilling prophecy. In other words, if small-scale fisheries are considered by policy-makers to be a lost cause to begin with, e.g., they are a weight on society rather than an untapped possibility, the policies are likely to keep them in a situation for which they cannot thrive. An example of this can be found in the way subsidies are allocated within fisheries, which shows that as much as 84 percent of total fisheries subsidies (about US$35 billion in 2009[5]) goes to large-scale fisheries. Further, of this amount, the majority is considered 'harmful' subsidies, while for small-scale fisheries a larger portion of subsidies is considered beneficial. One could imagine what situation small-scale fisheries would be in today if the ratio had been reversed. For this reason, the recently adopted Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF Guidelines[6]) emphasize the need for states to implement re-distributive equity policies, taking into account the marginalized conditions of small-scale fishing communities.

The fact that small-scale fisheries around the world are struggling to maintain their existence is largely an issue of poor defense mechanisms, including lack of power, voice, representation, and lack of organization, which add to their vulnerability and marginality. The lack of engagement in policy-making processes where their working conditions are determined is a governance issue that can be corrected through political will and entrepreneurship. Thus, their position should be understood by a thorough analysis of how small-scale fisheries work in order to keep the possibility open that the observed governability problem resides in the governing system, and not in the social or

5 A. Schuhbauer et al., "How Subsidies Affect Economic Viability of Small-scale Fisheries," *Marine Policy* (2017): doi.org/10.1016/j.marpol.2017.05.013.

6 FAO, *supra* note 2 above.

natural systems where they operate. In other words, rather than assuming that the problems of small-scale fisheries are either ecological or social, we argue that the problems of small-scale fisheries are located in the governing system and their interactions.

How Not to Fail

Small-scale fisheries have been ignored for reasons that are not always clear. It is true that their large number and their social complexity create challenges and difficulties for governance. Because small-scale fishing people are largely owner-operators who enjoy their independence and freedom, they are not aligned with the government's idea about efficiency. Thus, the general lack of interest and recognition of the sector may even be considered a deliberate act. For instance, acknowledging the values and importance of small-scale fisheries would imply policy measures that may lead to change in the distribution of resources and power, which would negatively affect large-scale fisheries and other influential sectors. The introduction of policies that do not bring out these values, but instead undermine small-scale fisheries capacity, serves to confirm the predisposition against them.

Small-scale fisheries are not only too big to ignore, but are also too important to fail. Recognizing their values and importance is therefore the first step in the process of making it possible for them to realize their contributions and become prosperous. That is partly an issue of knowledge and information. We simply need to know more about their characteristics, situations, and potentials, at local, national, regional, and global scales.

Here, the academic community has an important role to play. Small-scale fisheries research needs to be broad and holistic, and extend beyond a single discipline. It needs to build on and include the experience-based knowledge that small-scale fishing people possess, in a way that makes the research of small-scale fisheries transdisciplinary. It would also involve comparative research that sorts out how small-scale fisheries are different from place to place, and determines how these differences affect viability and sustainability.[7]

These needs are being increasingly addressed globally, including through the *Too Big To Ignore Global Partnership for Small-Scale Fisheries* (TBTI).[8]

7 G. Bateson and M.C. Bateson *Angels Fear: Towards an Epistemology of the Sacred* (Chicago: University of Chicago Press, 1988).

8 See Too Big To Ignore, Global Partnership for Small-Scale Fisheries Research website, http://www.toobigtoignore.net.

Such initiatives also speak to the need for researchers, practitioners, fishers' organizations, environmental groups, and government agencies at various levels to work collaboratively in enhancing the profile of small-scale fisheries. This can start with identifying the main reasons why small-scale fisheries around the world underperform. Further, since good governance requires better data and a solid knowledge base, developing an information system specifically for small-scale fisheries is important,[9] as is in-depth research to improve the overall understanding of small-scale fisheries, addressing the key questions mentioned above.

Further, small-scale fisheries need to be better organized and empowered so that they can play an effective and proactive role in their own governance. Improvement in governance requires attention to what Kooiman[10] calls the three governing orders, i.e., day-to-day decision-making (first order), institutional design and arrangement (second order), and an articulation of values, images, and principles that inform behaviors and decisions (meta order). Opportunities for improvement must also be sought in any governing mode, be it hierarchical, co- and self-governance. In fact, recent research reveals a general tendency of governance reform and transformation in the direction of more participatory and cooperative forms of governance in small-scale fisheries.[11] This is a positive movement relative to the SSF Guidelines, which suggest that what they regard as a necessary condition is already happening.

The SSF Guidelines are an important instrument for policy-makers and civil society organizations who share a vision of a positive future for small-scale fisheries. It is also an instrument that can help empower small-scale fishing people and their organizations in expressing their human rights, obtaining legitimacy, securing access to resources and markets, and gaining general recognition of their important contributions and inherent values. The implementation of the SSF Guidelines is now underway around the world.[12] Thus, it is essential that the academic community pays attention to their uptake as well as actively contributes to its success. The SSF Guidelines recognize the important role that research may play in this process. Now it is up to the academic community to deliver.

9 See Information System on Small-scale Fisheries website, https://issfcloud.toobigtoignore.net.

10 J. Kooiman, *Governing as Governance* (London: Sage, 2003).

11 S. Jentoft and R. Chuenpagdee, eds., *Interactive Governance for Small-scale Fisheries: Global Reflections* (Switzerland: Springer, 2015).

12 S. Jentoft et al., eds., *The Small-Scale Fisheries Guidelines: Global Implementation* (Switzerland: Springer, 2017).

IUU Fishing and Measures to Improve Enforcement and Compliance

Judith Swan
Rome, Italy and Victoria, Seychelles

Introduction to IUU Fishing

The term 'illegal, unreported and unregulated (IUU) fishing' was first used in 1997 in the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) to capture the scope of uncontrolled fishing in the Southern Ocean and the urgency for addressing it. Members agreed that the situation called for collective efforts within CCAMLR, measures by flag states and coastal states and steps vis-à-vis non-Contracting Parties to enhance enforcement and compliance with conservation and management measures (CMMs).

It ignited the determination of the international community to come to grips with IUU fishing, which spans activities under international, regional, and national governance. It involves practices such as unlicensed fishing, using forged licenses, illegal transshipment at sea, displaying fake names or call signs on a vessel, fishing in prohibited areas/with prohibited gear, use of flags or ports of non-compliance with little or no effective controls, and failure to comply with reporting or other information requirements.

Even worse, some IUU fishers are known to kidnap people to work as crew, then murder them or throw them overboard. Many are involved in transnational crimes including smuggling drugs, people, and arms. They engage in bribery and blackmail of government officials, document fraud, and money laundering. Fraud throughout the food supply chain is reflected by practices such as mislabeling.

In 2009, the total value of IUU fishing worldwide was reported to be between US$10 billion and US$23 billion annually, representing between 11.06 million and 25.91 million tonnes of fish.[1] By 2014, members of the Food and Agriculture Organization of the United Nations (FAO) recognized that the magnitude and characteristics of IUU fishing were likely to have changed significantly since

1 D.J. Agnew et al., 2009. "Estimating the Worldwide Extent of Illegal Fishing," *PLoS* 4, no. 2 (2009), doi.org/10.1371/journal.pone.0004570.

that study. To address this, a 2015 FAO Expert Workshop proposed, *inter alia*, that FAO develop technical guidelines to estimate IUU fishing.[2]

The changes in IUU fishing are driven by several key factors, in addition to the status and value of the stocks. One is the continuing developments in *technology* that benefit IUU fishers such as improvements in satellite fish finding, gear, and vessel capabilities.

To balance this, technologies for information systems that support compliance and enforcement are emerging or being strengthened. They include electronic tracking, electronic reporting, and electronic monitoring. It is expected that such analyses and trials will expand in future as technologies are further developed.

Another major factor that could affect the changing characteristics of IUU fishing relates to *subsidies*. In April 2017, most World Trade Organization (WTO) members expressed support for prohibiting subsidies for IUU fishing with no exceptions and many members identified as a 'critical area for action' at the December 2017 WTO Ministerial Conference an outcome on fisheries subsidies.

The role of *markets* is obvious; IUU fishers aim to profit, and where the markets dry up because of consumer preference for sustainably caught fish and increasing use of catch documentation schemes and traceability tools, the characteristics of IUU fishing will be impacted. Civil society is expanding its initiatives to partner with industry and foster consumer demand for sustainably caught seafood, as described below.

The above factors impact the characteristics of IUU fishing, and also serve as a basis upon which many compliance and enforcement measures are built. Such measures require a robust legal and procedural basis at all levels—international, regional, and national. This essay describes existing international instruments, trends in regional measures and—most important for implementation—forward-looking provisions to be considered for national legislation. The legislation, in turn, provides the foundation for operational procedures and technical/technological measures.

This essay elaborates the provisions in national legislation that must be considered to implement specific compliance and enforcement measures, and enable their implementation through supporting provisions, such as interpretation, institutions, evidence, and jurisdiction. Without such provisions, compliance and enforcement cannot exist and without regular review of such

2 Food and Agriculture Organization of the United Nations (FAO), *Report of the Expert Workshop to Estimate the Magnitude of Illegal, Unreported and Unregulated Fishing Globally, Rome, 2–4 February 2015*, FAO Fisheries and Aquaculture Report No. 1106 (Rome: FAO, 2015), http://www.fao.org/3/a-i5028e.pdf.

provisions to adapt to changing characteristics of IUU fishing and means of addressing it, compliance and enforcement suffer.

In this essay, *compliance* generally refers to the level of conformity with the law; it can be voluntary and improved by deterrence. *Enforcement* refers to activities that compel conformity with the law, and may include inspection, surveillance/monitoring, investigation, arrest, prosecution, fines, suspensions, forfeitures, and other penalties or sanctions. *Monitoring, control, and surveillance* (MCS) activities support both. Reference in this essay to 'IUU fishing' includes 'fishing related activities'[3] because of their inclusion in many international instruments. This essay focuses on the larger scale IUU fishing, mindful that smaller-scale fishing is also adversely affected but that different, but not dissimilar, enforcement and compliance mechanisms are needed.

International and Regional Framework

International Fisheries Instruments

The crusade against IUU fishing was taken to FAO, where in 2001 an International Plan of Action to Prevent, Deter and Eliminate IUU Fishing (IPOA-IUU) was adopted. A voluntary instrument, it defined IUU fishing[4] and built upon the approach discussed in CCAMLR, describing actions and measures to be taken by all states, flag states, coastal states, and port states and internationally agreed market-related measures. It has served as a foundation for development of a wide range of regional and national plans of action to combat IUU fishing.

The international community intensified its efforts to develop additional international instruments to address various aspects of IUU fishing, including the legally-binding 2009 FAO Agreement on Port State Measures to Prevent, Deter and Eliminate IUU Fishing.[5] Its aim was to provide for cost-effective enforcement through harmonized minimum standards, including for information and inspection, for denial of entry into, or use of, port for vessels where evidence shows IUU fishing activities. The IUU fishers suffer significant economic loss and may be subject to prosecution.

3 'Fishing related activities' means any operation in support of, or in preparation for, fishing, including the landing, packaging, processing, transhipping or transporting of fish that have not been previously landed at a port, as well as the provisioning of personnel, fuel, gear and other supplies at sea.

4 Definitions are in Paragraph 3 and apply nationally and regionally. See http://www.fao.org/fishery/ipoa-iuu/legal-text/en.

5 Entered into force in 2016. See http://www.fao.org/3/a-i1644t.pdf.

From 2009, several voluntary FAO international guidelines were adopted that would serve as useful tools in combating IUU fishing,[6] importantly including the 2014 Voluntary Guidelines for Flag State Performance.[7] They were all based on the 1982 United Nations Convention on the Law of the Sea and the 1995 United Nations Fish Stocks Agreement and contained strengthened and synergistic measures relating to fisheries monitoring, control, and surveillance.

Regional Fisheries Management Organizations

Regional fisheries management organizations (RFMOs) have mandates to adopt CMMs that are legally binding on their members and, in most cases, co-operating non-members. The measures may apply to areas within and beyond national jurisdiction, depending on the competence of the RFMO. They have adopted a wide range of CMMs establishing compliance tools, including establishment of IUU vessel and authorized vessel lists, observer schemes, requirements relating to vessel monitoring systems (VMS), reporting, transshipment, port state measures, flag state responsibilities, catch documentation schemes, unique vessel identifiers,[8] and import–export requirements.[9]

Regional Economic Integration Organization

The European Union (EU) has developed robust sanctions against IUU fishing. Measures against IUU fishing have been identified, and in respect of IUU fishers, the sanctions aim to reduce revenue and to increase operating and capital costs and the cost of the risk of doing business.[10] The 2010 EU IUU Regulation

6 These include the International Guidelines on Bycatch Management and Reduction of Discards and International Guidelines for the Management of Deep-sea Fisheries in the High Seas (http://www.fao.org/fishery/code/guidelines/en) and the Voluntary Guidelines for Catch Documentation Schemes, which were developed for adoption in 2017 (http://www.fao.org/fi/static-media/MeetingDocuments/CDS/TC2016/wpAnnex.pdf).

7 See http://www.fao.org/3/a-i4577t.pdf. See also K. Erikstein and J. Swan, "Voluntary Guidelines for Flag State Performance: A New Tool to Conquer IUU Fishing," *International Journal of Marine and Coastal Law* 29, no. 1 (2014): 116–147.

8 The tuna RFMOs have adopted requirements for unique vessel identifiers.

9 Performance reviews of RFMOs continue to make recommendations on strengthening compliance and enforcement. See M. Ceo et al., *Performance Reviews by Regional Fishery Bodies: Introduction, Summaries, Synthesis and Best Practices*, Volume I, FAO Fisheries and Aquaculture Circular. No. 1072 (Rome: FAO, 2012).

10 M. Beke and R. Blomeyer, *Illegal, Unreported and Unregulated Fishing: Sanctions in the EU* (Brussels: Directorate General for Internal Policies, European Parliament, 2014), http://www.europarl.europa.eu/RegData/etudes/STUD/2014/529069/IPOL_STU%282014%29529069_EN.pdf.

includes various tools to control fishing activities such as an IUU vessel list.[11] Member States are to adopt appropriate measures, allocate adequate financial, human and technical resources, and set up all administrative and technical structures necessary for ensuring control, inspection, and enforcement.

INTERPOL

INTERPOL has intensified its activities to address IUU fishing through project SCALE,[12] which was launched in 2013, mindful that the fishing industry is vulnerable to various types of international organized crime. It supports member countries in identifying, deterring, and disrupting transnational fisheries crime. It has contributed to discussions on fisheries crime in the United Nations Office on Drugs and Crime.

Civil Society

Civil society has played an important role in supporting the development and implementation of measures to combat IUU fishing, including as observers in international organizations and RFMOs.[13]

Organizations that are using emerging technologies to identify IUU fishing by individual vessels include Global Fishing Watch (Google, Oceana, and Skytruth), which makes satellite-based VMS data available to the public, and Fish Spektrum, which uses automatic identification system (AIS) data from the Marine Traffic database.

National Measures to Improve Compliance and Enforcement

It is vital that national laws and procedures implement current and emerging international and regional obligations, including minimum standards for harmonization, and respond to the continuously changing characteristics of IUU fishing. This will strengthen governance at all levels, reward legitimate fishers, and tighten the net around the IUU fishers and their beneficiaries. Key legal and procedural recommendations for strengthening and supporting compliance and enforcement measures appear below.

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11 Based on Council Regulation (EC) No 1005/2008 of 29 September 2008 establishing a Community system to prevent, deter and eliminate IUU fishing, OJ L 286/1 (29 October 2008).

12 See "Project Scale," Interpol, https://www.interpol.int/Crime-areas/Environmental-crime/Projects/Project-Scale.

13 For example, the Marine Stewardship Council and World Wildlife Fund have supported traceability and certification of sustainable fisheries to underpin seafood marketability.

Legal

National legislation should aim to achieve the following objectives to implement, and support, compliance and enforcement measures.

(a) Ensure consistency in *definition of terms* with international/regional instruments, including for basic terms such as 'IUU fishing', 'fishing', and 'related activities'.

(b) Ensure clarity in *institutional responsibilities* for compliance and enforcement, and where several government agencies are involved, provide a memorandum of understanding for seamless interagency co-operation. Conflict of interest should be prohibited and severely sanctioned.

(c) Ensure a process for taking *conservation and management measures* that is clear, inclusive, and well publicized to foster compliance. A mechanism that facilitates implementation of RFMO CMMs, which are usually agreed on an annual basis, should be integrated in the law.

(d) Provide a strong legal framework for requiring true, correct, and complete *information* and maintaining *registers* for purposes of compliance/enforcement.

(e) For *vessel registration* and *control of national vessels in areas beyond national jurisdiction*, apply the FAO Voluntary Guidelines on Flag State Performance and other instruments and relevant RFMO requirements.

(f) For *licensing*, require full information on the vessel as required in international and regional instruments.

(g) For *entry into areas under national jurisdiction* by all fishing vessels, including those in transit, require reports prior to or upon entry and electronic reporting through VMS or AIS consistent with international and regional standards and compatible with equipment in the coastal State.

(h) For *operations in the fisheries waters*, implement extensive reporting requirements consistent with regional and international requirements.

(i) *Compliance* requirements must be specified comprehensively, for unlicensed and licensed vessels. The 'operator' of a fishing vessel should always be responsible for compliance and enforcement.

(j) For strengthened *MCS authority*, ensure clear institutional functions and forge interagency agreements for co-ordinated compliance and enforcement. The officers authorized to inspect and arrest should be clearly designated and trained, and observers should be empowered for scientific, monitoring, and compliance functions.

(k) *Technological* advances for compliance and enforcement described in the introduction, including electronic tacking, reporting, and monitoring, must be underpinned by legislation.

(l) *Jurisdiction of the courts* must be specified and extend to nationals (vessels and persons) in areas beyond national jurisdiction. A 'Lacey Act' provision should prohibit the import, trade, and other dealings with IUU-caught fish in areas beyond national jurisdiction.[14] Evidentiary provisions should govern fisheries-specific activities.[15]

(m) *Offences* must be clearly set out. All too often legislation simply summarizes offences in a few sections, leaving unenforceable gaps.[16]

(n) To address situations where judges do not realize the seriousness of fisheries offences, the legislation should include *judicial guidelines* for determining and penalizing offences and a range of liabilities, fines, and penalties.

Procedures, Institutions, and Capacity Development

Procedures that assess risks of IUU fishing activity should be developed that target enforcement operations to the most significant risks. MCS procedures should be based on legislation and regional/international obligations and co-operation, and arrangements for interagency co-operation. They should be integrated as appropriate with regional/international organizations and partners. Human capacity development, including training for legal, compliance and enforcement personnel of all relevant agencies, and public awareness-raising, all support efforts to address IUU fishing.

Conclusion

In two decades, the international community has made great strides in developing tools for the compliance and enforcement of IUU fishing. Among the challenges that still lie ahead are staying ahead of the changing characteristics of IUU fishing and ensuring that the innovative measures and tools to address them are activated at regional levels and entrenched in national laws and processes.

14 See "Lacey Act," US Fish & Wildlife Service, International Affairs, https://www.fws.gov/international/laws-treaties-agreements/us-conservation-laws/lacey-act.html.

15 For example, they could include reversal of onus of proof as appropriate.

16 Many countries append a schedule to the act that sets fines for each relevant section and can be amended by regulation.

The Future of Managing Fisheries and the Global Commons through Regional Fisheries Management Organizations: Steps toward Global Stewardship

Susanna D. Fuller
Oceans North, Halifax, Nova Scotia, Canada

Kathryn E. Schleit
Ecology Action Centre, Halifax, Nova Scotia, Canada

Introduction

The high seas, to this day, are viewed by many as a hive of unlawful activity, with visions of piracy, illegal fishing, and mysterious sea creatures. Conversely, that same 70 percent of our ocean that is outside state waters, beyond 200 nautical miles, may be seen as a frontier area, with little human activity relative to nearshore and coastal ecosystems. Somewhere between those two extremes lies the truth. Our most intimate connection with the high seas comes from the fish on our plate and occasional news stories documenting the catch of a big fish by local fishers. On the other hand, public awareness about the high seas also centers on iconic species like cod and tuna that have been overfished and remain below historic levels. It is the collective decisions of individual countries that determine the ultimate fate of high seas fish populations. The past and future success of these group decisions in adhering to high-level principles and the best available science to protect the global commons will dictate if we can minimize human impacts and ensure the sustainability of the broader marine ecosystem.

The Challenges of Managing the High Seas and Migratory Stocks

Since the United Nations Convention on the Law of the Sea and the United Nations Fish Stocks Agreement (UNFSA) came into force, implementation has been slow but steady, yet new conservation challenges apart from fisheries management are emerging. UNFSA provides for implementation of global best practices for managing fisheries.[1] Regional fisheries management organizations

1 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of

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(RFMOs), as described by UNFSA, are governed by member states and primarily responsible for managing the straddling and migratory stocks that live in or pass through designated regions of the ocean. Those responsible for straddling stocks now cover ~65 percent of the high seas and those responsible for highly migratory species, such as tunas, swordfishes and billfishes, are in place for 91 percent of the world's ocean, including inside and outside of the 200-nautical mile limit of coastal states.

Managing high seas fisheries is a delicate balance for countries that are members of RFMOs, each with different political and economic motivations as well as historic access to particular fisheries. Coastal states—countries whose waters border adjacent high seas areas and have rights over the fish in their coastal waters—vie for access with distant water fishing nations, those states fishing in other country's exclusive economic zones or on the high seas. Furthermore, there are states that previously have not fished within specific RFMO areas, often because they are developing their fisheries or due to changing migratory patterns of fish species, but that want to build their fishing access and capacity for food security and trade purposes. Many of the latter may not have the competent national bodies to adhere to modern management principles such as precautionary decision-making and an ecosystem approach, which is now enshrined in the agreed mandates of most RFMOs.

The performance of RFMOs is measured most notably by the health of fish populations included in their mandates, and global assessments show that high seas fisheries are still in decline, despite the investments in science, research, management, and diplomatic efforts.[2] In addition to annual meetings, stock updates, and setting quotas, RFMOs engage in performance reviews[3] by external panels and states participate in 'review conferences' on the implementation of UNFSA every five years. While these processes are instituted in efforts to hold governments accountable, few high seas fisheries have been successfully rebuilt,[4] moratoria remain in place, fishing continues to impart collateral damage on other species and marine habitats,[5] and increasing uses

Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 4 December 1995, 2167 *U.N.T.S.* 88.

2 Food and Agriculture Organization of the United Nations (FAO), *The State of World Fisheries and Aquaculture 2016. Contributing to Food Security and Nutrition for All* (Rome: FAO, 2016).

3 M. Ceo, et al., *Performance Reviews by Regional Fishery Bodies: Introduction, Summaries, Synthesis and Best Practices. Volume I: CCAMLR, CCSBT, ICCAT, IOTC, NAFO, NASCO, NEAFC*, FAO Fisheries and Aquaculture Circular No. 1072 (Rome: FAO, 2012), http://www.fao.org/docrep/015/i2637e/i2637e00.pdf.

4 S. Cullis-Suzuki and D. Pauly, "Failing the High Seas: A Global Evaluation of Regional Fisheries Management Organizations," *Marine Policy* 34, no. 5 (2010): 1036–1042.

5 G.O. Crespo and D.C. Dunn, "A Review of the Impacts of Fisheries on Open-ocean Ecosystems," *ICES Journal of Marine Science* 74, no. 9 (2017): 2283–2297, doi.org/10.1093/icesjms/fsx084.

of the ocean, as well as climate change, are further reducing the chances that fisheries management measures can, in fact, ensure continued production of food for a growing global population.

Decision-makers and states that invest heavily in both science and advocacy for increased access to ever-diminishing stocks but too often lack the fortitude to enact fisheries closures or reductions at the right time, often succumb to industry pressure to reduce quotas gradually rather than immediately stop overfishing at the initial signs that all is not well. Despite increasing technology to track fishing activity, illegal and unregulated fishing continues. As many RFMOs were put in place following a fishing crisis or population decline, rather than in advance of overfishing and mismanagement, targets are often set to rebuild stocks to depleted levels rather than to a formerly abundant state. In addition, at the first signs of stock improvements, quotas are often increased too high, too quickly, reversing years of population rebuilding.

Facing poor or uncertain stock assessments and problems with single-species fisheries measures, scientists are developing more sophisticated scientific modeling and managers are taking preliminary steps to incorporate an ecosystem approach to manage habitat impacts, bycatch of incidental species and predator-prey interactions. Since 2006, and the commitment by states through the United Nations General Assembly resolution 61/105, increased pressure has been placed on both scientists and managers to assess the impacts of fishing on deep-sea habitats from bottom fishing and subsequently prohibit fishing activity where these vulnerable ecosystems are known or likely to occur. Progress has been made, but not to the degree that has been committed.[6] Incidental catches of sharks and seabirds are known, but no fishing limits have been agreed to in most of the global ocean to ensure no further damage to these non-target species While most RFMOs are supposed to consider the impacts of fishing not only on target stocks, but also on other stocks that are impacted, few effective multi-species management systems have been put in place.

Increasingly, state fisheries managers are coming to the realization that even if they followed all science advice at the right time and fully protected the marine ecosystem from direct and indirect impacts of fishing, other human activities are impacting the ecosystem, including oil and gas extraction,

6 United Nations General Assembly, *Report of the resumed Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, 23–27 May 2016, New York*, UN Doc. A/CONF.210/2016/6, http://undocs.org/A/CONF.210/2016/5.

deep seabed mining, plastic pollution, and climate change. Often times states make decisions outside of RFMOs that will fundamentally undermine future rebuilding of fisheries, whether it is through lukewarm commitments to reducing greenhouse gas emissions or enabling resource extraction on valuable fishing grounds. Increasing human activity will make this much more difficult as both the science and the governance to manage cumulative impacts of people on biodiversity is lacking. The only way that these other impacts can be managed is through global mechanisms that include most of the same states and high seas fishing nations.

Ways Forward for RFMOs

There are a few ways forward to improve fisheries management by RFMOs, the foremost of which is to ensure that states have the political fortitude to follow scientific advice, make decisions based on precaution, commit to transparency in all aspects of data and decision-making, and act, in a timely manner, upon recommendations of performance reviews. Fish do not follow RFMO boundaries so it is imperative that management is consistent across RFMOs if there is to be any possibility of meaningful rebuilding and ecosystem protection. The ingredients for successful fisheries management exist, with the political will of member states being the 'keystone' ingredient. And the time has come when just focusing on managing fisheries must be left to the bygone days of relative simplicity.

Many RFMOs came into force following UNFSA, and hence include in their mandates modern best practice in fisheries management such as maintaining or restoring stocks at levels capable of producing maximum sustainable yield and implementing the ecosystem and precautionary approaches. Some that predated UNFSA have modernized their conventions to include these principles, but several have not. Few, in any case, regularly put these policies into practice in all management decisions, but must do so as a way forward.

Some RFMOs are adopting more robust and adaptable fisheries management tools by developing science-based harvest strategies where fisheries management decisions are based on pre-agreed objectives and decision rules. In RFMOs where they have been tested, harvest strategies have been shown to reduce the time and political influence of management decisions, better plan for uncertainty, and ultimately maintain stock health over time. These new tools should be incorporated by all RFMOs to improve management.

An increasing challenge facing RFMOs, particularly in light of changing stock dynamics due to climate change, is states seeking increased access to stocks that they previously did not fish or only fished for in the past. The political decisions around quota sharing are thwarting good fisheries management decisions and calling into question states' abilities to equitably manage resources. RFMOs need to develop just sharing arrangements that consider changing stock dynamics and coastal and developing state rights that do not hinder precautionary, science-based management.

Beyond RFMOs, a New Evolution

While RFMOs have increasingly taken action to reduce the impacts of fishing, these actions are neither bold nor broad enough. For fish populations to recover from human impact, they will need long-term respite from our interventions. In the ocean, one option is for states to establish a mechanism allowing for high seas marine reserves,[7] setting areas off limits to human impacts, and ensuring effective and efficient establishment of enforcement mechanisms. These reserves can build upon and enhance spatial protection measures in place for fisheries. This will require inter-sectoral co-operation where governance bodies for fishing, shipping, mining, and oil and gas extraction will need an integrated approach to ensuring that all activities are restricted within these marine reserve areas.

A second and perhaps more radical option proposed by some is to end fishing on the high seas and allow fishing only in coastal state waters.[8] There are benefits to this; enforcement may be easier and costs for global instruments and regional management organizations would effectively end. The downside is that those organizations also provide a venue for sharing best practices and information, development of collective science, and ideally are a place where states can hold each other to account to higher level commitments and legal obligations. A further complication for states to address in this approach is the contracting and expanding ranges of fish populations as a result of climate change that will require adaptability to having more or less fish in their waters from year-to-year.

It is clear that despite global legal frameworks and subsequent incremental improvements in governance and science for fisheries management, these tools are not working as fish populations struggle to recover. While far from

7 U.R. Sumaila et al., "Potential Costs and Benefits of Marine Reserves in the High Seas," *Marine Ecology Progress Series* 345 (2007): 305–310.

8 U.R. Sumaila et al., "Winners and Losers in a World Where the High Seas is Closed to Fishing," *Scientific Reports* 5 (2015), doi.org/10.1038/srep08481.

the eyes of most people, it is only bold decisions and expedited action that can ensure the future of high seas ecosystems, which from an ecological perspective blend seamlessly into national waters. Our collective track record does not bode well, and future success will need strong leadership and a commitment to the fish and ecosystems that have served us well for so long. It is only in this way that stories of big fish being caught may be part of our ocean future.

Balancing Sustainable Tuna Resource Management and Economic Development: Small Island Developing States Perspectives

Esaroma Ledua and Joeli Veitayaki
University of the South Pacific, Suva, Fiji

Introduction

In small island developing states (SIDS), sustainable fisheries are the overriding goal of balancing fisheries management for important resources such as tuna and economic development.[1] However, reports over time have shown that fisheries management in general has continued to fail, sometimes spectacularly. Key factors that have hindered the effectiveness of fisheries management in SIDS include the combined effects of small fisheries departments, degradation of supporting ecosystems, heavy exploitation, environmental degradation,[2] uncertainties of scientific information, unpredictable variations in the growth of fish stocks, heightened economic development demands, and error in the implementation of management measures.[3] Determining SIDS' perspectives on what sustainability entails and ways of balancing tuna resource management and economic development is difficult but necessary, as it determines the long-term sustainable use of fisheries resources such as tuna.

Four species of tuna—albacore (*Thunnus alalunga*), bigeye (*T. obesus*), yellowfin (*T. albacares*), and skipjack (*Katsuwonus pelamis*)—are important to Pacific SIDS due to their value, high abundance, and level of dependence. Tuna caught within national waters of fifteen Pacific SIDS that are members of the Pacific Islands Forum Fisheries Agency (FFA) region contributed approximately 1.5 million metric tonnes (valued at US$2.8 billion) of about

1 Food and Agriculture Organization of the United Nations (FAO), *Code of Conduct for Responsible Fisheries* (Rome: FAO, 1995).

2 R. Mahon and P. McConney, "Managing the Managers: Improving the Structure and Operation of Small Fisheries Departments, especially in SIDS," *Ocean and Coastal Management* 47, no. 9–10 (2004): 529–535; K. Cochrane, "Fisheries Management," in *A Fishery Manager's Guidebook: Management Measures and their Applications*, FAO Fisheries Technical Paper No. 424, ed., K. Cochrane (Rome: FAO, 2002).

3 D.S. Holland, *Management Strategy Evaluation and Management Procedures: Tools for Rebuilding and Sustaining Fisheries*, OECD Food, Agriculture and Fisheries Working Papers No. 25 (Paris: Organisation for Economic Co-operation and Development Publishing, 2010).

2.7 million metric tonnes (valued at ca. US$4.8 billion) of tuna from the Western and Central Pacific Fisheries Commission (WCPFC) region in 2016.[4] Skipjack tuna contributed approximately 58 percent of the total annual catch, followed by yellowfin at 28 percent, bigeye at 8 percent, and albacore at 4 percent. Thus, tuna is the economic development driver in most Pacific SIDS.

Consequently, Pacific SIDS have been working individually, collectively, and collaboratively to forge management systems that reflect their perspectives, respect their rights, and increase income from tuna while simultaneously preserving its sustainability. The collaborative and collective arrangements of Pacific SIDS have been spearheaded by the FFA, established in 1979 to coordinate the regional drive to secure long-term maximum benefits from shared offshore fisheries resources. In 1982, eight of the Pacific SIDS and FFA established a sub-regional agreement known as the Parties to the Nauru Agreement (PNA), to formulate initiatives that maximize direct and indirect economic benefits to the parties.[5] Moreover, the SAMOA Pathway in 2014 reaffirmed SIDS' perspectives by promoting sustained, inclusive, and equitable economic growth, promoting integrated and sustainable management of natural resources and ecosystems, while facilitating ecosystem conservation, regeneration, restoration, and resilience in the face of new and emerging challenges.[6]

Pacific SIDS' perspectives are influenced by their rights and responsibilities provided under the United Nations Convention on the Law of the Sea (UNCLOS), Agenda 21 of the United Nations Conference on Environment and Development, and the FAO Code of Conduct for Responsible Fisheries of 1995. These frameworks outlined international standards to protect ecological wellbeing, sustainability of highly migratory species such as tuna, and the economic development aspirations of SIDS. They also highlighted the importance of using MSY as the basis for setting total allowable catch (TAC) to ensure that living resources in the exclusive economic zone (EEZ) are not overexploited.

Pacific SIDS are struggling to sustainably manage their tuna resources given the uncertainties surrounding the state of bigeye tuna and the full-to-overexploited state of yellowfin and albacore. Many regard MSY as inadequate for maintaining stocks at levels viable to achieve greater financial returns from tuna resources within EEZs. As a result, Pacific SIDS' perspectives focus on

4 Pacific Islands Forum Fisheries Agency (FFA), "Catch and Catch Values of WCPO Tuna Fisheries by Waters and Fleet 2016," last accessed 19 September 2017, https://www.ffa.int/node/425.

5 *Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Stocks* (as amended April 2010).

6 "Samoa Pathway—Outcome document," UN Conference on Small Islands Developing States, Apia, Samoa, 1–4 September 2014, http://www.sids2014.org/index.php?menu=1537.

sustaining increased benefits derived from foreign fishing nations by setting up local tuna processing facilities, domestication of tuna fishing fleets targeting stocks within EEZs, transshipment in ports, and increased percentages of local crews on foreign vessels. Engaging Pacific SIDS in monitoring, compliance, and surveillance (MCS) is also critical given increasing concerns of incompatible national tuna management arrangements and regional tuna conservation and management measures (CMM). Managing highly migratory fish stocks such as tuna requires arrangements that are understood and implemented by all stakeholders at national, regional, and international levels.

This essay uses a Pacific SIDS case study to examine the perspective on what sustainability entails, to explore why Pacific SIDS national tuna management arrangements were not compatible with regional and international CMMs, and to recommend solutions. The focus is on Fiji's tuna management framework, which is evaluated against national, regional, and international standards to determine the degree of compliance with international benchmarks on balancing sustainable management of tuna resources and economic development.

Tuna Fisheries Management in Fiji

Fiji's national fisheries management framework includes the Fiji Tuna Management and Development Plan (2014–2018) (hereafter the 'Tuna Plan'), the Offshore Fisheries Management Decree (2012), the *Fisheries Act*, Chapter 158, and the *Marine Spaces Act*, Chapter 158A of the laws of Fiji. The evaluation in this essay begins with conformance of the Tuna Plan to measures in the Offshore Fisheries Management Decree (2012), which defined how the Tuna Plan should be designed. The second level is on the degree of compliance of the Tuna Plan and the Offshore Fisheries Management Decree (2012) to regional and international control measures outlined under WCPFC-CMM 2015–02 and CMM 2016–01, the FAO Code of Conduct for Responsible Fisheries, Article 17 of Agenda 21, and UNCLOS.

Fiji's perspectives and intention on balancing sustainable management of tuna resources and economic development are reflected under nine goals of the Tuna Plan: (1) maintaining stock sustainability to support economic growth in offshore fisheries; (2) contributing to Fiji's gross domestic product by promoting development and growth in offshore fisheries; (3) increasing investments and employment opportunities in the economy; (4) managing resilience of offshore fisheries against climate change risks; (5) protecting fisheries investments and ensuring food security; (6) sustaining ecosystem health and exercising the precautionary approach; (7) managing tuna under rights-based and integrated fisheries management frameworks; (8) strengthening institutions; and (9) promoting capacity to support resource building and knowledge-based management.

The common fisheries management approach of using MSY or MEY for setting allowable catch limits is difficult to achieve in Fiji given its lack of capacity, resources, and differences in perspectives. For example, the country's TAC of 12,000 metric tonnes per annum set under the Tuna Plan was to allow the attainment of Fiji's economic development goals specified in the Plan. This TAC exceeded the MEY level of 6,610 metric tonnes recommended by the Secretariat of the Pacific Community (SPC) and the FFA scientists in 2012, which Fiji viewed as inadequate to attain greater financial returns from tuna resources.[7]

Section 2.3(iv) of the Tuna Plan identified overfishing and overcapacity as the main risks associated with the tuna fishery (albacore, yellowfin, and bigeye) in Fiji. This implied that the Fiji government was aware that the national and regional measures were not effectively controlling overfishing. Nevertheless, Fiji's domestic fleet continued to expand fishing on the high seas and waters of neighboring states. Tuna caught in international waters by Fiji's domestic fleet increased from 10 percent of total annual catch in 2001 to 45 percent in 2015.

Fiji's rights under regional tuna CMMs and international frameworks have influenced its perspective of balancing sustainability of tuna resources and economic development. Prior to the adoption of WCPFC-CMM 2010–05 in 2010, the total number of Fiji-flagged vessels targeting albacore was 92, but this grew to 121 vessels in 2011, 113 vessels in 2012, and 102 vessels in 2015, before vessel numbers dropped to 89 in 2016.[8] According to paragraph 1 of WCPFC-CMM 2015–02, "Commission Members, Cooperating Non-Members, and participating Territories (CCMs) shall not increase the number of their fishing vessels actively fishing for South Pacific albacore in the Convention Area south of 20°S above 2005 levels or recent historical (2000–2004) levels."[9] Paragraph 2 states that "the provisions of paragraph 1 shall not prejudice the legitimate rights and obligations under international law for small island developing State and

7 Fiji Fisheries Department, *Fiji Tuna Management and Development Plan* (*2012–2016*) (Suva: Fisheries Department, 2012).

8 Western and Central Pacific Fisheries Commission (WCPFC), "Fiji," *Annual Report to the Commission. Part 1: Information on Fisheries, Research and Statistics, Scientific Committee Thirteenth Regular Session, Rarotonga, Cook Islands, 9–17 August 2017*, WCPFC-SC13-AR/CCM-07, Table 3.

9 WCPFC, "Conservation and Management Measure for South Pacific Albacore," Conservation and Management Measure (CCM) 2015–02, Commission Twelfth Regular Session, Bali, Indonesia, 3–8 December 2015.

Territory CCMs in the Convention Area for whom South Pacific albacore is an important component of the domestic tuna fishery."

Paragraph 41 of WCPFC-CMM 2014–01 and CMM 2016–01 also encouraged Fiji to overfish resident bigeye tuna stocks within national waters to a maximum of 2,000 metric tonnes. Prior to 2014, bigeye landings by Fiji's domestic tuna longline fleet averaged only 740 metric tonnes per year. The catch grew to 1,586 metric tonnes in 2014, 1,169 tonnes in 2015, and approximately 1,190 metric tonnes in 2016.[10] Similarly, after implementation of WCPFC-CMM 2014–01 and CMM 2016–01, annual catch levels of yellowfin increased from 1,292 to 2,748 metric tonnes during 2005–2013, to 3,594 metric tonnes in 2014, 3,647 tonnes in 2015, and 3,928 tonnes in 2016.[11] The regional tuna CMMs encouraged overfishing of resident stocks of targeted tuna species within SIDS' EEZs and failed to protect the sustainability of targeted tuna stocks for future generations.

To address the paradox between sustainability of tuna and greater financial returns from tuna, we must balance sustainability of tuna stocks and SIDS' income over the long term. The way forward may be possible not only by developing an alternative source of income, but mostly by containing the growth spirals of economies and the depletion of tuna resources. There is a need to develop a new management approach beyond MSY and MEY that (a) recognizes SIDS' dependence on tuna resources, (b) reduces longline fishing competition between SIDS and distant water fishing nations (DWFNs), (c) promotes invention of appropriate technology and new sources of energy to reduce costs of SIDS' domestic fleet, (d) increases fair sharing of benefits through increased onshore activities of foreign fishing nations, (e) enhances accountability of tuna fisheries managers and fishers, and (f) encourages sustainability. SIDS' economic benefits from tuna longline fishing has increased steadily in the last twenty years, but their involvement in the purse seine fishery is limited to crewing vessels. Our case study showed that 45 percent of Fiji's domestic tuna longline fleet's annual catch is from international waters adjacent to its EEZ. Reducing DWFNs' longlining activities will balance SIDS' growing demands of expanding their fishing activities into adjacent high seas areas. At the moment SIDS cannot compete with DWFNs in purse seining, and see longline fishing as an important way forward for balancing sustainable tuna resource management and economic development.

10 WCPFC, "Fiji," *supra* note 8, Table 1.

11 WCPFC, "Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna," CMM 2013–01, Commission Tenth Regular Session, Cairns, Australia, 2–6 December 2013.

Conclusion

This essay has focused on the SIDS' perspective of balancing the sustainability of tuna resources and economic development. This refers to the sustainable increase in the sharing of benefits between SIDS and foreign fishing nations through the establishment of local tuna processing facilities, domestication of tuna fishing fleet's targeting stocks within EEZs, transshipment in ports, and increased percentages of local crews on foreign vessels. McCoy supported this statement that transshipment undertaken in ports has enhanced catch verification efforts and has also been a source of direct financial benefit to some FFA member countries.[12] Our case study shows that Fiji has been profiting from its domestic longline fleet fishing beyond Fiji's EEZ.

The common fisheries management approach of balancing sustainable tuna resource management and economic development using MSY and MEY is difficult for SIDS, which sees these management arrangements as impediments of their rights specified under UNCLOS and WCPFC-CMMS. It is important to develop a management system capable of better balancing tuna resource sustainability and long-term financial sustainability of tuna developments in SIDS.

12 M.A. McCoy, *A Survey of Tuna Transshipment in Pacific Island Countries: Opportunities for Increasing Benefits and Improving Monitoring* (Honiara: FFA, July 2012).

Sustainable Aquaculture: Protecting Our Oceans and Feeding the World

David Roberts
Sustainable Blue, Centre Burlington, Nova Scotia, Canada

Aquaculture's Time Has Come

The sustainability of aquaculture will not be a choice for the future, but a necessity. Aquaculture has grown from an alternative means of producing marine and freshwater plants and animals to an integral part of the existing food supply and, in fact, the most promising means of supplying the protein that the world will require to feed its growing population.

Over the last 30 years the world has seen changes in fishing technologies/effort that have facilitated our ability to extract fish and other aquatic organisms from the sea, lakes, and rivers at a rate never before experienced. As the world population has continued to increase so has the demand for aquatic protein and therefore our ability to sell 'all that we can catch', or extract from these aquatic environments. As we continued to extract at a rate greater than is biologically sustainable, we are faced with a diminished resource base and overfished species. Embracing terms such as maximum sustainable yield, countries began to implement quotas on fishing effort and gear and/or restrictions to entry. There were warning signs that the 'supply' was being 'fished out'. Today, of all the known commercial species being fished, only 15 percent are at a level that will allow for additional harvesting. This is not sufficient to keep up with demand. In fact, there has been little 'new' fish biomass extracted from our oceans since the 1980s.

In terms of global production volume, that of farmed fish and aquatic plants combined surpassed that of capture fisheries in 2013. In terms of food supply, aquaculture provided more fish than capture fisheries for the first time in 2014. By 2014, a total of 580 species and/or species groups were farmed around the world.[1] In 2014, 73.8 million tonnes of aquatic animals were harvested from aquaculture (Table 1).[2]

1 Food and Agriculture Organization of the United Nations (FAO), *The State of the World Fisheries and Aquaculture* (Rome: FAO, 2016), 22, http://www.fao.org/3/a-i5555e.pdf.
2 Id., p. 5.

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TABLE 1 Breakdown of aquatic animals harvested from aquaculture

Type	Harvested (millon tonnes)	Percent
Finfish	49.8	68
Molluscs	16.1	22
Crustaceans	6.9	9
Other	7.3	1
Total	73.8	100

As the supply of wild caught fish/seafood has plateaued, the world population growth in absolute numbers is at a point where protein demand will greatly exceed supply. We have reached a critical juncture in history, where the world needs to find alternative food sources that can be supplied and increased in an environmentally sustainable manner.

Sustainability Requires Change

All food production requires inputs such as food, water, energy, and physical space. The key is to find food production systems that have the highest yields of output for the least amount of inputs (resources), i.e., are the most efficient in terms of resource use.

The art of culturing fish for consumption began in China over 3,000 years ago. Today, China is the world's leader in fish production in terms of biomass, with most of this production based on the culture of freshwater fish (carp). The majority of this production is consumed locally. Carp are an excellent fish for culture as they are largely herbivores and can be grown without the need for fish-based protein diets.

Why does this matter? Fish feed is widely regarded as becoming a major constraint to the growth of aquaculture production in many developing countries. The culture of non-fed animal species in 2014 represented 30.8 percent of world production of all farmed fish species. The most important non-fed animal species include (i) two finfish species, silver carp and bighead carp, typically in inland aquaculture, (ii) bivalve molluscs (clams, oysters, and mussels, etc.), and (iii) other filter-feeding animals (such as sea squirts) in marine and coastal areas. Growth in production, however, has been faster for fed species than for non-fed species.[3]

3 Id., 25.

The Western world has, over the last decades, focused its seafood diet on primarily four seafood types, namely shrimp, tuna, salmon, and cod. Shrimp and salmon have been widely cultured for over 40 years now. With the loss of the commercial cod fishery stocks, aquaculture of this species has begun in several countries driven by existing demand. The culture of tuna (bluefin) has only recently 'cracked the technology' enabling the entire lifecycle to be replicated in captivity. There has always been a strong market for tuna, and the culture of it will relieve the pressure on wild stocks. But is the culture of these species 'sustainable'? All of these species require a diet that incorporates a protein that is presently derived from fish, primarily in the form of fishmeal. If aquaculture is to expand and fill the protein supply gap for the world then it cannot depend on fishmeal-based diets that are dependent upon the catch of wild fish. The answer lies in the production of fish that can be grown on plant-based diets, i.e., herbivorous/omnivorous fish *or* finding suitable fish protein replacements that can be derived from sustainable sources.

Initiatives have been undertaken to replace fishmeal in fish diets with soy and other plant-based proteins. Those fish that have evolved to utilize fish-based proteins for growth can withstand various levels of protein replacement, but ultimately growth and fish health is threatened when levels are exceeded. Commercial initiatives have recently begun for the culture of insect larvae, namely soldier fly larvae for the production of a larval meal. The soldier fly larvae are produced by growing soldier flies on pre-consumer food waste collected from urban centers. Thus, a 'waste' product is being used as a food source to produce what becomes a food source for a product (fish) that we can then consume. A 2014 review of insect feeding trials by the Food and Agriculture Organization of the United Nations found that fish common to aquaculture, like tilapia, could safely have between 25 and 100 percent of the soymeal or fishmeal in their diets replaced with insect meal with no negative consequences to fish production. Even when cooked, the fish showed no changes to aroma, taste, or texture.[4] There has also been preliminary research done on the use of other marine organisms at a lower trophic level, which are a direct replacement for fishmeal proteins and can be grown on organic wastes.

Changes to fish feed protein supplies are not the only change that will be required to allow aquaculture to expand. The world must examine its eating behaviors which not only impact resource use but also overall health of societies. In addition, food production systems, including the production of aquatic foods, must be examined in light of long-term sustainability and

4 M. Glassman, "Feeding 2050: Sustainable Aquaculture and the Future of Protein," The Chicago Council on Global Affairs, 7 June 2017, https://www.thechicagocouncil.org/blog/global-food-thought/feeding-2050-sustainable-aquaculture-and-future-protein.

'production efficiency'. Some aquaculture practices use the label 'sustainable', but not all of the resources used are accounted for, especially if wastes are being absorbed by the local environment. Life-cycle analysis takes a broader view and can be used to assess and rank the sustainability from a more holistic viewpoint.

In order for the benefits of aquaculture to be realized, it must be sustainable from both an environmental and economic perspective. This will undoubtedly mean that the world will have to change its dietary habits and begin to consume proteins that are more efficient in their resource use. However, a balanced diet includes other foods than just proteins.

There has been a growing interest in the integration of agriculture and aquaculture. When these two food production systems are combined, the result is a food production system that is extremely efficient in terms of its resource use. In Asia, rice farmers are integrating freshwater fish culture into their irrigation systems to reduce predatory snails. The result is a gain in fertilizer nutrients from fish wastes and harvesting the fish to add income to their crop. The waste from fish production has been found to be an excellent source of nutrients for plant production.

Production systems that combine aquaculture with hydroponic plant culture are termed 'aquaponics'. Aquaponics can be done at any scale and is one of the most efficient uses of land and water when producing fish and food crops. Aquaponic systems use 90 percent less land and water than traditional field crops. In addition to being efficient resource users, aquaponic systems are 'natural' by design and do not use insecticides or antibiotics. Aquaponic systems produce higher yields than field crops and greenhouse hydroponic production systems. It can be said that the integration of fish and plant production is the most efficient food production system on the planet. These same levels of efficiency are also realized in water usage.

When examining food production systems one must examine production parameters such as food and water conversion ratios, i.e., how efficiently the animal being produced converts its food and water into edible protein. In addition, to curtail practices that contribute to global warming one must consider the greenhouse gas emissions related to the production system being used.

Fish process energy more efficiently than mammals such as cows and pigs because they are cold-blooded (so less calories are needed for warming themselves) and live in water (so relatively more of the body converts to muscle than bone). Cultured fish score a 'low' rating with respect to relative greenhouse gas emissions.[5]

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5 "Protein Scorecard," World Resources Institute, April 2016, http://www.wri.org/resources/data-visualizations/protein-scorecard.

Aquaculture Expansion

Aquaculture began with the development of fish/plant culture in earthen ponds with flow-through or tidal water exchange from rivers and/or oceans. Because fish farming involves the active and daily input of humans, we tend towards developing them in areas where human access is easier, i.e., nearshore, but with the continued growth of the aquaculture sector, the utilization of nearshore sites for cage culture has resulted in 'conflict of use' and environmental pollution issues. Both of these have resulted in private and public opposition to the expansion of aquaculture.

This has led to the speculation that aquaculture growth will occur increasingly either offshore[6] or onshore (inland and land-based facilities). Land-based facilities (especially those practicing recirculation) have a reduced risk for disease exposure and are not exposed to varying temperatures and/or predators. Land-based facilities are easily monitored, do not require sea-going vessels to transport product, and can have a high degree of predictability that favors investment and market penetration. For these reasons and others, a strong case can be presented that will see expansion of the aquaculture sector taking place on land. Technologies exist that will permit the production of both freshwater and marine species independent of water sources. This allows aquaculture production facilities to be located in close proximity to urban centers, thereby further reducing the carbon footprint by avoiding extensive transportation routes.

Land-based fish farms require a continuous supply of energy to produce oxygen and run pumps and other equipment. To be truly sustainable this energy supply must come from renewable sources. A good fit for land-based fish farms would be operation of air compressors on solar power, with compressed air stored and used to generate electricity continuously. Compressed air is also used as a source to generate the oxygen requirements for the farms.

Conclusion

In 2015, the United Nations member states adopted the 2030 Agenda for Sustainable Development. The Agenda includes a set of seventeen Sustainable Development Goals (SDGs). SDG 14 expressly focuses on the oceans, underlining the importance of the conservation and sustainable use of the oceans and seas and of their resources for sustainable development, including through their contributions to poverty eradication, sustained economic growth, food

6 See Soto and Wurmann's essay on offshore aquaculture in this volume.

security, and creation of sustainable livelihoods and decent work.[7] Sustainable aquaculture can play an important role in achieving SDG 14.

Aquaculture has the ability to supply the world's protein, but it will require shifts in our patterns of resource use, eating habits, and continued development of technologies that allow for improvements in production efficiencies. Sustainable aquaculture will not only feed the world, but offer the needed protection and conservation of the world's ocean resources.

7 FAO, *FAO and the 17 Sustainable Development Goals* (Rome: FAO, 2015), http://www.fao.org/3/a-i4997e.pdf.

Offshore Aquaculture: A Needed New Frontier for Farmed Fish at Sea

Doris Soto
Interdisciplinary Center for Aquaculture Research (INCAR),
Concepción, Chile

Carlos Wurmann
AWARD Ltd., Santiago, Chile

Offshore Aquaculture and Its Potential Relevance

Aquaculture continues to be the fastest growing food producing sector in the world and it is expected to bridge the future global supply–demand gap for aquatic food.[1] However, this is a great challenge considering that a large proportion of current aquaculture for food is produced in fresh water and this resource is bound to be very scarce and even scarcer under climate change.[2] Today, practically all marine production takes place by the coast or not far from it. Yet, coastal zones are becoming increasingly limiting for aquaculture. Therefore, use of open ocean sites can be a solution for future aquaculture activities.

There is no single universally accepted definition of offshore aquaculture, or equivalently, open ocean aquaculture. In many cases these terms are used for any farming off the coast.[3] Here, the definition proposed in a special publication by the Food and Agriculture Organization of the United Nations (FAO) for offshore mariculture will be used.[4] That is, farming occurring away from the coastline (> 2 km), in waters deeper than 50 m and fully or partially exposed to stronger wave and wind action. The concept opposes that of coastal aquaculture, in as far as coastal refers to nearshore sites, mainly in sheltered places and those located off the coast but in waters not deeper than 40 m and with

1 Food and Agriculture Organization of the United Nations (FAO), *The State of World Fisheries and Aquaculture 2016: Contributing to Food Security and Nutrition for All* (Rome: FAO, 2016).
2 C.M. Duarte et al., "Will the Oceans Help Feed Humanity?," *Bioscience* 59 (2009): 967–976.
3 H.E. Froehlich et al., "Offshore Aquaculture: I Know It When I See It," *Frontiers in Marine Science* 4 (2017): 154, doi.org/10.3389/fmars.2017.00154.
4 A. Lovatelli, J. Aguilar-Manjarrez, and D. Soto, eds., *Expanding Mariculture Farther Offshore—Technical, Environmental, Spatial and Governance Challenges, FAO Technical Workshop, 22–25 March 2010, Orbetello, Italy*, FAO Fisheries and Aquaculture Proceedings No. 24 (Rome: FAO, 2013), 4, http://www.fao.org/docrep/018/i3092e/i3092e00.htm.

easy access. Under such a definition, currently the commercial or experimental production of offshore aquaculture is still minimal.

Most countries cannot expect to develop much further their nearshore marine farming industry because (1) world competition for coastal sites and conflicts over use of space has increased, (2) coastal farming operations have seen their densities increased over the years, often becoming the cause of severe sanitary and environmental disruptions, economic losses, and instability, (3) water quality in those locations is generally getting worse, (4) the cost of coastal marine sites is becoming prohibitive, (5) and coastal communities are increasingly opposing nearshore aquaculture. Therefore, it is certain that in the coming decades, a large portion, if not most, marine aquaculture activities will have to move to open-ocean locations or, alternatively, be done land-based, with pumped water, with or without recirculation.

However, even if offshore aquaculture might have some theoretical advantages, it is yet to be explored in terms of its technicalities, economic efficiency, and environmental and social sustainability.[5] Currently, there are no well-established or standardized offshore aquaculture production methods for marine finfish or other species, which is why offshore farming has very limited coverage thus far. Not many industry players are willing to lead the way, possibly due to the large initial investments, extra costs, and more complicated logistics related to moving offshore, which will require larger production to offset increased outlays.

Where Is the Potential to Develop Offshore Aquaculture?

An FAO publication in 2013, provided a global assessment of the status and potential for offshore mariculture development from a spatial perspective, with an indication of near-future global and national potential for its expansion.[6] Kapetsky et al. concluded that offshore mariculture was limited spatially by the need to tether cages and longlines to the seafloor, and thus, the exclusive economic zone (EEZ) area was either too deep (88 percent), or too shallow or showed stronger currents. With such considerations, only about 1.4 million km^2 (0.87 percent) of the EEZ area was suitable for offshore cages and longlines.

5 Id.

6 J.M. Kapetsky, J. Aguilar-Manjarrez and J. Jenness, *A Global Assessment of Potential for Offshore Mariculture Development from a Spatial Perspective*, FAO Fisheries and Aquaculture Technical Paper No. 549 (Rome: FAO, 2013), http://www.fao.org/docrep/017/i3100e/i3100e00.htm.

However, they did not discuss the increasing number of solutions currently being developed for vessel-type devices and self-positioned cages, which do not require mooring, thus amplifying spatial solutions immensely.

Kapetsky et al. also explored the potential production for fed fish in tropical ecosystems (e.g., cobia), in temperate ecosystems (salmon), and blue mussels, a non-fed species also from temperate environments. They showed, for example, that salmon production could be increased by more than one million tonnes using only 5 percent of the offshore aquaculture estimated suitable area (122 km^2), while cobia could increase by 48 million tonnes in 5 percent (48,000 km^2) of this area. These production numbers are very conservative since some technical restrictions will disappear due to rapid technology advances, e.g., tethering cages deeper than 100 m or not mooring them at all, and even considering floating cages in areas beyond national jurisdiction. Such farming systems may gain acceptability if they prove to be profitable and manageable from a logistics standpoint.

Investment, Technologies, Human Resources, and Research Needed

Most current offshore aquaculture production systems are submergible devices, particularly in the case of fish, mainly salmon and cobia. It has been concluded that underwater farming devices such as cages, longlines, etc., can perform better and survive even strong force, category 4 hurricanes. Other non-submergible equipment is also being devised and/or conceived, such as boats of different types (fixed or untethered), and cages and cage-like containers of different sizes and conditions.

The economics of offshore farming has not been well-studied, although it is commonly argued that offshore aquaculture farming devices will require more investment per unit of production than conventional coastal systems. Furthermore, they will be more expensive to operate and maintain. Indeed, it is expected that farms will cost more to run, as they require more sophisticated and expensive equipment and procedures, and correspondingly, highly trained personnel. It is likely that the latter expertise—fewer but very specialized jobs—will not necessarily be drawn from nearshore communities, a fact that might complicate offshore aquaculture's acceptance, though the possible provision of additional fish food in the future at more affordable prices may counter such concerns. Additionally, there is a need for much more research and development along the production process and value chain.

To offset higher investment costs and more complicated logistics, the average size of an offshore farming operation would likely exceed that of coastal farms. This fact limits for now the idea of small-scale offshore farming units, and makes large-scale operations the only ones with probable feasibility (economically, technically, and otherwise) in the near future.

Offshore Aquaculture: Environmental Implications

Compared with nearshore aquaculture, environmental risks associated with offshore aquaculture can be smaller, especially those associated with nutrient and organic enrichment of sediments and modification of benthic communities, eutrophication of water bodies, release of chemicals used to control water conditions and diseases, and competition for and, in some cases, depletion of resources (e.g., water).[7] Indeed, considering much deeper sites with higher currents, it is unlikely that organic matter will significantly affect the seabed, generate local eutrophication, or cause other cumulative impacts. However, appropriate oceanographic modeling to forecast potential impacts to the surrounding ecosystem and to the farm itself is essential, as well as close environmental monitoring to follow up on potential impacts. Offshore aquaculture operations could increase the danger of generating local conditions that could trigger phytoplankton blooms or attract/foster jellyfish outbreaks.

Risks that could increase from offshore aquaculture might relate to biodiversity and ecosystem losses due to escaped fish.[8] Even if fish cages are much more resistant today, weather conditions in offshore and open seas could be very rough, and escape risks will always be present. Considering much larger cages, as will be the case, massive numbers of fish could escape under extreme conditions. Given that cages will be comparatively far from the coast, chances for fish species such as salmon or mussels to interact with local biodiversity and/or establish a population could be low, but there is not enough information to ascertain the same for other species such as cobia, considering that species in this genus (*Rachycentron*) spawn in open seas.

Clearly, any offshore aquaculture development requires adequate risk-based spatial planning.[9] In an open-sea environment it is much more difficult

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7 See Duarte et al., *supra* note 2, and Lovatelli et al., *supra* note 4.

8 E.B. Thorstad et al., *Incidence and Impacts of Escaped Farmed Atlantic Salmon* Salmo salar *in Nature*, Report from the Technical Working Group on Escapes of the Salmon Aquaculture Dialogue, NINA Special Report 36 (World Wildlife Fund, 2008), http://oldsalmon.ca/docs/uploads/impacts-escapes-2008.pdf.

9 J. Aguilar-Manjarrez, D. Soto and R. Brummett, *Aquaculture Zoning, Site Selection and Area Management under the Ecosystem Approach to Aquaculture: A Handbook*, Report ACS18071 (FAO, Rome, and World Bank Group, Washington, DC, 2017), http://www.fao.org/3/a-i6834e.pdf;

to establish boundaries of impacts, and there is as well a need for very carefully designed and implemented monitoring systems for environmental conditions and biotic interactions in the farm's estimated area of influence.

Governance Issues and Needs

The poor image of aquaculture in many places, the fact that there is no previous or well-established history of offshore farming, and the likelihood that its initial development will involve huge projects, suggest that it will be resisted by many. Therefore, contacts with authorities, local communities, fishers and other ocean users will be necessary to make this new production system accepted and well-established.

In general, there is no special legislation regarding prerequisites to install and run new offshore fish farms, or to address the ways they should relate to local fisheries and traditional fishing grounds, ports, local communities, and tourism, etc. This is also the case regarding potential conflicts in areas where wild fish stocks, whales, and other marine mammals are known to forage, migrate, reproduce, or where it is believed that farming might put fragile marine environments at risk. In most cases, all new aquaculture activities are framed by national norms and regulations that tend to be more relevant to coastal aquaculture. Also, there is a legal vacuum over regulating mariculture operations in areas beyond national jurisdiction (ABNJ), leading to a series of potential controversies that could arise from such activity.[10] Further, according to Lovatelli et al., coastal states are entitled to legislate in order to protect facilities and installations within the territorial sea, and they must properly inform about their laws and regulations under the 1982 United Nations Convention on the Law of the Sea.[11] International law does not impose other general restrictions on how coastal states manage mariculture within their territorial seas. Most of the above-mentioned matters could benefit from an international approach to develop the main framework within which offshore farming should conform, especially if the activity is moved into ABNJ.

Safety at sea is and will be a matter of high priority for offshore fish farm operators. The same applies to fish escapes, predators, robberies, fish diseases,

FAO, *Aquaculture Development. 4. Ecosystem Approach to Aquaculture*, FAO Technical Guidelines for Responsible Fisheries No. 5, Suppl. 4 (Rome: FAO, 2010), http://www.fao.org/docrep/013/i1750e/i1750e.pdf.

10 See Lovatelli et al., *supra* note 4.

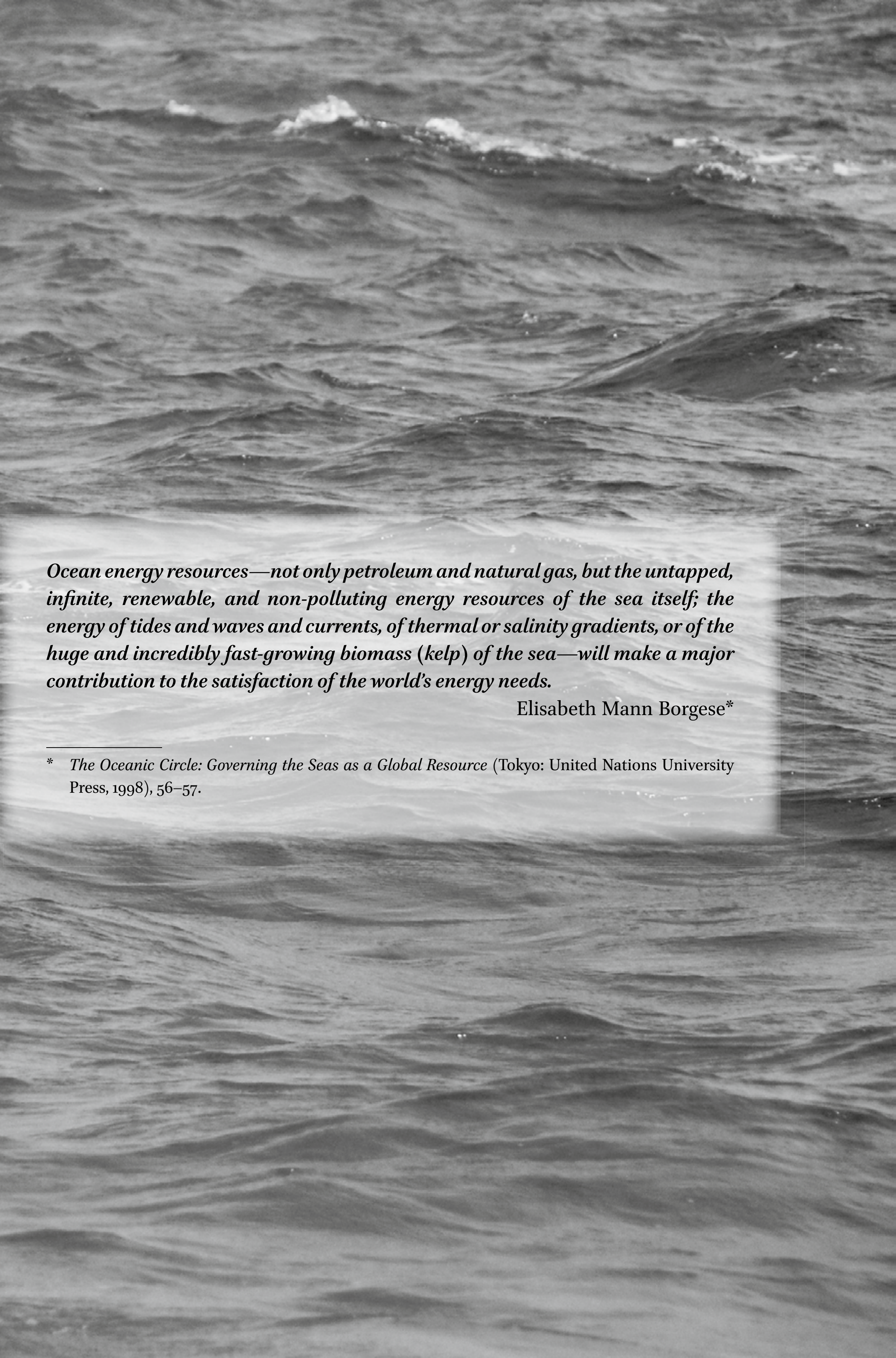
11 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3.

and the use of antibiotics and other pharmaceuticals, while the environmental effects of unused feed and fish faeces also have to be addressed. Treatment of fish mortalities and maintenance and repair procedures will also have to be dealt with under appropriate management. Clearly, a full set of regulations is needed worldwide to get offshore farming established, well-organized, and able to receive social acceptance, an extremely relevant goal.

We are certain that open ocean aquaculture is bound to become one of the most used production procedures in the coming decades in many parts of the world, and more increasingly so, as freshwater resources become scarcer. Therefore, careful and more intense consideration should be given to this novel and promising food production system, both at national and international levels.

PART 7

Ocean Energy



Ocean energy resources—not only petroleum and natural gas, but the untapped, infinite, renewable, and non-polluting energy resources of the sea itself; the energy of tides and waves and currents, of thermal or salinity gradients, or of the huge and incredibly fast-growing biomass (kelp) of the sea—will make a major contribution to the satisfaction of the world's energy needs.

Elisabeth Mann Borgese*

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* *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 56–57.

Introduction

Editor: Scott Coffen-Smout

Elisabeth Mann Borgese believed that ocean renewable energy was “likely to considerably increase the ‘quantifiable’ contribution of the ocean to the global GDP,” and stated that methane hydrates of the deep seabed created “fascinating futuristic scenarios” as an energy source in the twenty-first century.[1] In that context, her breadth of interests in the resource potential of the ocean is reflected in this part on ocean energy, in a few thoughtful and forward-looking essays. Topics include tidal energy resource development, environmental culture and regulation of the offshore petroleum development industry, and managing exploration risks of petroleum energy extraction.

1 E. Mann Borgese, *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 69.

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Marine Renewable Energy in Canada: A Century of Consideration and Challenges

Graham R. Daborn, Haley Viehman and Anna M. Redden
Acadia Tidal Energy Institute, Acadia University,
Wolfville, Nova Scotia, Canada

I must go down to the seas again, for the call of the running tide
Is a wild call and a clear call that may not be denied

JOHN MASEFIELD, *Sea Fever*

Introduction

There should be little doubt that the world needs to diminish its dependence upon fossil fuels for electricity generation. Marine renewable energy (MRE), in the forms of offshore wind, tidal, wave, or ocean thermal energy, remains the largest under-exploited energy source, with the potential to supply more than the total electricity demand in the world. It is estimated that the global wave energy resource alone is about 32,000 terawatt hours (TWh) per year, compared with the global electricity supply of ~24,000 TWh per year in 2014.[1] Global potential for tidal power could be up to 1,000 TWh per year.[2] The various MRE technologies differ significantly in their readiness for large-scale exploitation. The most mature technology is that of offshore wind generation, which has evolved from extensive experience on land. The least mature is wave energy generation, numerous devices for which are still in early developmental stages. Mechanical energy from tides is a centuries-old technology based upon impoundment of tidal waters, and barrage-based installations (the *tidal range* approach) for electricity generation has been considered in Canada (the Bay of Fundy) and Europe for more than 100 years. One turbine installed in a dam at

1 World Energy Council, *World Energy Resources, Marine Energy* (London: World Energy Council, 2016). 1 terawatt hour (TWh) = 1,000 megawatt hours (MWh).
2 M. Hoogwijk and W. Crijns-Graus, *Global Potential of Renewable Energy Resources: A Literature Assessment* (Renewable Energy Policy Network, 2008).

 | DOI:10.1163/9789004380271_066

Annapolis Royal, Nova Scotia, has been in operation since 1985. New technologies designed to convert the energy of flowing water (i.e., *tidal stream*), rather than impounded water, are rapidly developing and offer significantly fewer environmental effects than those based on barrages or tidal lagoons.

In Canada, significant opportunities exist for MRE on all three coasts. Of the options, tidal stream energy is particularly attractive because its timing and scale are eminently predictable, and its development can be incremental, which is an important consideration when the environmental effects are uncertain. Large-scale tidal stream devices generating one to two megawatts of electricity offer considerable potential, especially for isolated communities on all three coasts where tidal flows exceed one to two meters per second. In addition, arrays of such large-scale devices could make valuable contributions to established electricity grids, especially where, as in the Bay of Fundy, a large tidal resource exists in a region of strong energy demand.

Issues Affecting Progress

Technological Issues

During the past decade, tidal stream energy conversion technologies have advanced from conceptual designs to the testing of full-scale devices. While this progress in engineering is encouraging, challenges remain. Unlike wind power, the industry is nascent and has yet to converge on a single design type. The most mature designs tend to utilize lift-based axial- or cross-flow turbines, with a wide variety of installation configurations (e.g., bottom-mounted or surface-piercing, gravity-based or pile-driven). To date, tidal stream device deployments worldwide have been short-term (mostly less than one year), and have generally consisted of only one device, the largest thus far consisting of four. Deploying and operating large-scale arrays is therefore some time away.

Field testing to date has indicated that a major technological challenge to reaching commercial-scale arrays is in designing devices that can survive the extremely harsh environment in which they must operate. The fast currents that characterize tidal energy sites generate huge forces on any stationary structure.[3] Furthermore, tidal energy sites tend to be extremely turbulent as water is pushed at high speeds through complex channels and around headlands. Turbines built to operate in bi-directional flow are subjected to forces from many directions, leading to more rapid turbine failure. In areas

3 “Failed tidal turbine explained at symposium,” CBC News, 8 July 2011, http://www.cbc.ca/news/canada/nova-scotia/failed-tidal-turbine-explained-at-symposium-1.1075510.

with sediment-laden water, devices may be 'sand-blasted' on each tide, which hastens corrosion of essential components. Failures of seals and connectors are a common problem in any marine undertaking, and the lifespan of undersea components can be shortened by constant motion due to currents and by fluctuating environmental conditions. In addition, device access is generally limited to periods of low flow between each tide, and calm weather conditions. Depending on device design, regular maintenance may require costly retrieval of the entire device.

Other technological obstacles are related to the supporting infrastructure rather than the devices themselves. Many of the areas identified for instream tidal energy development are remote, and manufacturing facilities or vessels large enough to transport and deploy full-scale turbines may not be available locally. Furthermore, electrical grids in remote areas generally must be redesigned and strengthened to deliver tidal energy to where it is needed. Continued development and testing is expected to overcome many of these challenges in the near future.

Environmental Issues

Development of any marine industry poses potential risk to the environment, and tidal energy is no exception. Previous environmental studies at established tidal power stations, particularly the Annapolis Tidal Generating Station in Nova Scotia, identified numerous environmental issues, many of which are attributable to the dam rather than the turbine. Consequently, stand-alone tidal stream technologies are now being demonstrated in Nova Scotia and elsewhere.

To address environmental effects in Nova Scotia's high flow passages, numerical models describing the energy resource, flows of water, mixing, etc., on both large and small scales have been developed, allowing more precise prediction of the physical effects of extracting energy from the tides. Video and sonar technologies have been used to examine benthic life in the passages, and field investigations have looked at changes in sediments and salt marshes that might arise from changes to tidal flows. Priority environmental issues relate to the behavior of fish, birds, and marine mammals in the vicinity of working turbines, the possible mortality and deterrent effects that an array of turbines might have on the normal migratory behavior of these animals, and the population level consequences of these.

The biggest challenges faced in sensing both fish and marine mammals at the Fundy Ocean Research Center for Energy (FORCE) turbine test site in Minas Passage in the Bay of Fundy have been high flow-induced effects on noise and sensor mooring stability. These and other challenges experienced in conducting effects monitoring have created much uncertainty for regulators concerned with the potential effects of tidal turbine installations on critical habitat and endangered and commercial species. Assessing the likelihood of marine animals encountering tidal devices and colliding with their moving parts has been attempted through acoustic detection of tagged fish (four species of concern), passive acoustic detection of marine mammals, and various sonar technologies to monitor the seasonal presence, distribution, and movements of fish. Coupling of sensor technologies has recently aided understanding of the avoidance or evasive behavior of marine animals in close proximity to turbines, but the collection of sufficient data to address regulator concerns, even at the turbine demonstration stage (single device or small array), is expensive and the data sets are enormous. Automated detection software for many acoustic sensing technologies are in need of further development and will require validation via field sampling programs.

Research on environmental effects of tidal energy development will be incomplete for some time yet. Ongoing efforts are required to enable assessment of risk and, where identified, development of risk mitigation strategies. Priority activities need to include advancements in sensing technologies and software, high performance sensor moorings, field validation, and environmental monitoring guidelines for tidal energy developers and regulators.

Socio-economic Issues

Even if the current testing programs confirm that tidal stream technologies are technologically feasible and environmentally acceptable, there remain significant challenges toward their widespread development and application. First and foremost of these is financing. MRE electricity is initially more expensive than that from fossil fuels, and, given the uncertainty in the performance and maintenance costs of tidal stream devices, private sector funds have not been very forthcoming. In fact, at the present time, risk assessments tend to encourage companies to delay investment,[4] leaving the costs of research and demonstration to be met primarily from public funds. The more rapid development of MRE in Europe than in Canada is reflective of the willingness and capacity of European countries to address the challenges of climate change, and greater public investments have been made. Potential conflicts with existing uses and users of tidal coastal waters remains a challenge. In 2008 and 2014, Nova Scotia

4 S. MacDougall, "The value of delay in tidal energy development," *Energy Policy* 87 (2015): 438–446.

conducted two strategic environmental assessments[5] and a policy review[6] in relation to tidal power development in the Bay of Fundy that included extensive public and interest group consultations. These concluded that the public was cautiously optimistic that tidal stream energy could materially assist the province to reduce its use of coal and bring economic and social benefits to coastal communities. Subsequently, however, some coastal resource user groups have resisted even the testing of large tidal stream devices, arguing that turbines will significantly affect their use of space, kill marine life, and place endangered species at risk. In spite of the considerable research carried out since 2009 to assess the real risk to marine organisms, misinformation is rife, and the reluctance of developers to release information promptly allows such misinformation to prevail regardless of its lack of basis in fact.

An additional cause of declining public confidence lies in the slow progress of testing. After eight years, two turbines only have been installed at the Minas Passage test site: one in 2009 that failed after three weeks, and a second in 2016 that was removed after six months of operation. These short deployments result from the extremely harsh conditions encountered within the Minas Passage; an important consequence, however, is that answers to some of the critical environmental questions cannot be obtained without prolonged monitoring with turbines operating on site.

In contrast to some negative views repeated in the media, there remains optimism in government and the scientific sector that environmentally acceptable, cost-effective means of capturing energy from Canada's tidal waters can be found. If so, its predictability and potential use to support remote coastal communities that are currently dependent upon diesel fuel (e.g., in the Arctic) could benefit these communities and contribute to Canada's national plan to deal with greenhouse gas emissions. In addition, the expertise developed in environmental assessment, monitoring, and deployment is a marketable asset as other countries around the globe attempt to capture their tidal energy resources. Already, the challenging environmental conditions of high flow tidal waters has stimulated major innovations and improvements in monitoring technologies by Canadian companies that have substantial markets worldwide.

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5 Offshore Energy Environmental Research Association (OEER), *Fundy Tidal Energy Strategic Environmental Assessment Final Report* (Halifax: OEER, April 2008); Jacques Whitford, *Background Report for the Fundy Tidal Energy Strategic Environmental Assessment* (Halifax: Jacques Whitford, January 2008); AECOM Canada Ltd., *Tidal Energy: Strategic Environmental Assessment, Update for the Bay of Fundy* (Halifax: AECOM Canada Ltd., 2014).

6 R.O. Fournier, *Marine Renewable Energy Legislation: A Consultative Process*, Report to the Nova Scotia Government (Halifax, 2011).

The Role of Governance

The faltering progress of device development, combined with continuing questions of feasibility, true operating costs and benefits, and environmental effects, leave tidal power electricity generation in an uncertain position in Canada. In some ways, this is a repetition of past experience: electricity from the tides of Fundy has been considered numerous times over the last 106 years. Part of the cause lies in the extremely dynamic conditions at the site(s) chosen for testing. A second factor is the limited development of marine spatial planning in Nova Scotia's coastal waters, where important fisheries, aquaculture, transportation, recreational, and tourism-related activities already exist. Addition of renewable energy developments inevitably raises issues of conflict, particularly with fisheries in the Bay of Fundy.

Two things are clearly required: 1) an effective marine spatial plan for each location suitable for marine renewable energy development; and 2) a long-term vision for marine renewable energy at all levels of government. This vision needs to encourage systematic and achievable developments in science and engineering that will assist coastal communities and the nation to minimize dependence on fossil fuels.

Environmental Culture and Mitigation Criteria for Offshore Oil and Gas Activities

Elizabeth A. MacDonald
Canada-Nova Scotia Offshore Petroleum Board, Halifax, Nova Scotia, Canada

Background

While considered a frontier exploration area, offshore petroleum activities began in eastern Canadian waters in 1943, when the first offshore well was drilled off Prince Edward Island.[1] There have been substantial changes to the industry since the 1940s, most notably with changes in technology, the Canadian regulatory regime, and in philosophies and culture.

The most important advancement in the offshore petroleum industry, not just within Canada but worldwide, has been the development and continuous improvement in fostering a safe workplace mentality or 'safety culture' by industry professionals. Inherent within safety culture lies the lesser discussed, and even lesser understood, environmental culture. People, like other living things, have natural survival instincts; they *want* to work safely because life and limb may be at risk if they do not. It is relatively easy to convince employees, government officials, and executives that safety is important, especially in a high-risk work environment like the frigid Northwest Atlantic.

People appreciate the importance of working safely and maintaining a safe work place; their own lives and the lives of people they work with depend on it. So, how does environmental culture fit into all this? While environmental culture has not yet been elevated to the forefront of the minds of the general public when they consider day-to-day workings in the offshore, what lives beneath the waves is, however, at the forefront of the minds of offshore employees, regulatory bodies, and industry executives.

This essay discusses the established protections required when working in the offshore petroleum industry on the east coast of Canada, particularly offshore Nova Scotia and Newfoundland and Labrador.[2] Mass media typically focuses on extreme events, such as major explosions and spills. The typical

1 P. McKenzie-Brown, G. Jaremko and D. Finch, *The Great Oil Age: The Petroleum Industry in Canada* (Calgary: Detselig Enterprise, 1993).

2 The information provided is publicly available online at http://www.cnsopb.ns.ca/environment or http://www.cnlopb.ca/environment.

 | DOI:10.1163/9789004380271_067

day-to-day life on an offshore installation is not well-understood by the general public. Aversion to offshore activity is typically the norm, regardless of existing protections that help to ensure the norm is relatively uneventful. This essay summarizes information from hundreds of regulatory documents prepared over the past seventy years.

General Offshore Landscape

Offshore petroleum activity is divided into two broad categories: exploration and development. Major offshore exploration projects typically involve either seismic data acquisition or exploration drilling. Other technologies exist, such as aerogravity surveying,[3] Marine Vibroseis,[4] and electromagnetic surveying, but are infrequently used. This essay focuses on well-established mitigation measures for seismic data acquisition and exploratory drilling, as well as development and production of resources in the Canadian Northwest Atlantic.[5]

Regulatory Regime

It is important to assess the potential effects of offshore petroleum activity on marine wildlife during an activity application review. This assessment is conducted by regulatory authorities for populations of species anticipated to occur within or adjacent to project areas, and at an enhanced level for species at risk listed on Schedule 1 of the federal *Species at Risk Act*.[6] Consideration and mitigation are typically required for the following:

- marine mammals
- turtles
- marine and migratory birds
- fish
- species at risk and critical habitat
- commercial fisheries and other oceans users
- prevention of accidents and malfunctions

3 A form of gravimetry incorporating real-time aerial navigation.

4 Marine Vibroseis is quieter than seismic airguns and does not use sharp pulses, which are known to be quite damaging for marine life.

5 See the Canadian Association of Petroleum Producers website for information on how activities in Atlantic Canada are conducted at http://atlanticcanadaoffshore.ca.

6 S.C. 2002, c. 29.

Activity applications are reviewed by the respective Offshore Petroleum Boards whose jurisdiction contains the proposed activity (presently Nova Scotia or Newfoundland and Labrador), in conjunction with other federal departments, including, but are not limited to, the Canadian Environmental Assessment Agency, Fisheries and Oceans Canada, and Environment and Climate Change Canada. A myriad of acts, regulations, and guidelines apply, including the following:

– *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act* and *Canada-Newfoundland Atlantic Accord Implementation Act*
– *Canadian Environmental Assessment Act* (2012)
– *Oceans Act*
– *Fisheries Act*
– *Canadian Environmental Protection Act*
– *Species at Risk Act*
– *Nova Scotia Offshore Drilling and Production Regulations* and *Newfoundland Offshore Petroleum Drilling and Production Regulations*
– The Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment (Seismic Statement of Practice)
– Offshore Waste Treatment Guidelines
– Offshore Chemical Selection Guidelines
– Geophysical, Geological, Environmental and Geotechnical Program Guidelines (2012)

An environmental assessment is the main component of the activity application that considers potential effects on the marine ecosystem. Environmental assessment takes anywhere from six to eight months (typical for seismic applications) to two years (some exploration and development applications).

Seismic Exploration

Seismic exploration has been a fairly regular occurrence in the Canadian Northwest Atlantic this past decade (2006–2016), occurring every year or two. Arguably the least understood in terms of potential effects on marine species, seismic programs nonetheless have a comprehensive list of mitigation requirements. The precautionary approach is the primary established philosophy. It is a world of unknowns within the scientific community; therefore caution is exercised regardless of a lack of physical or observed evidence to support concerns of significant negative effects on marine wildlife. Published research has been, and continues to be, conducted on the topic; however, it would be remiss to claim scientific certainty in the form of statistically significant evidence of negative effects caused by seismic programs conducted offshore. Nonetheless, every living thing has intrinsic value regardless of whether or not there are interactions with anthropogenic activities, and mitigation is required and implemented during offshore petroleum exploration to help safeguard against adverse environmental effects on marine wildlife.

With respect to the potential effects of seismic activity, the main concerns are noise effects on marine life, vessel presence, and ship strikes on large cetaceans, especially species at risk like the North Atlantic right whale. Although no known evidence exists demonstrating that any large marine mammal in Nova Scotia or Newfoundland waters has been harmed through hearing damage or otherwise by a seismic program, the implemented mitigation measures are considered the regulatory standard. Adherence to mitigation measures within the Seismic Statement of Practice includes, but is not limited to the following:

- Implementing an exclusion zone for monitoring and shut-down requirements, such as shutting down in the case of species at risk entering the exclusion zone. Marine mammal observers have the ability to immediately shut down a seismic program if a species at risk comes within the exclusion zone of the program.
- Prescribed marine mammal detection measures such as visual and acoustic monitoring.
- 'Ramping up'—starting with the smallest volume outputs and working to full sound outputs when beginning programs, after shut downs and in poor visibility (fog) or darkness to give any wildlife a chance to leave the area should they wish to do so.
- Zero activity within known spawning grounds and during known spawning times.

The above mitigation measures are the major themes detailed within the Seismic Statement of Practice. Adherence to the Statement is considered a minimum standard for protection from seismic noise. Each seismic program application is reviewed with specific mitigation requirements assigned based on the spatial and temporal boundaries of the program, and the results of the environmental assessment. Other required mitigation measures may include the following:

- avoidance of species at risk and/or their critical habitat areas
- specific speeds at which vessels may travel
- limiting activity within or adjacent to marine protected areas or critical habitat areas
- no ballast water exchanges in sensitive areas
- minimizing hydrocarbons on board vessels and seismic equipment
- protocols for stranded birds

- communications protocols with other oceans users
- on-board fisheries liaison observers
- minimizing flaring
- spill prevention plans, procedures, and response equipment on board

These mitigation measures are not meant to be comprehensive lists because every activity application is unique.[7]

Exploratory Drilling and Development Activity

Exploratory drilling occurs less often than seismic programs in the Canadian Northwest Atlantic, and is a much less regular occurrence than in established areas, such as the Gulf of Mexico and the North Sea. Development activity is rare; less than half a dozen operations are currently in place as of 2017. Nonetheless, the potential effects of exploratory drilling and development are much better understood than the potential effects of seismic exploration because they are clearly observable. The potential impacts can also leave a larger ecological footprint. Required mitigation measures may include, but are not limited to the following:

- temporal and spatial restrictions for sensitive areas, such as marine protected areas and critical habitat
- minimizing discharges and emissions
- bird handling protocols
- reporting of wildlife observations
- use of specialized equipment to remove potential hydrocarbons or toxic fluids from entering the ocean
- use of water-based drilling muds where technically feasible and shipping cuttings to shore for disposal rather than at-sea disposal
- avoiding sensitive benthic habitat
- minimizing disturbance to the seabed
- appropriate ballast water control
- onshore disposal of hazardous wastes
- appropriate communication and coordination with other oceans users
- chemical screening for selection of least hazardous chemicals for use
- spill prevention plans and procedures, and proven, effective spill response plans, including exercising these plans to demonstrate effectiveness

7 For complete lists of current typical mitigations, see strategic environmental assessments produced by the Canada-Nova Scotia Offshore Petroleum Board and the Canada-Newfoundland and Labrador Offshore Petroleum Board online at http://www.cnsopb.ns.ca/environment and http://www.cnlopb.ca/environment/.

Of these mitigation measures, arguably the most discussed is spill prevention. It comes as no surprise, as a major spill has potential tragic consequences to both human life and wildlife, as well as to the ecosystem and other ocean users. For these reasons, there are numerous protections in place. One major protective measure is the coming into force in 2015 of the 'polluter pays' principle within the federal *Energy Safety and Security Act*, which outlines the liability regime that is applicable to spills and debris in the offshore areas. The Act's Summary states:

(a) …the "polluter pays" principle, which is consistent with the notion that the liability of at-fault operators is unlimited;

(b) increases to $1 billion the limit of liability, without proof of fault or negligence, to which certain operators are subject in the event of a spill or damages caused by debris;[8]

These requirements eliminate under-experienced operators from conducting exploration drilling in the offshore Canadian Northwest Atlantic. Regardless, spills remain a recognized risk. To minimize the risks and impacts of spills, prevention, preparedness, and response are key requirements. Applications must include assurances that a well is properly designed and controlled. Hazards must be identified and mitigated against. Applications are reviewed by regulatory authorities who are experts in the fields of engineering, technology, geology, geophysics, ocean sciences, and environmental protection.

In addition to the required environmental assessment, activity applications must include a spill response plan and an environmental protection plan. Audit and inspections of these plans and their contained processes are conducted on rigs and in-office several times per year. Spill response plans must include a spill risk assessment relevant to the project, detailed descriptions of how operators plan to prevent spills, and how they would respond to a variety of spill scenarios. It must be demonstrated that the necessary equipment is available and trained personnel are prepared to respond to a spill, should one occur. Drills and training exercises are required on a regular basis. The majority of spills is minor in nature (less than 100 ml), dissipating naturally and requiring no response. Every spill must be reported and investigated regardless of volume. Trends are analyzed and maintenance programs must be adapted when necessary to safeguard against incidents. Best available preventative practices are expected and enforced. In the rare case of a major spill, however, technologies available for use are evolving and improving. Examples of currently best available technologies include

8 S.C. 2015, c. 4.

– capping stacks and relief wells;
– use of barriers (floating boom);
– mechanical recovery using clean up equipment such as skimmers;
– burning oil gathered at sea; and/or
– dispersant use, if approved.[9]

Conclusion

In review, existing and well-established protections required when working in the offshore petroleum industry in the Canadian Northwest Atlantic have been discussed. Hopefully, the reader's understanding of how the environment is protected during the day-to-day norm of offshore operations has been enhanced. Accidents do happen, and they can and have been tragic. However, this is not the norm for the offshore petroleum industry in Atlantic Canada, or anywhere in the world. The Canadian offshore regulatory regime is designed to be fair, efficient, and safe, to hold environmental protection paramount. It's a cultural mindset.

9 An excellent resource for detailed information on spill response technologies is Oil Spill Response Limited's website at https://www.oilspillresponse.com.

Oil and Gas: Exploration and Risk

Bruce Batstone
Consultant, Marine Sciences, Fall River, Nova Scotia, Canada

Susan Belford
Keel HSE Management Inc., Dartmouth, Nova Scotia, Canada

Introduction

Risk analyses entail a multi-dimensional matrix that considers scalable political, economic, social, technical, environmental, and safety factors. Risk is the probability of an event occurring multiplied by the magnitude of its adverse consequences. The risk of offshore exploration is addressed through development and implementation of mandatory safety management systems (SMS) vetted by regulatory bodies and third-party certifying agencies. Risk management processes within the SMS are employed throughout all stages in exploration projects, from the conceptual planning stage down to each work shift on deck. This essay considers risks *to* frontier and offshore oil and gas exploration, as opposed to the risks *of* oil and gas exploration. The issue is considered in a Canadian context.

Meaningful commentary on exploration risk requires an outlook on global energy demand and socio-economic trends. Today, there is uncertainty as most major energy players are looking inward, re-assessing and adjusting their business models and re-baselining their market projections in response to the steep market downturn. The risks to conducting oil and gas exploration programs are always dynamic, but particularly complex under depressed market conditions.

Global Energy Outlook

According to a United Nations report, the current world population of 7.3 billion is expected to reach 9.7 billion in 2050.[1] Projected gains in global

1 United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables*, Working Paper No. ESA/P/WP.241 (New York: United Nations, 29 July 2015), http://www.un.org/en/development/desa/news/population/2015-report.html.

productivity will lead to increasing prosperity and rising standards of living, with more than two billion people lifted from low incomes.[2] Nearly two-thirds of the increase in global energy consumption will be for power generation.[3] Although there is an ongoing, gradual, and steady transition from combustible fuels to 'clean' energy sources, fossil fuels account for over 75 percent of present energy demand. The fuel mix transition will continue with growth in renewables, nuclear, and hydroelectric power, together accounting for half the growth in energy supply over the forecast; however, oil, gas and coal will remain the dominant sources of energy, especially in developing nations where fossil fuels are more affordable than renewables. According to Enerdata, virtually all growth in world energy demand will come from emerging economies, with China and India accounting for over half the increase.[4]

Under this demand forecast, one would expect businesses involved in exploring for hydrocarbons and exporting them to developing economy states to do well. Conservative estimates of global 'proved' oil reserves have more than doubled over the past thirty-five years. Thus, for every barrel of oil consumed, more than two new barrels have been discovered. The abundance of known oil resources today dwarves the world's likely consumption of oil out to 2050 and beyond.[5] Cumulative global oil demand amounts to less than half of today's technically recoverable oil resources.[6]

This abundance of hydrocarbon reserves, combined with the prospect of slowing oil demand, has prompted competitive change in global oil supply. Low-cost producers are leveraging their competitive advantage to increase market share. Although costs vary significantly within resource categories (i.e., coal, oil, and gas), the majority of low extraction-cost reserves are located in large, conventional onshore oilfields, particularly in the Middle East and Russia, followed by tight oil prospects in the United States. The extent to which supplier behavior changes is a key source of uncertainty.[7] Behavioral change

2 Id.

3 "World Energy Outlook 2017," International Energy Agency (IEA), 14 November 2017, http://www.iea.org/weo2017.

4 "2020 Global Energy Forecasts," Enerdata, 1 April 2007, https://www.enerdata.net/publications/reports-presentations/2020-global-energy-forecasts.html.

5 "BP Energy Outlook 2035: Focus on North America," BP plc, March 2015, https://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2016/energy-outlook-2015-focus-on-north-america.pdf.

6 "BP Energy Outlook: 2017 Edition," BP plc, 2017, https://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2017/bp-energy-outlook-2017.pdf.

7 Statoil, *Energy Perspectives 2017: Long-term Macro and Market Outlook* (Stavanger: Statoil ASA, 31 May 2017), https://www.statoil.com/content/dam/statoil/documents/energy-perspectives/energy-perspectives-2017-v2.pdf.

will depend on (1) the ability of low-cost producers to increase their supply, (2) the extent to which prices respond to increased supply, and (3) the ability of higher-cost producers (e.g., oil sands and offshore production) to compete by varying their tax and royalty regimes.[8]

What does this mean for oil and gas exploration in Canada? Market adjustments and environmental concerns have already led to short-term postponement or outright cancellation of infrastructure, exploration, and low-efficiency production projects. An estimated 185,000 direct and indirect jobs were lost in Canadian oil sands production over the past few years.[9]

Policy and Social License

Before hydrocarbon exploration can begin, the proponent must obtain social license to conduct offshore activities. Getting and sustaining social acceptability is fundamental to a project's approval process. The loss of social license or community trust by one offshore operator typically has ramifications for other exploration firms, even for other ocean sector users. The rise in public consciousness to the socio-economic and environmental implications of exploration projects, Indigenous rights to lands and resources and the global social justice movement are factors impacting the approval of exploration permits. This is exemplified by the recent cancellation of the Canadian Energy East pipeline project. There are moratoria against hydrocarbon exploration on Canada's Georges Bank and the Beaufort Sea, and against hydraulic fracturing in New Brunswick and Nova Scotia.

Part of the challenge to proponents is the evolving policy framework, including international, federal, provincial, and territorial jurisdictions. The Canadian federal government recognized that to achieve high standards for risk and safety management, effective environmental protection, industry investment, and economic development, a more efficient regulatory regime would have to be developed and aligned with existing international standards, such as in Norway.[10] However, the Frontier and Offshore Regulatory Review

8 IEA, *supra* note 3.

9 T. McMillan, "McMillan: Grow the energy industry, don't just tax it," Commentary to *Calgary Herald*, Canadian Association of Petroleum Producers, 10 July 2015, http://www.capp.ca/media/commentary/grow-the-energy-industry-do-not-just-tax-it.

10 Canada Senate, Standing Committee on Energy, the Environment and Natural Resources, *Facts Do Not Justify Banning Canada's Current Offshore Drilling Operations: A Senate Review in the Wake of BP's Deepwater Horizon Incident*, August 2010, https://sencanada.ca/content/sen/Committee/403/enrg/rep/rep08aug10-e.pdf.

Initiative has stalled, with little meaningful progress since the *Canada Oil and Gas Drilling and Production Regulations* were completed in 2009.[11] Issues include the following: regulatory boards have yet to resolve gaps in areas of environmental risk, mitigation and response; coordination between federal, provincial, and territorial agencies has been ineffective; transition from prescriptive to performance-based regulation is incomplete; and the unsatisfactory use of strategic environmental assessments to identify concerns.[12] As a result, social pressure has deterred resource development prospects in British Columbia, Quebec, Nova Scotia, Newfoundland and Labrador, and Nunavut.

Seismic: Not a Four-Letter Word

Seismic exploration is the first phase in the search for oil and gas reservoirs. A total of 401,651 km of two-dimensional seismic data and 48,864 km^2 of three-dimensional seismic data has been acquired offshore Nova Scotia.[13] To date, environmental monitoring programs conducted on seismic sound effects have not found dead cetaceans, sea turtles, or fish as a direct result of seismic exploration. Nonetheless, due to knowledge gaps and variability in research findings, speculation remains, and risk perception is heightened. Suspicion and mistrust sustain the impression that geophysical operations pose a high risk to marine mammals, crustaceans, sea turtles, and fisheries. Meanwhile, over the last four years on the Canadian east coast, there has been considerable scientific and public concern and media coverage attributing deaths of numerous large cetaceans to dense sea ice, entanglement with fishing gear, and alleged ship collisions. A New England Aquarium study by Kraus et al. in the Bay of Fundy found that between 2010 and 2015, 85 percent of North Atlantic right whale deaths were due to fishing gear entanglement.[14] Ship strikes have decreased with mitigation measures to relocate shipping lanes and reduce

11 A.L. Hanson, "Offshore Drilling in the United States and Norway: A Comparison of Prescriptive and Performance Approaches to Safety and Environmental Regulation," *Georgetown International Law Review* 23, no. 4 (2011): 555–576.

12 G. Caron, "National Energy Board on the Latest Developments in Northern Oil and Gas Regulation," Speech to the 14th Annual Arctic Oil and Gas Symposium, 11 March 2014, https://www.neb-one.gc.ca/bts/nws/spch/2014/nrthrnlgsrgltn/index-eng.html.

13 "Geoscience Overview, Data Compilations, Seismic Offshore NS," Canada-Nova Scotia Offshore Petroleum Board, last updated 2004, https://www.cnsopb.ns.ca/sites/default/files/pdfs/seismic_offshore_ns.pdf, pers. comm., updated to 2017.

14 S.D. Kraus, et al., "Recent scientific publications cast doubt on North Atlantic right whale future," *Frontiers in Marine Science* 3, no. 137 (17 August 2016), doi.org/10.3389/fmars.2016.00137.

speed. This study concluded that efforts to reduce cetacean and sea turtle deaths from fishing gear entanglement are largely unsuccessful. Approximately 40 percent of all animals caught in fisheries are discarded as trash.[15] The risk to cetaceans from harvest fishery practices has not been formally assessed by any government, or debated in the public arena. One may ask why equivalent mitigation and monitoring programs are not consistently applied across all ocean resource industries.

In many countries, including Canada, commercial fisheries practice mass removal of fish to the brink of population decimation. There seems little public opposition to harvest fishing practices, at least to the degree seen against seismic exploration. Fishing communities protest exploration primarily over concern for reduced catches, though there is no evidence that modern seismic methods cause mass death of fish. This year, the Supreme Court of Canada denied seismic exploration in the seas around Baffin Island. Meanwhile, new harvest fishery ventures (e.g., surf clams) face little risk of cancellation, regardless of how disruptive the seabed extraction method may be to the environment.

Spills, Media, and Fear

We usually think about accidental oil spills arising from well blowouts, pipeline breaks, derailments, and tanker collisions. With respect to exploration drilling, the direst consequences envisioned are from a blowout and the resultant impact of released hydrocarbons. SINTEF's offshore blowout database, current to 2014, indicates the risk of blowouts to be very low relative to tens of thousands of wells drilled. Then, only a fraction of blowouts last long enough to cause a significant spill. Canada's offshore exploration is nascent, with few exploration wells compared to the Gulf of Mexico, North Sea, and other mature jurisdictions. To date, 352 wells have been drilled in offshore Atlantic Canada, so it is necessary to look beyond our borders for a robust assessment of the likelihood of a blowout. ACONA predicted the overall probability for an exploratory well blowout in 1,000 meters of water to be once in every 8,488 wells drilled.[16] Statistics clearly indicate the risk to be very low.

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15 "Turtle Threats: Fisheries Bycatch," SEE Turtles, last accessed 23 January 2018, http://www.seeturtles.org/fisheries-bycatch.

16 ACONA Flow Technology AS, "Technical Report: Blowout Risk Evaluation in the Labrador Sea South-West of Greenland," last revised 23 March 2012, http://dce.au.dk/fileadmin/dce.au.dk/Udgivelser/Appendix_2_Blowout_risk_in_the_Labrador_Sea.pdf.

The US National Research Council estimated nearly 48 percent of oil entering the oceans is from spills and illegal discharges from ships.[17] Another 21 percent is carried by runoff from urban centers. In all, 18 percent of petroleum products entering the oceans originate from industrial accidents. Of this, hydrocarbon extraction accounted for six percent. So why the disproportionate scrutiny of oil and gas exploration?

We become captivated when a large spill or blowout occurs, partly because they are such rare events. Large oil spills like the *Exxon Valdez* in Alaska and the Macondo blowout in the Gulf of Mexico are considered catastrophes because they fulfill three criteria: a catastrophe must be big; it has to happen all at once; and something about it has to be calamitous, disastrous, and really bad. There is a place in our psyche for fear of big, unlikely catastrophes. Media coverage is undeniably excessive. Major news networks report tragedies because they know the public will pay attention, and that means increased viewership and revenue. It is the unforeseen events close to home, brought daily into our living rooms, as was the Deepwater Horizon incident, that sensitize and make us fearful. Was the 'No Rigs' movement born of such fears?

A Canadian Perspective

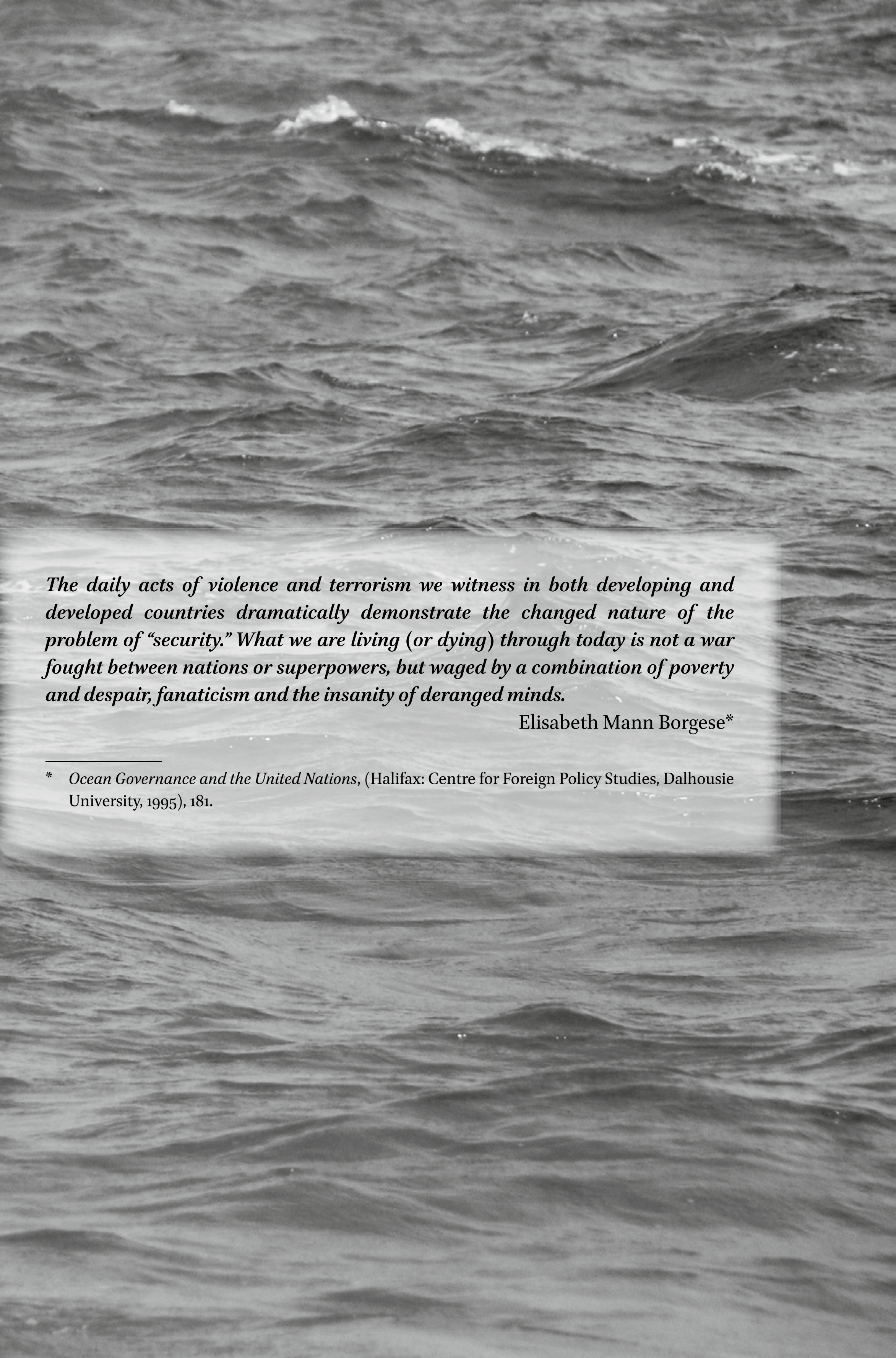
According to the Canadian Association of Petroleum Producers, Canada is among the top ten global oil producers, and the preferred supplier to many nations lacking domestic oil resources.[18] Sustaining that ranking will require continued innovation to improve the efficiency of production and delivery of all forms of energy. It will mean public education programs to 'de-risk' seismic exploration, drilling, and pipeline projects to attain informed social approval. Failing that, exploration investment in Canada will remain risky, our energy portfolio will become unbalanced, and our energy forecast will be bleak.

17 Transportation Research Board and National Research Council, *Oil in the Sea III: Inputs, Fates, and Effects* (Washington, DC: The National Academies Press, 2003), doi.org/10.17226/10388.

18 "Canada's Petroleum Resources," Canadian Association of Petroleum Producers, last accessed 23 January 2018, http://www.capp.ca/canadian-oil-and-natural-gas/canadas-petroleum-resources.

PART 8

Maritime Safety and Security



The daily acts of violence and terrorism we witness in both developing and developed countries dramatically demonstrate the changed nature of the problem of "security." What we are living (or dying) through today is not a war fought between nations or superpowers, but waged by a combination of poverty and despair, fanaticism and the insanity of deranged minds.

Elisabeth Mann Borgese*

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* *Ocean Governance and the United Nations*, (Halifax: Centre for Foreign Policy Studies, Dalhousie University, 1995), 181.

Introduction

Editor: David Griffiths

Elisabeth Mann Borgese's vision of maritime security was *pacem in maribus*—peace in the ocean—which became the thematic title of a series of international conferences beginning in 1970. Although the themes varied widely over more than four decades, the first such event was security-focused and titled "*Pacem in Maribus*: Quiet Enjoyment: Arms Control and Police Forces for the Oceans." Although Elisabeth was, by her own admission, a utopian idealist, and forceful advocate of naval disarmament, she was sufficiently pragmatic to recognize that until humanity becomes perfect, a perfectly peaceful, global ocean remains an aspirational vision. To enjoy peace, people must feel secure and, as the authors of this part will show, achieving security on the ocean and along its coasts is much more than having naval and police protection, or living behind well-defended walls. In addition to defense against all kinds of human perversity, *pacem in maribus* also requires an interdisciplinary approach to addressing economic insecurity, and the risks of natural, technological, and human-caused disasters. That, in her own words, requires the 'comprehensive security' approach reflected in the essays which follow.

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Security Dimensions of Ocean Governance

David Griffiths
International Ocean Institute-Canada, Halifax, Nova Scotia, Canada

> Security is like oxygen—you tend not to notice it until you begin to lose it, but once that occurs there is nothing else that you will think about.[1]

One would suppose that spending 36 percent of the entire world's military budget would keep a nation secure from a missile attack on its iconic symbols of commercial and military power; but one would be wrong. On 11 September 2001, nineteen young men, all but four being citizens of one of its trusted allies, armed only with dollar-store utility knives and dysfunctional ideology, did just that; turning four commercial airliners into guided weapons, killing almost 3,000 people, and triggering events which no one could have foreseen. This is not to say that military expenditure is a waste—far from it—but it is a vivid reminder that security is not just a problem for military, police and intelligence professionals.

Security is not the same as defense; that is, the capability to resist an attack. Rather, security is a state of being; confidence in freedom from danger or fear. Defense is part of the security equation and is, indeed, primarily a military and constabulary issue, but security is a broader, collective responsibility. What, then, is the place of maritime defense forces—navies—in ocean governance? What are the security roles of the ocean and coastal governance community?

Armed Conflict: Inconvenient Truths

Unpalatable as it may sound to safe, secure, and idealistic ears, the core function of a navy is its ability to fight. Of course, warships can, and do, deliver humanitarian aid and contribute to scientific research. Submarines can, and do, track criminals covertly and catch illegal fishing in the act. But while warships

1 J. Nye, "The Case for Deep Engagement," *Foreign Affairs* 74, no. 4 (July/August 1995): 90–120, 96.

doi:10.1163/9789004380271_070

can do such peaceful things, other government vessels cannot, for example, escort merchant ships safely through conflict zones, clear naval mines, or remove the threat of a submarine poised to launch a nuclear-tipped missile ashore. Nonetheless, possessing specialized combat capabilities does not mean a desire to use them. No responsible firefighter yearns for a disastrous mass-casualty fire, but still spends a lot of time preparing for one. No responsible police officer aspires to a life-threatening shoot-out with a criminal, but is still appropriately equipped and trained. Similarly, no responsible sailor aspires to war at sea with its deadly implications and inevitable unintended consequences. But wishful thinking will not make the world safer. "Virtuous motives, trammelled by inertia and timidity," said Winston Churchill, "are no match for armed and resolute wickedness."

Disarmament Myth and Experience

Informed advocates of naval disarmament are rare these days, not least because it has been tried before with notable lack of success. Far from making the ocean more secure, a decade of negotiations in Washington, Geneva and London following World War One served, if anything, to encourage warship construction to reach negotiated ceilings, and to hasten development of aircraft carriers to compensate for restrictions on battleships. The former head of the League of Nations Disarmament Commission later observed that "nations don't distrust each other because they are armed; they are armed because they distrust each other."[2] This suggests a potential contribution which the international, multidisciplinary ocean governance community can make in building trust, enhancing mutual understanding, and perhaps reducing the risk of armed conflict.

The Rule (and Role) of Law

Unsurprisingly, attempts to legislate violence out of existence have yet to be successful, but at least contemporary international law no longer condones war as a legitimate instrument of foreign policy, and the value of more than a century's evolution of international humanitarian law on the conduct of military operations and treatment of person should not be underestimated. Today all nations at least pay lip-service to the United Nations Charter provisions that "that armed force shall not be used, save in the common interest" and be limited to the "inherent right of individual or collective self-defence." As with any system there are violators, often attempting to justify aggression as self-defence, but we do not abandon laws and governance institutions simply

2 S. de Madariaga, *Morning Without Noon: Memoirs* (Saxon House, 1974), 48.

because some people abuse them. As a former Secretary-General observed, "the United Nations was not created in order to bring us to heaven, but in order to save us from hell."[3]

The centrality of our admittedly imperfect body of international law is precisely why responding to the 2001 Al-Qaeda attacks by declaring a so-called 'Global War on Terrorism' (with its unlovely acronym 'GWOT') was so misguided. Elevating a fringe non-government organization to the status of an enemy state played directly into the narrative of criminals from a culture that prizes honor and status. Small wonder that Al-Qaeda in Iraq spawned the preposterous pretensions of a so-called 'Islamic State' that is neither Islamic nor a state. Equally disturbingly, leaders of some otherwise advanced nations are now resurrecting retrograde notions like 'great powers' and 'spheres of influence'. Clearly this is no time for complacently taking security for granted.

Terrorism

Terrorism is not warfare: it violates every norm of the international law of armed conflict. Rather, it is a law-enforcement issue; albeit one in which armies, navies, and air forces have significant roles to play at the international level. It might equally well be approached as a public mental health issue because, in the words of one analyst, "terrorism is not an activity that attracts the well-adjusted."[4] No matter what the metaphor, terrorism, like disease, cannot be managed by focusing on symptoms while ignoring causes.

Despite dramatic headlines—which is precisely its objective—terrorism remains a small threat on a global scale compared with poverty, ignorance, inequality, and climate change. Whereas the official death toll from the 2001 Al-Qaeda attacks was 2,996, the US Institute of Medicine reported a year later that 18,000 Americans were dying annually from lack of health insurance—that represents six 9/11s.[5] Noting that two world wars and eighty million deaths in the twentieth century were triggered by an assassination in Sarajevo, Ronald Wright observes that the "first lesson of 1914 is the risk of overreacting to terrorism."[6] We must remain level-headed, cleansing the contaminants of injustice, inequality, and ignorance from the soil in which the roots of terrorism grow, rather than simply lopping off noxious shoots whenever they sprout.

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3 Address by Secretary-General Dag Hammarskjöld at University of California Convocation, Berkeley, California, Thursday, May 13, 1954, at 10:00 a.m. (Pacific Coast Time).

4 B.M. Jenkins, quoted in D. Saunders, "When Troubled Young Men Turn to Terror, Is It Ideology or Pathology?," The *Globe and Mail*, 24 October 2014.

5 D. Gardiner, *Risk* (Toronto: McClelland & Stewart Ltd., 2008), 331.

6 R. Wright, *What is America? A Short History of the New World Order* (Toronto: Alfred A. Knopf, 2008), 180.

Comprehensive Maritime Security

The 1987 Brundtland Report (the origin of contemporary 'sustainable development' policies) suggested that "a comprehensive approach to international and national security must transcend the traditional emphasis on military power and armed competition."[7] 'Comprehensive', according to Elisabeth Mann Borgese, extends "from the local level of the coastal community through the levels of provincial and national governance to regional and global levels."[8] While comprehensive security policy may originate at the higher levels, it must be grounded locally, where potential trouble-makers live, are educated and work. What, then, might the ocean and coastal governance community contribute?

Collegiality

Compartmentalization of professional cultures is a bane of ocean and coastal governance. Navies, for example (at least in democratic countries) are not secretive competitors for a disproportionate share of scarce resources; they are one of many elements of national governance capability. Navies have three broad functions. Defense is obvious, and the diplomatic roles of warships are generally well understood, whether as floating embassies during port visits abroad or demonstrating presence or resolve in waters of interest to their governments. The third function is much more diverse, however, and can best be described as supporting other government departments. This can include all of the topics discussed in this book: law enforcement; fisheries patrol; humanitarian relief and disaster response; search and rescue; support to marine science; and so forth. In the latter case, examples have ranged from scientific research by submarines under arctic ice, to post-Cold War use of the once highly classified SOSUS (Sound Surveillance System) to track whales, detect illegal fishing, and monitor underwater seismic events. All stakeholders in ocean and coastal governance need to understand each other, work together, and strive for common goals. The ocean governance whole thus becomes greater than the sum of its parts.

Engagement

In his book *Why Nations Go to War*, John Stoessinger identified a number of factors, chief among them that "the beginning of each war is a misperception

7 World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987), c 11, s. III-4.

8 E. Mann Borgese, *The Oceanic* Circle (Tokyo: UN University Press, 1998), 133.

or accident."[9] Unfortunately, in an age of weapons of mass destruction and hair-trigger response, we can no longer afford such luxuries. At least twice during the Cold War, only a judgment call by a relatively junior officer prevented a nuclear exchange, and only sheer luck prevented several disastrous nuclear weapons accidents.[10]

Our greatest enemies are therefore not so much other nations (or, more precisely, the governments of other nations) as misunderstanding, miscommunication and misperception; all of which marine scientists, scholars, environmentalists, educators and practical mariners are well equipped to reduce. Scientific dialogue brings people from even hostile states together as individuals. Environmental issues span human boundaries which are irrelevant to fish, winds, and currents. Navies and coast guards build confidence through joint operations, dialogue, or at very least agreements to prevent unintended incidents. Even retired officers, diplomats, and policy-makers contribute discreetly to confidence and co-operation through what is known as 'Track Two' diplomacy. The ocean transcends boundaries; so does ocean governance.

Affinity

There is evidence that our instinct to divide humanity into 'us' versus 'them' is genetically ingrained. But while a tribal mentality may explain, it does not excuse letting such thinking influence policy. It may have been appropriate when a few million primitive hunter-gatherers roamed the planet, but is dysfunctional when more than seven billion individuals share the globe, a tiny minority of which is able to exterminate most, if not all the others. The idea that 'we' are a group of unique individuals, while 'they' are a homogeneous mass with common faults is simply nonsense. Effective global governance cannot be based on denigrating or demonizing others based solely on lines drawn on maps, religion, race, ideology or any other generalization. The crew of Spaceship Earth needs to stop arguing about who is best, or who is responsible for letting the oceanic life-support system degenerate, and start thinking like global citizens. The maritime community is better placed than most to set the example.

Conclusion

Generations in the developed world have enjoyed unprecedented affluence, safety, and security since the end of World War Two, and even most of the

9 J.G. Stoessinger, *Why Nations Go to War* (Boston: Bedford/St. Martin's, 2001), 260.
10 For example, see E. Schlosser, *Command and Control* (New York: Penguin Books, 2013).

world's poorest societies are materially better off in absolute terms, if not relatively. But it is by no means certain this trend will continue. At the moment, the military threat to security is not so much inter-state war as localized conflict, along with the privatized violence lumped under the label of terrorism. Today, our enemies are not so much hostile states as the risks of misunderstanding, miscommunication, and misjudgment. Our physical security cannot be taken for granted, and is a collective responsibility in which we all have a role to play. It can never be absolute or guaranteed, but the risks can certainly be reduced and mitigated. To give Ronald Wright the last word, "If we fail—if we blow up or degrade the biosphere so it can no longer sustain us—nature will merely shrug and conclude that letting apes run the laboratory was fun for a while but in the end a bad idea."[11]

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11 R. Wright, *A Short History of Progress* (Toronto: Anansi Press, 2004), 31.

Intelligence Gathering and Espionage in the Exclusive Economic Zone: Peaceful or Not?

Hugh Williamson
Marine Affairs Program, Dalhousie University, Halifax, Nova Scotia, Canada

Those fortunate enough to know Elisabeth Mann Borgese were well aware of her deep lifelong commitment to peace. For her, inclusion of 'for peaceful purposes' and 'exclusively for peaceful purposes' in the United Nations Convention on the Law of the Sea (UNCLOS) were intended as operational, not merely dressing up an otherwise highly practical convention. Her long association with the international law of the sea community developed many long and enduring friendships, often culminating in social gatherings at her home in a small fishing village outside Halifax, Nova Scotia.

One such gathering took place after a Law of the Sea Institute annual meeting at Dalhousie University in the early 1980s. Elisabeth gathered an eclectic group of friends, including leading scholars, diplomats, lawyers, neighboring fisherfolk and a few fortunate students to share food, drink, and lively discussion. The director of the Institute at the time was Dr. John P. Craven, a widely respected legal scholar, engineer, scientist, and amateur musician.[1] That evening, he entertained by singing operatic arias while accompanying himself on Elisabeth's grand piano, but these were not his only hidden talents.

While Dr. Craven's legal scholarship and musical talent were openly displayed, details of his previous role as chief scientist for the United States Navy's Special Projects Office would remain hidden for many years.[2] He had, in fact, been the US Navy's 'ocean spy chief', involved in many intelligence-gathering and espionage operations, including recovering lost ships, submarines, and weapons systems, and electronic 'bugging' of Soviet Navy telecommunications cables under the Sea of Okhotsk.[3] He was also an international lawyer, deeply committed to the principles of UNCLOS as he saw them. Had the clandestine

1 W.J. Broad, "John P. Craven, 90, Pioneer of Spying at Sea, Dies," *The New York Times*, 18 February 2015, https://www.nytimes.com/2015/02/19/us/john-p-craven-90-scientist-who-shaped-cold-war-spying-at-sea-dies.html.

2 J.P. Craven, *The Silent War: The Cold War Battle Beneath the Sea* (New York: Simon and Schuster, 2002).

3 C. Morris, "Operation IVY BELLS: Lessons Learned from an 'Intelligence Success'," *Journal of the Australian Institute of Professional Intelligence Officers* 20, no. 3 (2012): 17–29.

part of his life been public knowledge at the time, one can only imagine lively discussions which could have taken place around the table in the presence of so many leading international experts on intelligence gathering and espionage.

While the media tends to sensationalize collection of intelligence at sea as 'espionage' or 'spying', referring to any intelligence-gathering vehicle as 'spy ships' or planes, there is considerable divergence of legal opinion as to whether any particular event could be defined as research, intelligence collection, or espionage.

Within the intelligence community, 'data' refers to individual facts, such as a name, or sea temperature and salinity in a particular location. 'Information' is a collection or coalition of data related to a specific subject such as time, location, oceanographic conditions, ships in the area, or other facts related to a particular noise source. 'Intelligence' is the analysis and significance of information; in this example an assessment that the noise information might identify a new class of submarine. 'Espionage', or spying, is the illegal obtaining or possession of any of the foregoing.

For purposes of discussion, the most inclusive and neutral term is probably 'information'. This can be applied in scientific, economic, or strategic contexts, requiring further clarifications on the means or purpose of collection to determine its status and legitimacy. Moreover, information itself is inherently neutral but, when gathered for one purpose, may still be utilized for a variety of others.

It is worth noting that the act of espionage itself is not a violation of international law.[4] Virtually every country has provisions in its national security, criminal, and other statutes that make espionage against the state, private companies, or individuals an offense. National espionage law may also include various categories of sensitive information, including those related to national security, economic, political, scientific, military, or personal privacy. However, the offense can only be prosecuted where the state has jurisdiction. In the case of intelligence gathered at sea, whether a state can take action will depend on whether it is in compliance with international law, particularly UNCLOS.

Maritime military activity remains a problem area, presenting a serious potential threat to peace on a regional and global scale. The increased capabilities of current weaponry and the nature of naval operations have led to a number of confidence-building measures, notably incidents at sea agreements (INCSEA), to avoid accidents or limit the unintended use of force when opposing naval forces are operating in close proximity. While an INCSEA may govern

4 G.B. Demarest, "Espionage in International Law," *Denver Journal of International Law and Policy* 24 (1996): 321–348, 325–326.

the use of weapons and associated active sensors, and vessel or aircraft maneuvering, it specifies surveillance of other vessels, not intelligence-gathering.

The issue of control or restriction of intelligence gathering by ships and aircraft operating in the maritime domain remains unclear. Whether units are engaged in a lawful collection of intelligence or in espionage against an opposing state remains, in most cases, a matter of opinion and perspective. Intelligence gathering at sea was common during the Cold War and has continued subsequently, arguably with an increased number of players.

Within the territorial sea, intelligence gathering is an act incompatible with the right of innocent passage. This may be the only specific provision in international law prohibiting intelligence gathering or espionage. On the high seas, in areas beyond national jurisdiction, states are free to engage in activities under the regime of freedom of the seas, provided that they do not interfere with or threaten other states. While surveillance and intelligence gathering are not a specifically enumerated freedom, they are not specifically prohibited and are customary practices of naval forces, a point which is used to support a right of intelligence gathering at sea.

Within the exclusive economic zone (EEZ), however, there are two major divergent schools of thought regarding control of intelligence gathering by foreign vessels. The major traditional naval powers, led by the United States, take the view that the EEZ is strictly a resource and environmental management jurisdiction and other activities, including military, are governed by the high seas regime. Some newer naval states, led by China and India, increasingly emphasize that military activities in the EEZ may only be conducted subject to the approval of the coastal state. This has led to a number of confrontations between coastal state naval forces and naval units presumed to be gathering intelligence within a clearly recognized or contested EEZ. In 2017, however, a Chinese naval intelligence-gathering vessel (AGI class) undertook active surveillance of naval exercises in the Australian EEZ, possible denoting a shift China's position.

Broadly speaking, information gathering within the EEZ falls into five main categories: academic scientific research, natural resource research, hydrographic research, military related research, and intelligence gathering. Information may be obtained actively, such as coring, or passively, such as acoustic recording. Information gathering or research may be conducted by naval vessels, naval auxiliaries, public and private oceanographic and scientific research vessels, or other commercial vessels of opportunity. Warships and naval research ships are considered sovereign territory and beyond the jurisdiction of a foreign coastal state. While they may be involved in passive or covert information-gathering, a coastal state cannot determine if this is so by going aboard to make a direct examination.

Academic scientific research is generally to advance scientific knowledge of the ocean environment and is conducted by universities, scientific institutions and other bodies pursuing scientific knowledge, not usually for economic gain. It is largely regulated by UNCLOS Part XIII and carried out in the EEZ and on the continental shelf with prior notification and approval of the coastal state, which is normally granted. Research by private or government oceanographic vessels, including naval auxiliaries, would all be subject to this regime of consent.

Natural resources research in the EEZ and on the continental shelf are covered in UNCLOS Article 246(5) and may only be undertaken with full prior consent of the coastal state. Under the EEZ and continental shelf regimes, coastal states have sovereign rights for exploration and exploitation, conservation and management of living resources, as well as jurisdiction with regards to marine scientific research. The coastal state may withhold consent if it has a direct significance for the exploration or exploitation of natural resources, involves drilling into the shelf, the use of explosives, or the introduction of harmful substances into the marine environment. This regime also applies to both private and government (including military) research vessels.

Hydrographic research is more problematic. Hydrography is considered by many states as a survey activity for navigational purposes. As it is conducted in support of navigation it may be considered distinct from marine scientific research carried out to expand scientific knowledge or resource-related purposes. Since UNCLOS does not define 'marine scientific research', 'survey activities', 'hydrographic survey', or 'military survey' some countries view these as distinct, and include hydrographic survey as a freedom of the seas ancillary to freedom of navigation. Recently this has led to diplomatic protests and more kinetic actions, notably in the South China Sea between vessels of the People's Republic of China and United States naval auxiliary research vessels. There have also been protests from India involving survey vessels from the United States and the United Kingdom.

Military scientific research, which can include military surveying, can also involve the collection of hydrographic, oceanographic, marine geological, geophysical, chemical, biological, and acoustic data. However, military-focused research may be of limited commercial value, for example, oceanographic data related to acoustic transmissions used for submarine tracking. While the data gathered may be the same as for marine scientific research, the resulting information may be considered highly sensitive or classified, and usually not intended for public release to the scientific community.[5] Since it is obtained

5 S. Bateman, "Hydrographic Surveying in Exclusive Economic Zones: Jurisdictional Issues," *International Hydrographic Review* 5, no. 1 (New Series) (2004): 24–33.

for strategic or tactical support to military operations and has not been specifically addressed in UNCLOS, many states consider it to be outside coastal state regulation as part of freedom of the high seas and may be exercised in the EEZ as well.

One further consideration is whether surveillance or intelligence gathering by a vessel could be considered a legitimate peaceful use of the sea. The customary interpretation of 'peaceful use' is 'non-aggressive' as opposed to 'non-military'.[6] Espionage is the illegal gathering of intelligence and, while forbidden under national law, is not prohibited by international treaties or agreements. Covert or passive means of intelligence gathering are, by their nature, largely undetectable. Even during the Cold War, intelligence vessels were generally left alone, with a few notable exceptions. Some active means of intelligence gathering, however, may violate UNCLOS or other international agreements, such as interfering or disrupting communications, disturbing living resources or persons, or causing environmental damage.

There is a further argument for the role of intelligence gathering and espionage in promoting peace and security. While a state may be reluctant to accept the assurances of a potential adversary of a lack of hostile intent or purpose with any degree of confidence, an independent verification provided by a state's own intelligence sources may have more credibility, especially if it is based on intelligence gained through trusted covert means.

Intelligence gathering and espionage are often used to advance a state's strategic and military objectives, and may be prejudicial to the security of others. To say that surveillance and intelligence-gathering in a coastal state's EEZ is always prejudicial to the coast is an oversimplification. Since intelligence gathering also fulfills the necessary role of 'trust but verify', its utility as a confidence-building measure cannot be underestimated. Intelligence gathering and espionage are an important component of global security.

Undoubtedly both Elisabeth Mann Borgese and John Craven would agree that using the telescope on her deck for surveillance of the nearby nudist beach before walking her dogs might be considered 'spying' by some, but would definitely be 'a peaceful use' if it avoided future conflict with sunbathers.

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6 A.S. Skaridov, "Naval Activity in the Foreign EEZ: The Role of Terminology in Law Regime," *Marine Policy* 29, no. 2 (2005): 153–155.

Marine Piracy: A Continuing Challenge

Mark Sloan
Centre for the Study of Security and Development, Dalhousie University, Halifax, Nova Scotia, Canada

Introduction

Since the peak of the Somali piracy outbreak between 2010 and 2011, piracy has been on the decline. Nevertheless, the problem has not gone away, the figures for the first half of 2017 showing 87 incidents of piracy and armed robbery reported to the International Maritime Bureau (IMB) Piracy Reporting Centre.[1] Furthermore, piracy is not only a crime in its own right, but also destabilizes economic, social, and political structures. Countering piracy therefore remains an important challenge, particularly off Indonesia and the Philippines, in the Gulf of Guinea, and in parts of the Indian Ocean. This short essay can only skim this complex subject, but considers the nature of piracy, and some of the factors that can help contribute to its prevention.

Definition

The definition of piracy needs to be established at the outset in order to provide a baseline for subsequent discussion. That most widely accepted definition is enshrined in the United Nations Convention on the Law of the Sea (UNCLOS), which states that piracy is "illegal acts of violence or detention, or any act of depredation committed for private ends, on the high seas," committed "in a place outside the jurisdiction of any State", and includes "inciting or intentionally facilitating (such) an act."[2]

In the context of this essay, three important facts emerge from this definition. The first is that piracy is 'committed for private ends'. Attacks conducted or sponsored by terrorist groups are therefore excluded from the definition, and from this discussion. The second is the fact that the acts are only considered piracy if they are conducted 'on the high seas' and 'in a place

1 International Maritime Bureau (IMB), *ICC-IMB Piracy and Armed Robbery Against Ships—Report for the Period 1 January–30 Jun 2017*, available on request from International Chamber of Commerce Commercial Crime Services at https://www.icc-ccs.org/index.php/piracy-reporting-centre/request-piracy-report.

2 Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 3, art. 101.

outside the jurisdiction of any state'. Acts committed inside territorial waters are, therefore, not considered to be piracy, but would fall instead under the heading of armed robbery. The third is in sub-paragraph (c) of the UNCLOS definition, which includes those 'intentionally' facilitating the crime, so that those supporting the activity could be prosecuted as pirates.

Studying piracy, but ignoring attacks not perpetrated on the high seas, adversely affects the ability to gain a true understanding of the problem. Notably, it fails to examine and quantify the totality of the threat to seafarers, and therefore hampers the development of appropriate response strategies whether on land or at sea, nationally, regionally, or internationally. Nor does it contribute to the identification of potential precursors to outbreaks of piracy, which are equally threatening to mariners even though they occur in waters that are under a state's jurisdiction. From the maritime perspective, this prevents the development of comprehensive maritime security strategies. This shortcoming is recognized by organizations such as the IMB, Oceans Beyond Piracy (OBP), and the Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia. The IMB, for example, not only collects reported incidents that meet the UNCLOS definition of piracy, but also includes those that meet a definition of armed robbery occurring in a state's "internal waters, archipelagic waters and territorial sea."[3] This wider perspective more fully captures the extent of the challenge, and both piracy and armed robbery will therefore be addressed here under the heading of piracy. However, incidents must be reported to be recorded, and there is general recognition that many incidents are still not reported, which means that the full extent of the problem is not exposed. Comparing the total number of incidents gathered through a recently established 'Community of Reporting' with those reported through formal channels, the IMB assessed that 63 percent of incidents in the Gulf of Guinea region between January and June 2017 were not reported through official channels.[4]

Motive, Means and Opportunity

Now, as historically, piracy occurs where the drivers of motive, means and opportunity combine to the extent that the potential private ends outweigh the perceived or actual risk of arrest, injury, or death. The basic motive is generally the same as for any financially related crime—greed and the ability to achieve material gain more easily than through lawful means and at an acceptable degree of risk. Nevertheless, other factors may also drive motive, including gang

3 IMB, *supra* note 1.

4 Id., p. 12.

or tribal loyalties, revenge, and social retribution. Means includes the availability of the organization, finances, materiel, information, and personnel necessary to support the activity. Opportunity arises from a flawed security environment on land and at sea, which reduces the risk taken by pirates, and contributes to an increase in the availability of potential targets.

Where attacks do occur, they can be graded on a scale of complexity. At one end of the scale, subsistence-type piracy is simple, often opportunistic, requires limited organization, and provides low levels of economic gain. This category can be found around the world where the outcome is simple theft of stores and personal possessions, for example. In contrast, in its most developed form, piracy is transnational organized crime requiring a complex web of enablers. Any effort to prevent piracy should, ideally, therefore address the drivers on both the land and at sea, rather than either in isolation. In addition, such efforts will require a multi-agency approach that almost certainly extends beyond national boundaries to include regional and international partners.

So What?

Breaking piracy down into its drivers (motive, means, and opportunity), makes it easier to identify the main elements of each. Once these are identified, decisions can be made about those efforts to counter them that will be most effective.

To counter motive, if alternative means of income generation can be introduced, this will go some way to removing the motive of economic gain. However, although easily said, it can be very difficult to achieve. This is especially so in failed states where there is minimal rule of law and little likelihood of alternative, legal ways of earning a living being established until there is a will to succeed and it is safe to act. Although the driver identified by the UNCLOS definition of piracy is 'private ends', these are not always economic gain, even if that is the most common motive. The International Contact Group on Piracy off the Coast of Somalia stated that "piracy is symptomatic of the overall situation in Somalia including the prevalence of illegal fishing and toxic waste dumping off the coast of Somalia, which adversely affects the Somali economy and marine environment."[5] It can be argued from this that the initial motive in this case therefore included grievance as well as material gain. Identifying ways to counter the means to conduct piracy can be helped by considering the network of activities needed to support the pirates' business

5 International Contact Group on Piracy off the Coast of Somalia, "Communiqué from the First Plenary Session," (New York, 14 January 2009), last accessed 8 August 2017, http://www.lessonsfrompiracy.net/files/2015/03/Communique_1st_Plenary.pdf.

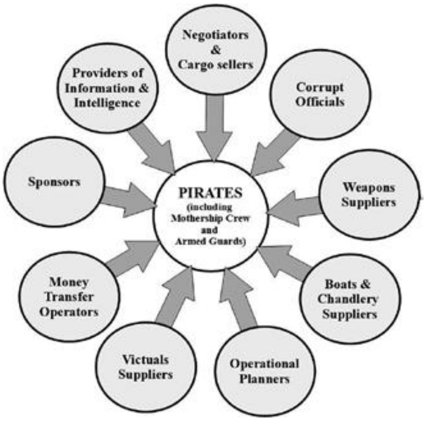

FIGURE 1
Illustrative piracy business model

model. Even the simplistic, generic business model at Figure 1, shows the complexity of support required when piracy has evolved from the subsistence level to organized crime. However, looking globally, although there are elements of the model that are common to any of the more complex outbreaks of piracy, specific outbreaks will have unique characteristics. Each therefore requires a tailored rather than generic solution.

Considering the business model in use allows identification of those parts of the model that are most vulnerable, or that will have most effect on the operation of that model if disrupted. Such disruption may be short term, allowing more permanent measures to be put in place in order to counter any or all of motive, means, and opportunity, or they may be longer term solutions in themselves. However, pirates are able to adapt their operations, whether as a natural process or in response to external pressures. Forcing changes to the pirates' mode of operation will result in changes to the business model, in the same way that forcing changes to the business model may require the mode of operation to be adapted to fit the changed circumstances or, preferably, cause it to fail. Strategies developed to counter piracy must therefore be equally adaptable.

Historically, many efforts to counter piracy have focused on the sea-borne element of the model, and paid less attention to the land-based supporting and enabling functions, without which piracy could not be sustained. This may be born of necessity if it is not possible for national, regional, or international bodies to tackle the problem ashore. Such was the case in much of Somalia at the height of the Indian Ocean piracy outbreak, when the lack of government and law enforcement meant that it was often not possible for outside agencies to operate safely or effectively. Once again it is clear that, without action on land, the problem can only be contained and not solved.

As with countering motive and means, reducing opportunity, including increasing risk to the perpetrators, must also look across both the land and sea.

A coastline subject to limited or no rule of law, provides opportunity for pirates not only to launch their operations, but also to hold ships and crews hostage pending completion of ransom arrangements. This was the situation in much of Somalia for a period. Likewise, corruption can create opportunity, as seen in the Gulf of Guinea where it is a contributory factor to the pirates' ability to sell stolen cargos of oil products. At sea, opportunity can be reduced by lowering the number and/or vulnerability of potential targets and/or increasing the level the risk posed to pirates when conducting an attack. In the Straits of Malacca, the pirates' ability to find vulnerable targets has been reduced by improving maritime security both nationally and regionally. In many piracy areas, implementation of self-protective measures derived from best management practices have also had a positive effect. The embarkation of privately contracted armed security personnel (PCASP), heightened international military presence, and improved mechanisms for prosecuting those captured, were further significant factors in reducing opportunity in the Indian Ocean. In the Gulf of Guinea, the use of PCASP has not been as widespread because many of the attacks occur inside territorial waters, where coastal states control the use of civilian armed teams. However, adoption of best management practices, combined with improved maritime security capabilities of coastal states has achieved a significant reduction in the number of attacks. Nevertheless, as pointed out by OBP, "there are still no piracy convictions that can be cited to support an effective Rule of Law solution,"[6] both willingness and ability to prosecute being important factors in the risk versus gain balance for pirates. There are, therefore, a wide range of means by which opportunity can be reduced.

Conclusion

Preventing piracy and armed robbery is a multi-faceted task. It first requires information about the nature and extent of the problem, regardless of whether it is present in its precursor or more developed forms. Thereafter, willingness and the ability to act against motive, means, and opportunity on land and at sea, across the full spectrum of agencies nationally, regionally, and internationally, supported by the necessary legal processes, are essential. Such actions are having an effect, as evidenced by the significant reduction in the number of attacks over recent years. However, there is no room for complacency, and lessons learned from recent outbreaks must not be forgotten.

6 Oceans Beyond Piracy, "Working Group Meeting Held 13 March, London, UK," (March 2017), http://oceansbeyondpiracy.org/sites/default/files/attachments/March_2017_Working_Group.pdf.

Refugees at Sea

Constance MacIntosh
Schulich School of Law, Dalhousie University, Halifax, Nova Scotia, Canada

Deadly and Desperate Crossings

In April 2015, over 1,000 would-be migrants drowned in a single week while trying to cross the Mediterranean Sea.[1] Most had started their journey in Sub-Saharan Africa, where gross human rights violations and civil break-down were, and remain, rampant. Because Turkey had enhanced its border control measures to try to quell the flow of asylum seekers fleeing from Syria, it had become harder to reach the safety of European states via a land corridor. Opportunities for smugglers and traffickers increased, who routed tens of thousands of displaced people to the coastal state of Libya. Here, many migrants found themselves sold to criminal gangs or to other traffickers. They were subjected to torture, to sexual abuse by armed forces, and to forced labor and long incarcerations underground.[2] In short, they found themselves enslaved or subsisting in conditions of extreme vulnerability, and ultimately directed onto large wooden boats by the smugglers and traffickers. Once well into the Mediterranean, the people were often forced onto small rafts or dinghies, to (hopefully) be picked up by European coastal patrols or otherwise make it to shore alive.

In the first half of 2015, one in 16 persons drowned trying to make the crossing. This was due to the poor condition of the boats, the lack of safety equipment, overcrowding, and the inherently perilous character of ocean crossings. It was also due to the decision by the European Commission and Italian government to end funding for the humanitarian initiative Mare Nostrum. This initiative, launched due to mass drownings of trafficked migrants trying to reach Europe in 2013, had been effectively co-ordinating search and rescue operations near Libya during 2013 and 2014. The program was cancelled because of concerns that the increase in safety which it offered was incentivizing displaced people to take to the sea, as well as the refusal of other countries to contribute to its costs despite—or perhaps because of—having rescued

1 Human Rights Watch, *Europe's Refugee Crisis: An Agenda for Action* (December 2015), 5.
2 Amnesty International, "Refugees and Migrants Fleeing Sexual Violence, Abuse and Exploitation in Libya" (1 July 2016), https://www.amnesty.org/en/latest/news/2016/07/refugees-and-migrants-fleeing-sexual-violence-abuse-and-exploitation-in-libya/.

over 100,000 people during its year of operations.[3] It was replaced by Frontex's Operation Triton, which focused on Italian coastal border protection. With this refocus on coastal security change came a modest decrease in the number of migrants arriving in Europe from the Libyan coast, and a nine-fold increase in known deaths at sea.[4]

The Scope of Humanitarian and Legal Obligations to Rescue

Seas are unpredictable and dangerous, and have long taken lives. The vulnerability of anyone who is out on the water—from fishermen to pleasure-craft sailors to cargo ship crew—has since time beyond memory been recognized as triggering a moral duty to aid those in distress. In the last one hundred years or so, this humanitarian imperative came to be written into international laws that almost all coastal nations have agreed to. One such law states:

> The master of a ship at sea which is in a position to be able to provide assistance, on receiving information from any source that persons are in distress at sea, is bound to proceed with all speed to their assistance.[5]

After a rescue, such laws commonly require the rescuer to ensure that those who they have assisted are taken to a place of safety. The obligation to provide assistance to those in distress at sea would seem complimentary to the key obligation under the 1951 Convention Relating to the Status of Refugees (Refugee Convention), which is to assist those who are fleeing persecution. Both obligations are essentially ones of offering salvation, through responding to a person's actual situation of risk, and apply regardless of the nationality, sex, or race of the person in need. These are humanitarian laws grounded in fundamental principles about promoting human security, and are triggered by externalized threats to individual lives.

But in practice their relationship is more complicated. The Refugee Convention has a very narrow definition for who qualifies for assistance. For example, the only persecution that counts is that motivated by religious, political, racial, ethnic, or social group membership, and there must be no place in the person's

3 Amnesty International, *A Perfect Storm: The Failure of European Policies in the Central Mediterranean* (London: Amnesty International, 2017), 10.

4 A. Denti, "Hundreds Drown Off Libya, EU Leaders Forced to Reconsider Migrant Crisis," Reuters, 19 April 2015.

5 International Convention for the Safety of Life At Sea, 1 November 1974, 1184 *U.N.T.S.* 3, as amended, Chapter V, Regulation 33.

home state where it is reasonable to believe they could be safe. And refugees have more and more often come to be swept into larger flows of would-be migrants, on the move because of some combination of human rights violations, gut-wrenching poverty, and environmental degradation. This description certainly covers those who have been and continue to flee from Sub-Saharan Africa, where life has become grossly unsafe due to on-going violent civil unrest and the presence of warlords, coupled with drought and famine. However, international law does not, generally speaking, impose an obligation on states to accept and shelter such displaced individuals. Instead, it sanctions viewing them as migrants who are trying to evade being held to a state's normal immigration policies and practices.

There are also gaps in maritime law that leave room for vulnerability. It requires that ship masters rescue, but does not require states to send boats to waters where they suspect unseaworthy boats may be being launched. It requires that rescued persons be brought to safety, but is not explicit about the obligation of states to permit disembarkation. Historically, when the rescued people were largely shipwrecked sailors, there seems to have been no dispute that the rightful course of action was to permit disembarkation at the next safe port of call. States have taken a more narrow reading in recent years, because if a rescuee claims refugee protection, the state becomes obliged to shelter the person while the protection claim is determined, and may be required to permit the individual to remain if they cannot be safety returned to their state of citizenship. And so we witness states refusing to allow the landing of rescued asylum seekers, with the most famous being the 'Tampa Affair' of 2001 when Australia refused to allow a Norwegian boat to disembark 438 Afghan refugee claimants. And we witness intentional interceptions in international waters by state agents, where the intercepting state denies they are bound to any of the obligations set out in refugee law while in international waters, and so return the claimant to their home state. The United States Supreme Court has found that this is a permissible interpretation of international and maritime law,[6] and so validates their practice of forcibly returning Haitian asylum seekers to Haiti without determining their protection needs. This practice is roundly condemned as violating international law by others, who argue that upon a state intercepting a boat and taking control of its passengers, that state has assumed de facto jurisdiction over the people on board, and must ensure that their protection claims are heard.[7] And so the generosities, limitations, and vagaries of

6 *Sale v. Haitian Centers Council*, 509 U.S. 155 (1993).

7 J. Hathaway, *The Rights of Refugees under International Law* (Cambridge: Cambridge University Press, 2005), 337.

both maritime and international humanitarian law, especially when coupled with state concerns about migration control, may result in a rescue ultimately returning a person to vulnerability, cycling them back into the hands of traffickers, or to the desperate situation that made them decide that risking death at sea was safer than staying on land.

Coastal Border Security Is a Dangerous Substitute for Human Security

After the massive drownings in the Mediterranean in the spring of 2015, the European Union responded by increasing resources for rescuing migrants at sea and putting measures in place to facilitate safe and quick disembarkation of the migrants in Europe, where their protection needs were assessed. These immediate humanitarian acts, however, came to be overshadowed by national security interests and concerns about managing migration. In June 2015, the European Union established EUNAVFOR Med ('Operation Sophia'). Operation Sophia's primary mandate was to disrupt traffickers' and smugglers' ocean-based operations by arresting the smugglers and destroying the boats. Operation Sophia was also to train the Libyan coast guard in rescue operations, so that unseaworthy crafts would be intercepted before they left territorial waters. With these two shifts in emphasis—each entirely consistent with maritime law concerning rescue, and international law which condemns smugglers and traffickers—came consequences that ironically increased human insecurity both on the water and on land.

Operation Sophia proved quite successful at intercepting boats, rescuing the trafficked or smuggled occupants, and then destroying the boats. Recognizing that ship masters could not determine if a person met the terms of the Refugee Convention, all rescuees were transported to Europe to determine whether they could be returned or if they were at risk of persecution. By June 2017, over 452 boats had been destroyed.[8] Business as usual had indeed been disrupted. But once again the smugglers and traffickers adapted and, in particular, adopted riskier tactics for getting their human cargo into European hands. With most of the large wooden boats that had been used to get migrants close to Italy's shore gone, they were largely replaced by small inflatable boats. These boats could not be expected to actually make the crossing—passengers became effectively in need of rescue quickly after they set out. In 2016 this

8 House of Lords, European Union Committee, *Operation Sophia: A Failed Mission*, 2nd Report of Session 2017–19, HL Paper 5, 12 July 2017, para. 18.

translated both into 52 percent more rescues than 2015 and a 42 percent increase in recorded casualties. The numbers from 2017 threaten to show further increases. On top of this, the migrant flows trying to escape to Europe did not decrease, because the situation in Sub-Saharan Africa remained, and remains, grossly violent with the threat of starvation ever present.

Efforts to train the Libyan coast guard to intercept and rescue potential migrants while still in Libyan territorial waters have drawn considerable criticism. Reports were published in *The Times* in February 2017 of coast guard officers whipping and threatening to kill the migrants they had rescued, consistent with UN reports from 2016 of Libyan coast guard members engaging in gross human rights violations of intercepted migrants. Not surprisingly, the United Nations High Commission for Refugees has rejected designating Libya as a state that meets the criteria for being a place of safety for disembarking following a rescue at sea.[9] So while it would violate international law for the European Union to return any migrants they rescue to Libya for disembarkation, or even shipwrecked sailors, such a fate awaits those who are intercepted by the EU-trained Libyan coast guard.

Refugees at sea—and others fleeing gross human rights violations and environmental disasters by ocean routes—find themselves caught in an incomplete legal regime. Their security turns not just on whether the ocean is kind to them, but also on the ever shifting relationship between funding, state security, and border interests. It is these relationships which permeate the gaps in the legal regime, inserting policies and programs that shift with political interests. Responding to a refugee crisis by trying to manage ocean transiting routes is bound to fail, with this failure being highlighted by waves of predictable mass drownings. Ironically, it is these mass drownings that trigger the humanitarian high points, points which seem to be held until too many people are rescued at sea, and then other political interests rise to the surface.

9 United Nations Support Mission in Libya and United Nations Human Rights Office of the Office of the High Commissioner, *Detained and Dehumanized: Report on Human Rights Abuses Against Migrants in Libya* (13 December 2015), 8.

One Hundred Years of Certitude? Disaster Response and Recovery since the Halifax Explosion

Adam Rostis
Nova Scotia Health Authority, Halifax, Nova Scotia, Canada

In 1917, a collision between two ships in Halifax Harbor resulted in the largest human-made explosion before the bombing of Hiroshima. SS *Mont Blanc* was loaded with munitions, and when the *Imo* collided with it, the resulting explosion destroyed 22 percent of the city, killed 1,963 people, and injured 9,000.[1] In 1920, Samuel Prince published a sociological analysis of the response. His was one of the first explorations of disaster and community recovery and set the tone for the modernist view of disaster response, relief, and recovery.[2] The Halifax Explosion was a maritime disaster that devastated a coastal community, and on the 100th anniversary this essay takes stock of the prevailing and emergent views of disaster response, relief, and recovery.

It is variously claimed that the frequency of disasters is increasing, that this is happening naturally, or that there is some inherent process of disaster creation that is rapidly accelerating.[3] Alarming suggestions are made that rapid technological revolution, globalization with attendant interconnectedness of events, increasing terrorist and subversive activities, climate change causing new weather patterns, increasing mobility of humans heightening the risk of mass epidemics, and exponential population growth resulting in use of marginal land have all contributed to the growing number of disasters and crises.[4] No longer, it is claimed, can organizations and governments hope for stable and predictable patterns of continuity.[5]

These claims often begin arguments for an increased need for organizations and experts able to understand and manage these events. In other words,

1 J. Scanlon, "Rewriting a Living Legend: Researching the 1917 Halifax Explosion," *International Journal of Disasters and Mass Emergencies* 15, no. 1 (1997): 147–198.

2 S. Prince, "Catastrophe and Social Change, Based upon a Sociological Study of the Halifax Disaster" (Unpublished Ph.D. thesis, Columbia University, 1920).

3 G. Bankoff, "Rendering the World Unsafe: 'Vulnerability' as Western Discourse," *Disasters* 25, no. 1 (2001): 19–35.

4 D. Alexander, "Globalization of Disaster: Trends, Problems and Dilemmas," *Journal of International Affairs* 59, no. 2 (2006): 1–22.

5 A. Farazmand, "Introduction: Crisis and Emergency Management," in *Handbook of Crisis and Emergency Management*, ed., A. Farazmand (New York: Marcel Dekker, 2001), 1–10.

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the number and intensity of disasters has been increasing, together with the number of people affected, and this has been met by a technical and organizational response. An example of this approach, and the flaws with it, can be seen in the 2005 Hurricane Katrina disaster.[6] On 29 August 2005 it devastated the Gulf Coast of the United States, precipitating a scene that could barely be believed: the complete evacuation and near-complete destruction of an entire US city. According to a 2006 report commissioned by the White House, the storm caused 1,330 deaths, resulted in about US$96 billion in direct damage, destroyed or made unlivable 300,000 homes, forced the evacuation of 1.1 million people, and created a huge pool of internally displaced people.[7] President George W. Bush admitted that Katrina was the worst natural disaster in US history, and the federal government admitted its failures.[8] Katrina is a well-known example of a major disaster exposing the underlying logic of the current approach taken by formal organizations in managing disasters. The popular media has presented the decisions made by government leaders during the Katrina response as being confused and irrational. However, government officials were all operating under laws and policy that limited their ability to take decisive action. Further, individual decision-makers all worked within formal response organizations such as the Federal Emergency Management Agency (FEMA). When approaching the management of a disaster, these organizations take a highly rational, positivistic approach in that they attempt to understand and diagnose the problem, rely upon pre-defined rules and policies, adopt formal roles for individuals involved in the response, and utilize a centralized decision-making system.

Understanding that response organizations are structured this way, it then seems reasonable to suggest that the disaster management system did exactly what it was expected to do. In this light, the much-discussed failure of the response to Katrina can therefore be recast as a success. It is the logical outcome of a bureaucratic, rational approach to the management of a chaotic and ambiguous environment.[9] In the Katrina disaster, FEMA behaved as it was

6 A. Rostis and J. Helms-Mills, "A Pedagogy of the Repressed? Critical Management Education and the Teaching Case Study," *International Journal of Management Concepts and Philosophy* 4, no. 2 (2010): 212–223.

7 Government of the United States, *The Federal Response to Hurricane Katrina: Lessons Learned* (Washington, DC: The White House, 2006), https://georgewbush-whitehouse.archives.gov/reports/katrina-lessons-learned/index.html.

8 Id.

9 M. Takeda and M. Helms, "Bureaucracy, Meet Catastrophe: Analysis of Hurricane Katrina Relief Efforts and their Implications for Emergency Response Governance," *International Journal of Public Sector Management* 19, no. 4 (2006): 397–411.

designed; that is, to be intolerant of rapid change, to seek approval of authority before making decisions, and to apply rules rigidly when making decisions. Therefore, the failure of the response to Katrina was not of the organization, or even of the leaders, but rather of the organizational structure given the unstable and chaotic environment in which it was asked to operate. FEMA is one example of a disaster management organization that is a machine bureaucracy. It has a hierarchy of authority, a high division of labor, and centralized decision-making. It is best suited to an unchanging environment; however, in a disaster the environment is unstable and chaotic.

In contrast, other organizational structures may have resulted in a different outcome. For example, the loosely integrated regional structure of the US Coast Guard is an alternative model for disaster response. In the Katrina response, individual responders and ships from the Coast Guard worked more independently than other response agencies. Rather than waiting for orders from the top, Coast Guard responders were given leave to search and rescue on their own. This example is sometimes cited as being one of the few success stories in the Katrina response.[10] The Coast Guard model's organic structure is ideal for chaotic environments as it exhibited elements of an adhocracy and a divisional structure. Decentralization allowed for greater decision-making ability in those closer to the problems. The Coast Guard empowered individual employees to make decisions based on the environment in which they were operating. This is an example of what Bigley and Roberts call the incident command system (ICS) of team response to crises.[11] Under ICS, the team is formed dynamically and rapidly. Technical competence is a factor in disaster team selection as individuals need to be qualified to perform their specific team task. However, consideration is not given to the level of an individual's potential fit on a team. Teams formed using ICS methodology seem to have high levels of performance, as measured by their ability to solve complex tasks. The combination of a hierarchical structure and flexible individual roles within that structure contribute to performance. Thus, taking a contingency approach to organizational design, such as the Coast Guard model, would enable organizations to make decisions in an uncertain environment.

Humans, throughout their history, have faced disasters such as Katrina. It is not surprising then that much of the organizing behavior for disaster response is deeply rooted in our human past and has evolved into an ability to

10 A. Ripley, "How the Coast Guard Gets It Right," *Time* (23 October 2005).

11 G.A. Bigley and K.H. Roberts, "The Incident Command System: High-Reliability Organizing for Complex and Volatile Task Environments," *The Academy of Management Journal* 44, no. 6 (2001): 1281–1299.

organize and respond. Over time, community resilience in the face of disaster emerged, only to be replaced later by formal organizations and plans to confront disasters. The objective of organizations has been to seek a return to pre-disaster conditions, unseating a natural, latent ability within people to survive disasters.[12] This reflects a larger, totalizing process of modernization in which institutions replace tradition.[13] Take for example two floods that occurred in England: one in the 1950s and the other in the 1990s.[14] The 1950s floods were devastating to the population but were met with a sense of stoicism and resiliency. They were characterized as part of the natural flow of life, and the population adapted and moved on. In contrast, a flood in the 1990s saw the population characterized as vulnerable and traumatized, even though fewer people died. A rhetoric of vulnerability has usurped a rhetoric of resiliency, and that this has been driven by the sudden emergence of the psychological evaluation of survivors as fragile, traumatized, and in need of care.[15] It is not surprising to find modernity's influence in the creation of disasters that never used to exist; in other words, there has been an erosion of the border between disaster and normality.[16] Through science and technologies of observation and communication such as satellite imagery and the Internet, disasters can be discovered in remote places and with a rapidity that allows them to feed into the news cycle and become disaster events.

Therefore, disasters have become institutionalized: they have been removed from the personal and made organizational. Why did this happen? Perhaps, as Rebecca Solnit reflects on the 1906 San Francisco earthquake, disaster affords people the opportunity to be free: free from institutions, free from laws that assume that society tends to disorder in the absence of rules.[17] In disaster, Solnit argues, people see the unimportance of organization. This may be why order is often imposed violently in the face of mass informal organizing in the aftermath of disaster. For example, in post-earthquake San Francisco, military authorities who were put in charge of keeping order perceived their job "as saving the city from the people, rather than saving the people from the material

12 A. Kirschenbaum, *Chaos Organization and Disaster Management* (New York: Marcel Dekker, 2004).

13 M. Foucault, *Security, Territory, and Population: Lectures at the College de France 1977–1978* (New York: Picador USA, 2009).

14 F. Furedi, "From the Narrative of the Blitz to the Rhetoric of Vulnerability," *Cultural Sociology* 1, no. 2 (2007): 235–254.

15 Id.

16 Kirschenbaum, *supra* note 12.

17 R. Solnit, *A Paradise Built in Hell: The Extraordinary Communities that Arise in Disasters* (New York: Viking, 2009).

city of cracked and crumbling buildings."[18] This impacted upon emergent helping behavior of citizens. In the fire that followed the earthquake, citizens attempted to save what they could using their own means while the organized, formal structures of helping were convinced that neighborhoods had to be deliberately dynamited or burned down to stop the spread of fire.

How then has the approach to disaster response and recovery changed since the Halifax Explosion? At one end of the spectrum, in 1917 disasters were viewed as exceptional events beyond the daily societal background noise of tragedies and avoidable mortality. A disaster was an abnormal and easily recognizable event that resulted in a temporary setback to progress. After almost 100 years of experience, we now recognize that disaster responses can be categorized into informal, emergent, and co-ordinated responses.[19] The latter two are centered within organizational structures, while the former is characteristic of citizen or individual responses. Since 1917, the management of disaster by organizations has evolved into an all-hazards approach; that is, while each has unique features, it is believed that the effects and impact are similar and require a standard arsenal of response activities including search and rescue, evacuation, and relief. However, disaster is now more and more enmeshed within political and economic systems, to the point where it becomes impossible to distinguish disaster from everyday existence. Disaster scholars now recognize the tension between emergent versus organizational responses to crisis, so that a managed, organized response should not impede improvisation.

18 Id., 34.

19 E. Quarantelli and R. Dynes, "Response to Social Crisis and Disaster," *Annual Review of Sociology* 3 (1977): 23–49.

Women, Communities, Resilience: What's Not to Understand?

Murielle Provost
Cape Breton University, Sydney, Nova Scotia, Canada

Introduction

Zeinab Mokalled in Lebanon and Sanumaya Kumal in Nepal live 4,600 kilometers apart in very different places, cultures, and circumstances, so what can they possibly have in common? The late poet Maya Angelou would have called them 'women warriors'. They understood hardship, and overcame challenges with wisdom, creativity, and fortitude. Armed with a secret weapon—resilience—their courageous actions have triggered a social tsunami of progressive change within their own communities and beyond—much needed and welcome given that the 'Blue Marble', which we affectionately call 'Mother Earth' or 'Mother Nature', has been increasingly showing her displeasure as she "groans in travail"[1] to restore equilibrium after decades of human neglect and irresponsible activities. In the Americas alone in 2017, hurricanes Harvey, Irma and Maria, earthquakes in Mexico, and California wildfires have been just a few examples of her artful rebukes.

Masses of women like Zeinab and Sanumaya recognize that they can be, and are, key agents of change in addressing Mother Nature's wrath. But despite this knowledge—which will come as no surprise to the more than 1.5 billion women who constitute half of today's coastal dwellers—being less visible in their work also makes them less likely to have access to decision-makers, to be consulted on how to better safeguard community assets and resources, or to be engaged in reconstruction of their living environment following a disaster. Underscoring the foresight and resolve that women everywhere are contributing to creating better communities—whether inland or coastal; urban, rural, or remote—this essay portrays two stories of "women developing resilience to manage vulnerability" in their own communities.[2]

1 The Bible, Romans 8:22.

2 B. Leipert, "Rural and Remote Women Developing Resilience to Manage Vulnerability," in *Rural Nursing: Concepts, Theory, and Practice*, eds., H.J. Lee and C.A. Winters (New York: Springer, 2005), 79–95, 79.

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Mother Earth's Difficult Children

Out of a total landmass of almost 37 billion acres, Mother Earth houses 58 people per square kilometer atop the 16,000,000,000 acres that are habitable. Sixteen billion acres—how large is that? If it were dollars, it would mean the equivalent of saving $10,000 every single day for 4,384 years. Or buying 80,000 houses at $200,000 each. Or, if you like travelling and think in terms of miles, flying around the world 642,544 times, or even taking a round trip to the Moon 33,487 times.

On that habitable terrain, approximately three billion people or about 40 percent of the world's population live within 100 kilometers (62 miles) of a coast—that's the equivalent of just over two consecutive 42.2-kilometer marathons. And by 2025, that population is anticipated to double.[3] Our persistence in developing diverse societies in coastal areas—defined by the UN's Food and Agriculture Organization as the "interface or transition areas between land and sea"[4]—results in increasing and unremitting challenges to all facets of human activity that hamper "the ultimate purpose" of emergency management, disaster risk reduction, and resilience-building, which is "to save lives, preserve the environment and protect property and the economy" from natural, technological, and human-caused events.[5]

In addition to their status in the community, women confront another determinant in how they contribute to that 'ultimate purpose', and that is the type of community in which they live. Factors such as geographical size, demographic composition, availability of critical infrastructure, governance, emergency response resources, cultural ideologies, and beliefs are just some of many influences that play a role. In an attempt to offer clarity with respect to different coastal community types, Professor Tim Smith classifies them into five kinds: cities (including megacities, which typically have populations exceeding ten million, such as Tokyo-Yokohama, Japan or New York City and its surroundings); peri-urban areas (the transition zones between urban and non-urban areas); regional centers (smaller than cities); regional settlements (small

3 L. Creel, "Ripple Effects: Population and Coastal Regions," Population Reference Bureau, last accessed 10 September 2017, http://www.prb.org/Publications/Reports/2003/RippleEffectsPopulationandCoastalRegions.aspx.

4 Food and Agriculture Organization of the United Nations (FAO), *Integrated Coastal Area Management and Agriculture, Forestry and Fisheries* (Rome: FAO, 1998), Part A, s. 1.1.

5 Government of Canada, Ministers Responsible for Emergency Management, *An Emergency Management Framework for Canada—Third Edition* (Ottawa: Public Safety Canada, Emergency Management Policy and Outreach Directorate, 2017), 7.

clusters of villages and hamlets); and rural areas.[6] While there are abundant opportunities to advance the greater good, a novel approach is required to engage women fully in preventing or mitigating, preparing for, responding to, and recovering from emergencies that threaten the 'ultimate purpose' as well as in affecting change, and overcoming long-standing political, social, and environmental challenges.

Regardless of their type, coastal communities are increasingly vulnerable to threats of cascading anthropogenic activities. Climate change (causing unprecedented volatile weather patterns), rising sea levels (is it possible that some coastal communities will become ramshackle floating 'atolls' as portrayed in the 1995 movie *Waterworld*?), coastal erosion and degradation, decline in ecosystems, unmanaged development, growing urbanization, poor resource management, and other kind of threats from human activities—all are well documented. And although the alarm bells have been ringing for several decades now, implementing effective measures remains difficult for many public and private bodies since they rely primarily on the certainty of facts for decision-making. To this end, the Sendai Framework for Disaster Risk Reduction 2015–2030, agreed upon at the UN World Conference on Disaster Risk Reduction in 2015, is notably encouraging. It outlines targets and priorities aiming "to achieve the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries over the next 15 years."[7]

Despite these efforts, Mother Nature is no longer waiting for us to get our act together. As she continues to go about her business, we must become better at developing hazard-resilient communities and enhancing the ability of coastal communities to absorb and recover from impacts. That requires everyone's effort; and yet almost 50 percent of coastal dwellers are underutilized. Women—100 of them for every 102 men[8]—can help, as Zeinab's and Sanumaya's stories will illustrate.

6 T. Smith, *Climate Change Impacts on Coastal Communities, CoastAdapt Impact Sheet 13* (Queensland: National Climate Change Adaptation Research Facility, Gold Coast, 2016), 7.

7 United Nations Office for Disaster Risk Reduction, *Sendai Framework for Disaster Risk Reduction 2015–2030* (18 March 2015), http://www.unisdr.org/we/inform/publications/43291.

8 United Nations, *World Population Prospects: The 2017 Revision Key Findings and Advance Tables* (New York: Department of Economic and Social Affairs, 2017), 1.

Zeinab

When the regional governor asked why she cared—after all, "We are not Paris" he had told her—81-year-old Zeinab Mokalled from Arabsalim, Lebanon established a community collection team in the mid-1990s to address the rubbish that was piling up on the streets of her village. At the time, southern Lebanon had been occupied by Israel for 15 years and waste collection had ceased. Refused assistance by the regional governor, Zeinab "called on the women of the village to help, not the men—partly because she wanted to empower them, and partly because she thought they would do a better job." Today, her commitment to "ensuring that Arabsalim is clean and tidy" has inspired women in the nearby villages of Kaffaremen and Jaarjoua to establish their own initiatives, as well as the creation of an organization named 'Call of the Earth' where a stream of visitors is learning more about how "caring for the earth is our responsibility in this part of the world. Whether we do it or not, our politicians won't care. It's down to us."[9]

Unknown to Zeinab, her modest efforts have far-reaching implications in our contemporary world. In 2012 alone, Derek Thompson wrote, the world would generate "2.6 *trillion* pounds of garbage—the weight of about 7,000 Empire State Buildings"[10] and that was predicted to reach "approximately 2.2 billion tonnes per year by 2025."[11] As the world population continues to balloon, getting a handle on safe management of daily garbage disposal is increasingly critical for public health, and even more so during an emergency.

> Not only will existing collection and disposal systems be disrupted, but there will be extra waste caused by the emergency itself. Initially, for camps of displaced people or refugees and similar new sites, there will be no arrangements in place at all. If solid waste is not dealt with quickly, serious health risks will develop which will further demoralize the community already traumatized by the emergency.[12]

Thank you, Zeinab Mokalled from Lebanon, for your insight.

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9 N. Abou Mrad, "The 81-year-old Woman Inspiring a Nation to Recycle," BBC *News*, 8 June 2017, http://www.bbc.com/news/magazine-40191270.

10 D. Thompson, "2.6 Trillion Pounds of Garbage: Where Does the World's Trash Go?," *The Atlantic*, June 7, 2012, https://www.theatlantic.com/business/archive/2012/06/26-trillion-pounds-of-garbage-where-does-the-worlds-trash-go/258234/.

11 D. Hoornweg and P. Bhada-Tata, *What a Waste: A Global Review of Solid Waste Management* (Washington, DC: World Bank, 2012), 8.

12 J. Rouse and B. Reed, *Solid Waste Management*, Technical Notes on Drinking-Water, Sanitation and Hygiene in Emergencies No. 7 (Geneva: World Health Organization, 2013), 7.1.

Sanumaya

At the time of the devastating earthquake on 25 April 2015, almost half the households in Nepal had at least either one migrant abroad or a returnee, with nearly 88 percent of those being male.[13] Consequently, after the disaster, women in rural communities found their contributions toward recovery efforts particularly gratifying. With so many men working abroad, reconstruction was slow as Nepal was facing "a lack of manpower at a crucial time."[14] Two years later it was still estimated that 60,000 skilled workers were needed to build earthquake-resistant houses in fourteen districts.[15]

That is when Sanumaya Kumal, her friends, and others broke with their cultural tradition of household chores to become trained in construction by national and international organizations to help rebuild damaged houses, and make them more earthquake resistant in a severely affected district north-west of Kathmandu. From carrying sand and bricks, to digging foundations, building walls, roof-fitting, and plastering, Sanumaya, who used to work on a farm, was thrilled with her new-found skill sets, now capable to "do everything that a male mason can do."[16]

Today, over two years later, "the women say they are earning a decent living, as well as being happy that they are taking part in important national work" such as rebuilding schools and health centers as well.[16] If this isn't an exemplary story of what *An Emergency Management Framework for Canada* calls a "valuable opportunity to develop and implement measures to strengthen resilience," then what is?

Thank you, Sanumaya Kumal from Nepal, for your determination and courage.

Women Warriors

We are accustomed to it by now. Every day, every single day, we hear disaster stories of some sort—whether human-caused, technological, or natural—

13 S. Sharma et al., *State of Migration in Nepal, Research Paper VI* (Kathmandu: Centre for the Study of Labour and Mobility, 2014).

14 S. Tamang, "How Nepal Quake Turned Women into Builders," *BBC News*, 24 April 2017, http://www.bbc.com/news/world-asia-39694171.

15 R. Samachar Samiti, "Shortage of Skilled Workers Affects Reconstruction Work," *The Himalayan Times*, 7 January 2017, https://thehimalayantimes.com/nepal/shortage-of-skilled-workers-affects-reconstruction-work/.

16 Tamang, *supra* note 14.

and each one validates decades of reflection by competent authorities that commitment, actions and enforceable policies are no longer optional, they are an urgent imperative. The human race will not stop getting innovative in creating chaos and Mother Earth is unlikely to calm down, so, isn't it time we do things differently? There are 50 percent of adult humans—women—who are more than willing to become full participants in disaster-related activities. By empowering them, we are ensuring a prerequisite for success in building better, sustainable resilience for their family and community. "Whatever her role, she achieves greatness by standing her ground and pushing for change. Women warriors possess as much strength, determination and fortitude as any man."[17] The time has arrived—now what?

17 "Are You a Woman Warrior?," Keen, last accessed 31 January 2018, https://www.keen.com/articles/spiritual/are-you-a-woman-warrior.

In Search of Relief with Development

Ian McAllister
International Ocean Institute-Canada, Halifax, Nova Scotia, Canada

From Bangladesh and Myanmar to Syria, Mexico and Puerto Rico—today's world is fraught with crises. Some are people-made, some are 'natural'. Many are some combination—underpinned by the earlier symptoms of global warming or widening gaps between rich and poor.

Since at least the earlier post-World War II years, international development agencies, not least the World Bank and European Investment Bank, sought to balance 'structural adjustment' strategies with fostering efforts 'to oil' economies through a reduction of impediments to freer flowing markets: 'perfect competition' remained a theory to be cited, if not a practice to be pursued 'in one's own backyard'. Principles and procedures needed to be articulated and infused into legal systems. Among two such examples are the various efforts to codify 'human rights' (tracking back to the initial Geneva Convention triggered by Henry Dunant, founder of the International Red Cross movement) and the law of the sea (much supported by the life work of Elisabeth Mann Borgese).

This short essay, and more particularly the brief book that it draws upon, is much influenced by both. The experience of working within, and exposure to, Henry Dunant's legacy of the International Red Cross Federation led the author to write a small booklet *Projects for Relief and Development*.[1] The subsequent use of that work as part of course materials by the author for International Ocean Institute (IOI) courses, at the request of Elisabeth Mann Borgese, led in part to the writing of the 'more cautious' book that is addressed in this essay, *Projects in Search of Relief with Development*.[2] That work comprises six main chapters, incorporating a number of planning and management frameworks, as well as drawing upon a variety of case studies and 'lessons learned' critiques. These case experiences range from the 2015 earthquake in Nepal to challenges that have been encountered by Newfoundland, Canada, from a variety of African and South-East Asian events, to reflections on a sample of North American and European Union approaches.

The *introductory chapter* opens by challenging the reader to define a 'good project' and just how its potential impacts are indeed to be assessed. So-called 'relief' and 'development' projects are introduced: issues such as community

1 I. McAllister, *Projects for Relief and Development* (Geneva: Henry Dunant Institute, 1991).
2 I. McAllister, *Projects in Search of Relief with Development* (New York: Linus Learning, 2016).

strengthening, environmental sustainability, and the biases of particular professional groups, be they engineers, economists, or international development bankers and medical personnel, are raised, as well as (for example) the kinds of approaches that might be anticipated from institutions at varying levels of evolution/maturity. A critique by the International Committee of the Red Cross about Somalia experiences provides a 'reality check' annex.

The *second chapter* probes further into the identification and design of projects. It draws initially on the World Bank's project cycle approaches and then moves into a cross section of private sector and non-governmental organization frameworks. The influences of core themes, including 'new towns' and 'national parks', on public sector strategies are examined, with examples of some of their apparent strengths and limitations. The chapter then moves into project preparation phases, including participation issues that are so important for both relief and recovery processes. How are gender and ethnic issues responded to, not to mention corruption and the behavior of rival power groups? Thence, the discussion introduces several design and feasibility frameworks and, too often neglected in relief project planning, the spelling out of coherent exit options. "Exit strategies," it is emphasized, "are not to be viewed as 'escape mechanisms', but rather as avenues for planned capacity-building.... In many cases, the best exit strategy will incorporate a long-term partnership agreement." This philosophy it might be noted, also underpinned the emphasis Elisabeth Mann Borgese placed (in many conversations with the author) on the evolving IOI training courses.

Chapter 3 explores aspects of the appraisal and financing of projects. The challenges of both identifying and also quantifying the costs and benefits of projects are delved into—over time and taking into account alternative kinds of potential risk and insecurity scenarios. A proposed international assistance project for a West African university is used as one model, with care taken to note that donor agencies are frequently pressured by their financial units to focus too narrowly on the more readily quantifiable cost and revenue dimensions—thereby downplaying critical but less-measurable environmental and social costs/benefits. Chapter 3 then draws on a review the author undertook on the manner Canadian Treasury Board officials had been responding to a maze of project proposals that were fraught with political and other, dubiously presented, alleged 'rates of return'. Those findings, to put it mildly, were provocative—not least in the context of coastal zone management impacts.

Donor-driven relief and development projects are then discussed, as well as a cross section of issues encountered within federal-provincial systems and also after war situations. Oxfam's experience with the British government's reading of the *Charity Act* is referred to, as well as UNICEF's enlightened study of some of the impacts of the International Monetary Fund's understandable, yet heavy-handed, 'structural adjustment' approaches in quest to reduce waste in a number of developing countries, not least targeting, sometimes corruptly managed, state corporations.

The chapter concludes with (as an annex) a follow-up framework, written immediately after the 2015 Nepalese earthquake. As important as the author argues the shorter and longer-term suggestions of 'what to do' might be, equally important can be the framework lists of 'what not to do'. In each case, both short-term and longer range approaches are suggested. Insights were not only drawn from more recent Haitian earthquake experiences, but also from tsunamis (among other examples) in Southeast Asia.

Chapter 4, on project implementation and management, introduces basic emergency management models such as those designed by Erik Auf de Heide. Next, a model developed for the International Red Cross at the time of the first Gulf War is discussed, followed by critical path and decision tree frameworks for agency intervention (the last by Mary Anderson and Peter Woodrow). From such earlier design phases, the chapter leads into project work structures, including critical approaches to project supervision. This section is followed by a discussion of monitoring and operations that includes details of three case studies: a university teaching hospital in a poverty-stricken region of Africa, a cyclone shelter on the Bangladesh coast, and a school in rural Canada. Among the concluding remarks to this fourth chapter is:

> Responsible project management builds not merely on the kinds of mechanical skills that can be routinely acquired in the engineering or business oriented programs of urban universities, but it necessarily draws heavily upon social skills, cultural understanding, and (above all) a commitment to achieving results within ethically responsible community frameworks.

Project evaluation, follow-up and institutional memory-building is the next main theme (*Chapter 5*). Starting with a discussion of challenges encountered by government auditors, especially when questions of efficiency spill over into issues of effectiveness (not least on foreign aid projects), the chapter cites a number of findings from World Bank project reviews. These range from a technical paper on lessons from the Tennessee Valley Authority to audits in Bosnia/ Herzegovina and Indonesia. In the last, for but one example, a physical audit of a World Bank-financed (community-driven development program that constructs roads) found that a full quarter of expenditures were 'lost to theft', probably orchestrated by village heads who oversaw projects.

Evaluations, it is noted, can obviously vary in scale and approaches from in-house reviews to sometimes complex and extended procedures on controversial projects, such as a major Olympic Games complex or international port. An entire academic industry, now, it is also observed, appears to be evolving around measurements of 'well-being' and the reader is referred to the thoughtful work on universities by Derek Bok, a former Harvard president.

'What happens to the findings?' is next discussed. This leads into a critique on ethical values and projects, including the findings of a review of the British Public Service, *Just and Honest Government*. One question that recurs, not least in peacekeeping settings, is 'can ethical values appropriately change?' Issues relating to media, political, business, and non-governmental organizations are raised. The chapter concludes with a critique of codes of conduct and their apparent effectiveness (and otherwise) at the project level—especially in the context of large organizations under financial pressures, not least including banks and international fishing corporations.

Chapter 6 brings together a cross section of the key points raised in earlier sections, under the heading 'The Project in a Policy Cauldron'. This takes the reader from issues linked to mosquito nets and malaria to a bridge project in Croatia, from changes to a school curriculum in Zimbabwe to the political re-routing of national airlines. 'Good projects', it is argued, may indeed be Trojan horses for ideas that bring in societal change, but they cannot be viable substitutes for the changes themselves. The chapter is followed by an extensive annex that hinges back to the author's early experiences, cited in the preface, in Bangladesh. Drawn from a World Bank report, the annex concludes on a cautiously optimistic note, "Bangladesh shows [in the context of cyclone impact reductions] how even poor countries can prevent disasters, thereby nourishing [community strengthening] institutions."

The closing sections of the book comprise a select bibliography,[3] a series of follow-up discussion and research questions, as well as the detailed outline for a workshop that leads directly back to (but also extends beyond) the core themes of the main book itself.

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3 This 'outline for a workshop' includes elements of workshops that have been used by IOI, as well as by the Pearson Peacekeeping Centre, International Red Cross Federation, and Olympic Aid.

PART 9

Maritime Transportation

The globalization of the shipping industry, just like globalization in other sectors, has, on the whole, not contributed to human security, the protection of the environment, and the fortunes of the poor. Suffice it to remember that about 70 percent of the globalized fleet is registered in open registries issued in Panama, Liberia, the Bahamas, Cyprus, and half a dozen other states, often with loose standards, if any, for labor conditions and for the environment. Globalization has contributed to the plight of seamen from poor countries and to the marginalization of weaker economies and countries off the mainstream of shipping and transport developments.

> *Shipping requires a huge capital investment. ... The best laid company plans can be made to look foolish by sudden collapses in the market.* (*Vassilis Constantakopoulos*)

> *Shipping is in its own knowledge crisis. Recognition and understanding of the industry is low. In many cases, the shipping community itself is growing disheartened. Professionals quit the industry, taking their precious knowledge with them.* (*Vassilis Constantakopoulos*)

And, as Edgar Gold points out, the number of well-trained seafarers is also dwindling, for a variety of reasons, thus contributing an additional dimension to the "crisis of knowledge."

Elisabeth Mann Borgese*

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* "Preface," in *The Crisis of Knowledge: New Directions for Learning and Informed Decision-making for Oceans and Coasts, Proceedings of Pacem in Maribus xxvi, Halifax, Canada, 29 November-3 December 1998*, ed. S.J. Rolston (Halifax: International Ocean Institute, 1999), xii.

Introduction

Editor: Mary R. Brooks

Historically, control of international shipping was the foundation of international power and economic development, from the days of the Greeks and Phoenicians (and their control of the Mediterranean), to the dominance of the British Empire in more recent centuries. After World War II, many developing nations saw shipping as a means to control their economic destiny, and their efforts were supported by Elisabeth Mann Borgese. So while very little of her work on ocean governance related to shipping, she has inspired a vessel named after her![1]

Elisabeth would be surprised to see that there are eight papers in this part, as only seafarers' rights and port state control were close to her heart. The thought that a Polar Code to govern the Arctic Ocean has materialized would delight her; the introduction of autonomous ships to confound that governance would definitely be of interest. She recognized shipping as a truly global industry, and that it was one with serious capital requirements that do not incent the best in human behavior. Each of the eight papers in this part would be received with enthusiasm by her as her mission of good ocean governance for the benefit of the planet, as a whole, and the prosperity of its citizens were a key driver in each of the topics covered in this part. Enjoy!

1 The research vessel *Elisabeth Mann Borgese*, IMO no. 8521438, was built in 1987 and is registered in Germany, see http://www.marinetraffic.com/en/ais/details/ships/shipid:152735/mmsi:218601000/imo:8521438/vessel:ELISABETH_MANN_BORGESE#cmJKM69AwyzrrsFv.99.

National Shipping Policies and International Ocean Governance

Mary R. Brooks
Dalhousie University, Halifax, Nova Scotia, Canada

> The spokesman for the Group of 77, recalling the statement made by the President of the Ivory Coast that the path to economic liberation passed across the sea, said that, for the third world, the question of shipping was not just one aspect of general economic life, as it was in many developed countries; it was one of the basic foundations … He went on to say that while developing country exports accounted for 61 per cent of world seaborne cargo, the developing countries owned only 8 per cent of world tonnage.[1]

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Thus, in the late 1970s, the question of shipping was seen as critical to the aspirations of the developing countries that made up the Group of 77.

As an ardent supporter of the Group of 77, Elisabeth Mann Borgese's work on ocean governance reflected two primary beliefs relevant to shipping. One was the right of the nation state to ensure the quality of shipping that took place within its territorial waters, and she was a strong advocate of port state control as a means of ensuring that (a) the environmental costs of shipping did not fall on port states, and (b) seafarers were protected by relevant International Labour Organization and International Maritime Organization conventions. The second belief was that the nation state should be able to share in the benefits of shipping, and that those benefits should not just accrue to the developed world countries that owned shipping.

Two essays in this section address her interests in port state control and seafarer protection; therefore, this essay explores the second of her beliefs

1 United Nations Conference on Trade and Development (UNCTAD) (1981), *Proceedings of the United Nations Conference on Trade and Development, Fifth Session, Manila, 7 May–3 June 1979*, Volume I, paras. 195–196.

DOI:10.1163/9789004380271_078

in a modern context. It begins by identifying the current state of beneficial ownership of shipping, flag of registration and location of shipbuilding activity, raising questions about where the true value of shipping resides: Is it with the beneficial owners of vessels (as she thought) or is it found in other parts of the industry, for example, by serving the trading interests of the countries involved? There is a common assumption that it is the former, and this essay challenges that assumption. It examines what developing countries can do, in terms of shipping policies, to ensure that the benefits and costs of this most global of international businesses are equitably distributed and that developing countries have the opportunity to acquire some of those benefits. It then provides a checklist of shipping policies for nation states to review in their efforts to increase their participation in the benefits of shipping before closing with some thoughts on the future of developing country shipping policies.

Beneficial Ownership and the Value of Shipping to Nation States

According to the United Nations Conference on Trade and Development (UNCTAD), as of January 2017, the top five ship-owning nation states (in terms of deadweight tonnage [dwt]) were Greece, Japan, China, Germany, and Singapore; these five countries beneficially owned half (49.5 percent) of the world's tonnage.[2] Most important, the UNCTAD data demonstrate that more than 50 years after the founding of the Group of 77, developed countries continue to own the majority of vessels; developing country participation in owning vessels still does not reflect their share of the population as Elisabeth had hoped.

On the other hand, the top five countries for vessel registration at the beginning of 2017 were Panama, Liberia, the Marshall Islands, Hong Kong (China), and Singapore, flagging 57.8 percent of the world's dwt. Developing countries play a significant role in vessel registration, flagging 76.2 percent of the ships registered in the world.[3]

A third means of participating in the industry is by building the ships. Only three countries are significant suppliers of ship hardware, as ship building takes place predominantly in China, Japan and the Republic of Korea, accounting for 91.9 percent of gross tonnage constructed in 2016.[4] That China and

2 UNCTAD, *Review of Maritime Transport 2017* (Geneva: UNCTAD, 2017), Table 2.3.
3 Id.
4 Id., Table 2.9.

Korea have significant presence in this component of the industry would have appealed to Elisabeth.

The questions that should be asked are: How does shipping create value for a nation state? Is it through the ownership function that value is created? What are the best policies for nation states to ensure that they benefit from value creation in the industry?

In the 1970s and 1980s, there was a firm belief that participation in the business of shipping would bring benefits to developing countries through the reduction of freight payments internationally, a drain on the foreign currency reserves of these countries. The crews of a nationally owned fleet could presumably be paid in local currency, assuming that there was a requirement to use national citizens; the fallacy of this belief caused considerable consternation as the reality was that most shipping companies wished to be paid in the industry standard of US dollars (or other hard currencies in more recent years) and would have to pay expenses like fuel and foreign port charges in a hard currency. This means that the residual value of revenue minus expenses is positive only when the ship makes a profit in hard currency, that the revenue is received in a hard currency, and that the costs as, as much as possible, are in the local currency. This is not, and has not, always been the case, and the impacts on developing countries have been particularly destructive in those years when the industry is unprofitable, and this industry is notoriously cyclical.

National Policies to Acquire Value from Shipping

Given the above statistics, many developing countries clearly decided that participation in the industry is easiest and quickest through offering a flag of registry to foreign owners. Simply, charging a registration fee brings in foreign exchange from developed country owners, although not substantive levels of income tax, as corporate tax on shipping needs to approximate zero in order for the particular flag to be attractive.

If developing country value creation is not through ownership, and only minimally through registration, does it come from shipbuilding (or shipbreaking)? The argument is positive so long as the local government does not feel it must subsidize the industry to generate vessel orders or scrapping activities. Again, many countries have allowed subsidy policies to destroy that means of creating value.

Finally, can value be created through the offering of ship management activities? This question was investigated by Canadians to explore how Canada might benefit from shipping without necessarily subsidizing or protecting a national flag fleet.[5] Canada supports its national flag fleet through a cabotage policy,[6] but is there more to be gained? The report concluded that the valuable jobs in shipping are those created by ship management companies. Countries that serve as ship management locations, i.e., Cyprus, Hong Kong, Singapore and Malta, generate employment for professional shipping jobs (accounting, crew management, marketing, operations planning, and the like) and then acquire the personal income tax revenue from those jobs rather than the corporate income tax from the ship owning company. Changes in 1992 to Canada's tax laws created the opportunity for Canada to serve as a ship management center with significant revenue for government generated from employee personal income tax.[7] Today, Vancouver is one of the top maritime capitals in the world (ranked 24th) by DNV/GL.[8]

For the most part, vessel ownership is a more expensive option for trading interests than buying shipping services on the open market. A 1985 study examined the fleet development initiatives of five developing countries and concluded "the ability to gain increased control of shipping through government measures designed to promote private sector investment is tied to the ability of companies to engage in such an investment."[9] In other words, success in developing country investment in shipping needs strong capital market access, the very thing many developing countries lack. In seeking greater prosperity, four of the five developing countries examined only found greater debt.

Furthermore, it is important to recognize that shipping creates value at the port, as it not only creates shore-based cargo-handling employment, but also serves to connect exporters and importers to world markets and suppliers. It is here, as the 2017 Council of Canadian Academies study found, that the true value of shipping accrues; the value of connectivity to world markets was nine times the economic value (GDP) found in traditional economic impact

5 Jonathan Seymour and Associates, *Vancouver: An International Centre for Maritime Commerce Final Report* (Vancouver: Asia Pacific Initiative Transportation Task Force, 22 December 1988).

6 The requirement to use a vessel of national flag vessel for domestic marine traffic.

7 M.R. Brooks and J.R.F. Hodgson (2005), "The Fiscal Treatment of Shipping: A Canadian Perspective on Shipping Policy," in *Shipping Economics: Research in Transportation Economics*, Vol. 12, ed., Kevin Cullinane (2005), 143–171.

8 E.W. Jakobsen et al., *The Leading Maritime Capitals of the World* (Norway: DNV/GL & Menon Economics, 2017), https://www.dnvgl.com/maritime/publications/leading-maritime-capitals-2017.html, last accessed 13 August 2017.

9 M.R. Brooks, *Fleet Development and the Control of Shipping in Southeast Asia*, Occasional Paper 77 (Singapore: Institute of Southeast Asian Studies, 1985), 89.

studies.[10] The true value of shipping, therefore, is in its role as a generator of trade-related economic development for a country.

Brooks, Sánchez and Wilmsmeier (2014) evaluated national shipping policies in six Latin American countries in order to identify impediments to the provision of efficient regional shipping, updating the earlier framework of shipping policies[11] to include: (1) domestic cabotage policies (and any exceptions for foreign-flagged vessels), (2) shipbuilding requirements for vessels accessing regional cargo, (3) existing bilateral cabotage agreements, (4) foreign ownership restrictions on national flag shipping, (5) shipping taxation, (6) crewing requirements, (7) carbon-pricing for fuels and/or existing emissions control areas, (8) pro-national flag incentives, and (9) any other requirements/rules or special treatment of cabotage services/ships.[12] This is a good checklist for any country wanting to understand why it may or may not attract shipping services with a net gain for the local economy. Non-tariff barriers to shipping operations in any geographic region (at the national or regional level) can impact on the ability of the shipowner to provide fully efficient and effective shipping services at a price the market will bear. Without such efficiencies, the trade routes and markets a developing nation seeks to secure may be(come) inaccessible.

Final Thoughts

Elisabeth Mann Borgese would be very surprised to see the world of shipping today as not having greater developing country beneficial ownership. In her view, the passage of the UNCTAD Convention on a Code of Conduct for Liner Conferences 1974 was supposed to assist in securing that participation by promising them a 40 percent share of liner conference traffic (Article 2). Even though the convention came into force, the participation outcome never materialized because it was economically unrealistic and not supported by the cargo owners paying for the services.

Today, many developing nations see shipping as producing value by simply serving as flag states for a truly global industry, collecting a minimum foreign registration income that has little loyalty. Owners of poor quality vessels

10 Council of Canadian Academies, *The Value of Commercial Marine Shipping to Canada* (Ottawa: The Expert Panel on the Social and Economic Value of Marine Shipping to Canada, Council of Canadian Academies, 2017).

11 Brooks (1985), *supra* note 9.

12 M.R. Brooks, R. Sánchez and G. Wilmsmeier, "Developing Short Sea Shipping In South America: Looking Beyond Traditional Perspectives," *Ocean Yearbook* 28 (2014): 495–525.

continue to migrate to flags where there is the least amount of government interference, while those seeking a premium quality business image choose from reputable flag states that offer significant tax advantages without the damage to reputation that comes from a neglectful government bureaucracy. The value in shipping today continues to come, as it did in Elisabeth's day, from its role in facilitating trade and the resulting wealth creation that accrues from trade participation. This means that UNCTAD's current trade facilitation initiatives and its liner connectivity focus are of highest priority in securing economic prosperity for developing countries.

Globally, the way national shipping policies have evolved, and with today's world concerns about the oceans and our planetary future, we can expect to see the ownership and flag decisions taken by multinational shipping companies monitored by governments. They will find participation in strong port state control intervention, international labour conventions, and a climate policy agenda that seeks safer ships, cleaner seas and responsible shipping as the paths to follow, all approaches that would have appealed to Elisabeth.

Growth in the Shipping Industry: Future Projections and Impacts

Peter Noble
Noble Associates, Inc., Katy, Texas, United States

Introduction

Since earliest times, ships and shipping have shaped civilization. Ships have been used for discovery, war, and leisure, but most of all for cargo transport. In his poem 'Cargoes', the British poet laureate John Masefield describes such activities through the ages, from the "Quinquireme of Nineveh from distant Ophir, ... With a cargo of ivory, and apes and peacocks ..." through the "Stately Spanish galleon coming from the Isthmus …" to the "Dirty British coaster with a salt-caked smoke stack, butting through the Channel in the mad March days, …."[1] While recognizing the past, this essay will focus on the potential growth in the shipping industry with a focus on commercial cargo shipping, and will exclude sectors such as cruise ships, ferries, offshore drilling and production units, tugs, barges, and related vessels.

Since the end of World War II, the world has seen an explosive growth in trade. Globally the sum of export and import values as a percentage of the total world gross domestic product (GDP) grew from around 20 percent in the late 1940s through early 1950s to close to 60 percent in 2011, with the shipping industry as the backbone of global trade.[2] This growth is likely to continue. In its report, *2017 Outlook for Energy: A View to 2040*, ExxonMobil projects a two billion increase in world population, a 130 percent increase in the global economy, and a 35 percent increase in energy demand.[3] Further information developed by BP plc for its *2017 Energy Outlook* report suggests a base case where world GDP almost doubles by 2035, driven by fast-growing emerging economies, as more than two billion people are lifted from low incomes.[4]

1 J. Masefield, "Cargoes," *Ballads* (Elkin Mathews, 1903).

2 R.C. Feenstra, R. Inklaar and M.P. Timmer, "The Next Generation of the Penn World Table," *American Economic Review* 105(10) (2015): 3150–3182, available for download at http://www.ggdc.net/pwt, Penn World Tables, version 8.1, University of Groningen, The Netherlands (release date 13 April 2015).

3 Available at http://cdn.exxonmobil.com/~/media/global/files/outlook-for-energy/2017/2017-outlook-for-energy.pdf.

4 Available at https://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2017/bp-energy-outlook-2017.pdf.

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Looking specifically at commercial marine transport, we have seen a steady increase over the past decade or more. Growth in cargoes transported by ship has risen from around 30.5 trillion ton-miles in 2000 to approximately 52.5 trillion ton-miles in 2014. The United Nations Conference on Trade and Development (UNCTAD) reported that in 2015 total cargoes transported by ship exceeded 10 billion tons for the first time, with a fleet size of over 50,000 ships, and that 62 percent of these cargoes were unloaded in developing countries as compared to only 41 percent in 2006.[5]

All this suggests that marine transport will continue to be an important part of the global economy for many years into the future.

Current Fleet

Three main types of cargoes, dry bulk, liquid bulk and containerized, largely describe the commercial marine transport industry. Within these broad sectors there are a number of sub-divisions. The dry bulk trade is dominated by three types of cargo: iron ore, coal, and wheat; the liquid bulk cargoes also split into three main segments: crude oil, gas (liquefied natural gas (LNG) and liquefied petroleum gas), and refined hydrocarbon products. Containerized cargo is primarily manufactured or semi-manufactured goods and can be split into transoceanic liner trade and small regional feeder trade segments. Using figures for 2015, dry bulk cargoes accounted for 44 percent of the total global marine trade measured by tonnage, while oil and gas accounted for 30 percent and containers for 16 percent, with the remaining 10 percent being general cargoes of various types.

Future Growth

Looking to the future, it is likely that dry bulk cargoes will continue to rise, with steady growth in the wheat and iron ore segments, but with perhaps a smaller growth or even a decline in thermal coal for power generation. The demand for metallurgical coal for steel making is likely to remain strong over the longer term. Similarly, we may expect changes in the oil and gas sector where oil may see limited growth while natural gas in the form of LNG will continue to see the substantial growth we have witnessed in recent years.

5 United Nations Conference on Trade and Development (UNCTAD), *Review of Maritime Transport 2016* (New York and Geneva: UNCTAD, 2016), 6 and Figure 1.4(b).

Containerized cargoes have seen rapid growth over the last 25 years, growing from approximately 90 million twenty-foot equivalent units (TEUs) in 1990 to nearly 700 million TEUs in 2015. The container trade is likely to remain strong although we have seen occasional disruptions such as the financial crisis around 2008 and 2009.[6]

Factors Affecting Growth

The future growth of shipping will be driven by the abovementioned growth in global trade, but will be impacted by a number of factors, which may put some limits on this growth or may lead to increased innovation to satisfy demand.

Ship Efficiency and Environmental Impact

In terms of emissions per ton of cargo, marine shipping is the most efficient form of commercial transport. However, due to the sheer scale of the industry, shipping contributes to about 3 percent of the world's emissions. In order to minimize air pollution from ships, the International Maritime Organization (IMO) has established sulfur emission control areas (SECAs) or emission control areas (ECAs).[7] The emission limit requirements are being addressed by use of low sulfur fuels, using post-combustion treatment of the exhaust, and by use of alternative fuels, such as LNG.

Further, in 2011, the IMO addressed the overall efficiency of ships when it adopted an Energy Efficiency Design Index (EEDI), which is aimed at promoting the use of more energy efficient (less polluting) equipment and engines.[8] The EEDI requires a minimum energy efficiency level per capacity mile (e.g., ton-mile) for different ship type and size segments.

Another concern with shipping has been the potential for the transport of invasive species in ballast water. The IMO International Convention for the Control and Management of Ships' Ballast Water and Sediments,[9] which

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6 UNCTAD, *Trade and Development Report, 2015: Making the International Financial Architecture Work for Development* (New York and Geneva, 2015).

7 See "Prevention of Air Pollution from Ships," IMO, http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Air-Pollution.aspx, last accessed 14 February 2018.

8 See "Energy Efficiency Measures," IMO, http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Technical-and-Operational-Measures.aspx, last accessed 14 February 2018.

9 London, 13 February 2004; see "BWM Convention and Guidelines," IMO, http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/BWMConventionandGuidelines.aspx, last accessed 14 February 2018.

entered into force in September 2017, marks a significant step towards halting the spread of invasive aquatic species, which can cause problems for local ecosystems and lead to substantial economic loss. Under the Convention, ships are required to manage their ballast water to remove, render harmless, or avoid the uptake or discharge of aquatic organisms and pathogens within ballast water and sediments.

Ship Size

One of the ways in which the shipping industry has sought to enhance overall efficiency has been through increasing ship size and capacity. However, we have seen limits to ship size already occurring with crude oil tankers and large LNG carriers. The largest crude oil tanker, built in 1979, was over 560,000 ton deadweight capacity; since that time, however, the industry has seen ships of around 350,000 dwt ton capacity as the most useful maximum. Similarly, a number of very large LNG carriers were built in the late 2000s with capacities up to approximately 265,000 cubic meters. More recent ship orders have been in the 170,000 to 185,000 cubic meter range.

Part of the problem with these very large ships is the limited access to ports. The sheer physical dimensions are hard to handle at many berths, and also draft/depth limits in many commercial ports do not allow for such mega-ships, restricting where they may be deployed.

To date we have not seen these technical size limits reached for containerships, with recent orders for 22,000 TEU ships. Again, port facilities and shore-based cargo handling and infrastructure systems are being stretched, so we may see a de facto reduction in the size of such ships before long.

Port Size and Infrastructure

Port infrastructure, including shore facilities in terms of cargo handing or storage, will limit the rate of growth in ship size. One of the dimensions that most impacts design options and operations as ship size increases is water depth in a port. Many of the world's most significant ports, like New York and Rotterdam, have had to invest in channel and berth dredging to increase water depths but the economics of initial and continuing maintenance dredging must be compared to the improved transport efficiency in using larger ships. Ultimately, to participate in global trade, water depth matters.

One way to overcome port draft restrictions is to develop offshore ports where larger ships can discharge and temporarily store cargoes prior to delivery. One example of this is the Louisiana Offshore Oil Port (LOOP), which is a deep-water port designed for unloading crude oil cargoes from deep-draft tankers unable to access existing Gulf coast ports. The LOOP Marine Terminal is located in open waters of the Gulf of Mexico approximately 29 kilometers (18 nautical miles) offshore from the State of Louisiana. Other concepts for offshore ports for container and other types of cargo offloading and distribution are being examined, and we may see future developments of this type as cargo volumes rise.

Panama and Suez Canal Improvements

Both the Suez Canal, opened in 1869, and the Panama Canal, opened in 1914, have had a major impact on global shipping for a century or more in terms of both routing and vessel design. Over the last few decades, ships have been specifically designed to optimize cargo capacity given canal size limitations. Both canals have added capacity with a new, wider Panama Canal now in service and the expansion of the Suez Canal to allow for two-way traffic. These projects will no doubt result in further opportunities for creating new classes of ships to take advantage of the increased capacity.

Potential Future Changes

Over the past two decades, we have seen a shift in cargo patterns with developing countries no longer being predominantly exporters. UNCTAD notes that the balance of developing country traffic was more than three times loaded to unloaded in 1970, but by 2016 had shifted to a more balanced trade.[10] This trend is likely to continue.

In addition, we will see expansion of routes supplying raw materials and food imports from Africa and South America to China. The New Silk Road, which will provide an overland connection between China and Europe, is likely to have a moderating effect on marine transport.[11] This will most likely be in the form of reducing the rate of increase rather than in diminishing the actual volume of marine cargo.

We are also likely to see less oil transported to Europe and North America as demand stabilizes. However, we will see increased trade in LNG, with significant increases in imports into Asia. Finally, a major change in marine transport could occur as the world moves to reduce the use of fossil fuels. At the present time approximately 40 percent of all seaborne cargoes are fossil-fuel

10 UNCTAD, *Review of Maritime Transport 2017* (Geneva: UNCTAD, 2017), Table 1.4(b).

11 See P. Tae-Woo Lee et al., "Research Trends and Agenda on the Belt and Road (B&R) Initiative with a Focus on Maritime Transport," *Maritime Policy & Management* (November 2017), 1–19, doi.org/10.1080/03088839.2017.1400189.

related, namely, oil, gas, and coal. As the world reduces the use of such fuels, it seems likely that the demand for their marine transport will also diminish substantially.

Conclusion

Demand for commercial marine transport will continue to grow with innovations being brought to the market to satisfy increased demand. Developments already underway point to increased efficiency and reduced environmental impact; to the lowering of manning levels on ships, maybe even unmanned ships in the not too distant future; and to improvements in marine and port infrastructure. For the foreseeable future there is no other system that can match the overall efficiency of commercial shipping in providing transoceanic movement of freight.

Port State Control: An Important Concept in the Safety of Life at Sea, the Protection of the Marine Environment, and of Goods in Transit

Alan Knight
Transport Canada, Halifax, Nova Scotia, Canada

Historically, the power to regulate merchant ships resided with the nation where the ship was registered. When seaborne trade was geographically limited, this method of control was somewhat effective. With the expansion of the European empires, the ability of nations to regulate ships flying their flag was diminished by distance, and they would appoint consuls, or merchants, to represent them in distant ports, and they would advise masters on commercial matters, and on local ship-repair facilities. Lloyd's of London, which, as insurers, had a financial interest in arranging reliable repairs to damaged ships, began in the 1740s, to hire shipwrights to represent their interests in overseas ports, and to appoint surveyors at major ports along the trade routes of the British Empire. Other nations, such as France, Germany, Norway, and the United States adopted this system, which worked fairly well for 200 years. However, in 1967, the Arab-Israeli War resulted in the closure of the Suez Canal, lengthening oil supply-lines of the Western industrial nations, as ships were forced to travel from the Middle East using the longer route past the southern tip of Africa. As a result, freight rates increased dramatically, prompting the ordering of hundreds of ships to take advantage of these increased rates. When the Suez Canal re-opened in 1975, too many ships were chasing too few cargoes, and freight rates plummeted. Many shipowners went bankrupt, and those who survived had to drastically cut their costs.

Most of a shipowner's costs are 'hard costs' (mortgage, insurance, fuel, spare parts) over which there is little control. The only 'soft costs' are registration and crewing. Many shipowners removed their ships from the high-cost industrial nations, and re-registered them with lower-cost 'flags of convenience' (FoC). By registering with a FoC, the shipowner was able to replace the high-wage unionized workforce of industrialized nations with crew from nations with low wages. This labor outsourcing came at a hidden cost as many of the 'new' crews were inexperienced, and inadequately trained. This led to several accidents, many involving serious oil-pollution, such as *Torrey Canyon* (1967) and *Argo Merchant* (1976), and an awareness that safety standards in merchant shipping were in serious decline. In a related development, the classification

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societies, which had acted on behalf of flag states, were faced with competition from newly-formed classification societies who were anxious for business and prepared to drop their standards in order to get it. Some shipowners moved their ships to classification societies with lower technical and ethical standards.

In 1978, the Liberian-flag tanker *Amoco Cadiz*, laden with 200,000 tons of crude oil, was approaching northwest France when its steering gear failed. The ship drifted ashore, and disintegrated, polluting hundreds of miles of beaches and fishing grounds. The coastal ecosystem was devastated. The French government convened the Regional European Conference on Maritime Safety at Paris in order to devise a plan to prevent a re-occurrence of *Amoco Cadiz*-type events. The Conference decided that the existing regulatory regime, under which flags were given exclusive authority over ships flying its flag, either directly, or through authorized classification societies, was not providing an adequate level of safety to their crews, or to the coastal states whose waters the ships were transiting. The Final Declaration of the Conference, adopted on 2 December 1980, underlined the need to improve maritime safety, to protection the marine environment, and to improve living and working conditions on board ships, and the need for a memorandum of understanding (MoU) to guide future action.[1]

Subsequently the Paris Memorandum of Understanding on Port State Control (Paris MoU) was signed in January 1982.[2] Following the Final Declaration, the Paris MoU states:

> Convinced of the necessity, for ... an improved and harmonized system of port State control and of strengthening co-operation and the exchange of information;
> have reached the following understanding:
> Section 1: Commitments
> 1.1 Each Authority will give effect to the provisions of the present Memorandum and the Annexes thereto.
> 1.2 Each Authority will maintain an effective system of port State control with a view to ensuring that, without discrimination as to flag, foreign

1 For a more detailed review of the history and timeline of port state control agreements, see "35 Years of Paris MoU on Port State Control," Paris MoU (12 September 2017), https://www.parismou.org/35-years-paris-mou-port-state-control.

2 For the text of the Paris MoU, see https://www.parismou.org/inspections-risk/library-faq/memorandum. Annex 1, the List of Relevant Instruments, is reproduced as Annex 1 to this essay.

> merchant ships calling at a port of its State, or anchored off such a port, comply with the standards laid down in the Relevant Instruments listed in Section 2.
>
> …
>
> 2.3 Each Authority will apply those relevant instruments which are in force, and to which its State is a Party. In the case of amendments to a relevant instrument, each Authority will apply those amendments which are in force, and which its State has accepted. An instrument that is so amended will then be deemed to be the 'relevant instrument' for that Authority.
>
> 2.4 In applying a relevant instrument, the Authorities will ensure that no more favourable treatment is given to ships of non-Parties and apply the procedures specified in Annex 1. In the case of ships below convention size [less than 500 Gross Tons] the Authorities will apply the procedures in Annex 1.

The Paris MoU sets out an agreed upon an inspection mechanism to ensure that ships calling at the ports of members of the Memorandum are inspected, and if found to be non-compliant, forced to correct those faults. The MoU Secretariat is in The Hague, and the THETIS database resides at the European Maritime Safety Agency in Lisbon, Portugal.

When members of the Paris MoU inspect a ship calling at their ports or anchorages, they record the findings of the inspection and send them electronically to the database, thus making it available to all members of the MoU. An unscrupulous shipowner can no longer 'promise' to repair an identified deficiency, or deficiencies, at the next port, but not actually do the repairs, as the next port would already be aware of those deficiencies. Now the performance of the ship's flag and classification society was open to scrutiny by all members of the Paris MoU. It was a major advance in the fight against sub-standard ships.

The Paris MoU decided that for the inspection regime to have credibility with the marine community, Port State Control Officers (PSCOs) must have 12 months experience as a flag state inspector, and hold one of the following qualifications: Master Mariner (STCW II/2), First Class Motor Engineer (STCW III/2), or a degree in naval architecture and five years relevant industrial experience. When a PSCO inspects a ship, he/she will board the ship, present their identity document to the gangway guard, be escorted to the master, and ask to see the ship's statutory certificates. The dates, of issue, expiry, and annual endorsement by flag or class will be noted on the PSC Form A, for onward transmission to THETIS. The Maritime Labour Convention, 2006 documentation will be examined to check that wage rates are clearly stated, and that each crew member has a copy of his/her contract of employment. The officers' certificates of competency, and records of training will be checked. The crew's medical certificates will be examined for validity. The PSCO will examine the record of safety drills, the oil record book, and the garbage management plan.

The PSCO will tour the ship in order to ascertain the level of maintenance. It is customary to ask crew members to operate equipment, in order to ascertain their knowledge of their duties, and to verify that the equipment functions in a satisfactory manner. Should crew knowledge, or maintenance, be found inadequate, the PSCO's report will list the deficiency or deficiencies, on Form 'B', and a copy will be given to the master. The deficiency codes allow for a variety of remedies: 'fix at the next dry-docking', 'fix at next port', and 'fix within two weeks'. If the deficiency(s) is/are more serious, and constitute a danger to safety of life, or the marine environment, a 'fix before departure from this port' will be issued.

A serious deficiency, or a multiplicity of small deficiencies, gives evidence of an inadequate safety management system, and may lead to the ship being detained. This will have serious consequences, as the ship will no longer be able to maintain its schedule, and may lose its charter. Additionally, there will be serious consequences for the ship's insurance, and protection & indemnity coverage.

The International Maritime Organization (IMO), realizing that port state control was a valuable technique, passed Resolution A.682(17) (1991), "Regional co-operation in the control of ships and discharges," to create a framework on which regional PSC MoUs could be created. Subsequently eight other regional MoUs have been formed (Tokyo, Caribbean, South America, West and Southern Africa, Indian Ocean, Mediterranean, Black Sea, Persian Gulf). The United States operates its own PSC system, as does Iran. The various MoUs have annual meetings, and participate in exchanges of personnel and information. Because of frequent changes to regulations, personnel training is a major ongoing commitment, however all MoUs are constrained by budgetary concerns. The adoption of a future 'world MoU' has been postulated. Whilst this would be desirable, integrating MoUs that are separated by large distances and their databases would be a difficult and expensive task. The question of how such a body would relate to the IMO has yet to be defined. Nonetheless, the future will involve ever-closer liaison between the MoUs, the active participation of the MoUs in advising the IMO, and the standardization of training and inspection techniques.

Whilst the vast majority of shipowners endeavor to maintain high standards, there will always be a small minority of owners who, through ignorance or greed, try to cut corners, and a small minority of flag states, and classification societies who, through lack of knowledge, or for other reasons, fail to live up to regulated standards. For such organizations, port state control is a powerful adversary, and protector of the safety of life at sea, the marine environment, and goods in transit.

Annex 1: List of Relevant Instruments as of 1 July 2017

1. The International Convention on Load Lines, 1966
2. The Protocol of 1988 relating to the International Convention on Load Lines, 1966
3. The International Convention for the Safety of Life at Sea, 1974
4. The Protocol of 1978 to the International Convention for the Safety of Life at Sea
5. The Protocol of 1988 to the International Convention for the Safety of Life at Sea, 1974
6. The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, and as further amended by the Protocol of 1997
7. The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978
8. The Convention on the International Regulations for Preventing Collisions at Sea, 1972
9. The International Convention on the Tonnage Measurement of Ships, 1969
10. The Merchant Shipping (Minimum Standards) Convention, 1976
11. The Protocol of 1996 to the Merchant Shipping (Minimum Standards) Convention, 1976
12. The Maritime Labour Convention, 2006
13. The International Convention on Civil Liability for Oil Pollution Damage, 1969
14. The Protocol of 1992 to amend the International Convention on Civil Liability for Oil Pollution Damage, 1969
15. The International Convention on the Control of Harmful Anti-Fouling Systems on Ships, 2001

16. The International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001
17. The International Convention for the Control and Management of Ships' Ballast Water and Sediments[3]

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3 See "40th Amendment Paris MoU (English)—Effective 1 July 2017," Paris MoU, https://www.parismou.org/inspections-risk/library-faq/memorandum.

Seafarers' Human Rights: Compliance and Enforcement

*Peter B. Payoyo**
The Graduate Institute, Geneva, Switzerland

The governance of the world's seas and oceans requires new ways of thinking and new ways of doing things that are fundamentally different from the established modes of terrestrial governance that have been built on the traditional foundation of state freedom and sovereignty. This 'oceans perspective', initially given voice by Professor Elisabeth Mann Borgese beginning in the late 1960s on the eve of the Third United Nations Conference on the Law of the Sea, became the hallmark of her efflorescent advocacy. Both a vision and an evolving action-oriented programme, the oceans perspective was vigorously pressed by Elisabeth as only the gentle and caring 'Mother of the Oceans' that she was could have done.

The oceans perspective was a novel and altogether intriguing proposition, articulated at a time when the entire international community was about to embark on its most ambitious regime-building exercise on record, i.e., to revise and codify all international sea laws and establish a new order for the oceans. Could it really be that the new legal order of the oceans can be founded on principles, norms, and imperatives other than sovereignty? Is there a *ratio maris* above and beyond *mare liberum* and *mare clausum* circumscribing the scope of freedom or sovereignty of states to do as they please in, and to, the oceans?

The continuing relevance of the 'oceans perspective' is confirmed by recent developments relating to the protection of human rights at sea. An examination of the process and prospects of human rights regime-building in the ocean domain, specifically in the field of seafarers' rights, will at once reveal that it is possible and desirable to redefine or recalibrate the well-entrenched freedom of states to navigate the seas in order to achieve human rights objectives at the global level.

On both land and sea, the relationship between state sovereignty and human rights has always been a problematic one. In a setting where the rights of human beings have been recognized, catalogued and legalized, there remains the outstanding issue of what else must be done to realize those rights when

* Former Chairman, The International Committee on Seafarers' Welfare, London.

sovereign states, as the duty bearers to these rights, are unable or else unwilling to comply with their obligation to uphold these rights. Historically, the international supervision of states' compliance with human rights norms by the United Nations (in relation to the post-World War II human rights movement) or by the International Labour Organization (which preceded the UN, in relation to seafarers' rights) has leaned in favor of the sovereignty principle: there is not much that the international community can do if a state chooses not to ratify a human rights treaty, or otherwise decides to implement widely-agreed human rights norms only partially and on its own terms.

In the maritime context, the creation of an impressive treaty infrastructure governing seafarers' rights supervised by the ILO had taken place side-by-side with ongoing and widespread abuses committed against seafarers. Notwithstanding the 'International Seafarers' Code', a compendium of some seventy ILO conventions and recommendations on maritime labor developed over a period of more than 70 years, the oceans remained a poor home for human rights and human dignity. Throughout the twentieth century, the oceans were theatre to dehumanization and labor exploitation. The international shipping industry's race to the bottom in the (non-) observance of seafarers' rights was exacerbated further by the proliferation of flags of convenience or 'open registries'. Fierce and intensely protracted competition in this industry, coupled with low treaty ratification rates, and the haphazard and fragmented implementation of maritime labor standards globally, inexorably led to the marginalization of seafarers and their rights. The free-for-all situation in the observance and implementation of international maritime labor standards finds its ultimate justification in the principle of flag state sovereignty, which treats ships as extensions of national territory and gives primacy to national regulatory frameworks in the governance of social matters, including labor conditions on board.

Convinced that this system had become increasingly and intolerably dysfunctional for the industry as a whole, the shipowners' and the seafarers' group representatives at the ILO joined in an unprecedented call to rationalize the international regulatory infrastructure governing maritime labor. This was the historic 'Geneva Accord' of January 2001, an urgent plea for radical reform by the ILO Joint Maritime Commission, which demanded no less than an international regulatory response that would apply global standards to the entire industry. For the seafarers group, the time had come for an 'international bill of rights for seafarers'. On the part of shipowners, there was a pragmatic reason for the more assertive international regulation of maritime labour: in the absence of a level playing field on maritime labour standards, shipowners that drive labour costs and conditions down will continue to enjoy an unfair competitive advantage over quality operators. Fair competition in the industry can only happen with a drastic reworking of the global regime of maritime labour standards. Attracting unanimous support from governments at the ILO, the catalytic Geneva Accord paved the way for the negotiation and eventual adoption of the Maritime Labour Convention, 2006 (MLC, 2006).

The MLC, 2006 is a signal achievement of the ILO for several reasons. First, it neatly consolidates the numerous conventions and recommendations applicable to maritime labor and updates these in a single instrument following a novel format combining hard law and soft law elements. All aspects of seafarers' working and living conditions are covered under five subject titles (*viz.*, minimum requirements for seafarers to work on a ship; conditions of employment; accommodation, recreational facilities, food and catering; health protection, medical care, welfare and social security protection; and compliance and enforcement), each of which identifies in detail the rights and entitlements of seafarers. Secondly, the MLC, 2006 as a standard-setting instrument delivers not only an essential social justice objective but also, perhaps more crucially, a political-economy objective of securing fair competition in the international shipping industry. The MLC, 2006 is uniquely ambitious in the sense that it is a direct regulatory intervention in the business of international commercial navigation, directly impacting on the operation of global markets. Finally, the MLC, 2006 injects a heavy dose of verifiable flag state obligations in the realization of its objectives, putting to task the flag state in its role as the principal duty bearer in the MLC, 2006 regime of seafarers' rights. Such redefinition of flag state supremacy is most clearly seen in the Convention's pioneering approach to compliance.

The novel system of enforcement and compliance of MLC, 2006 stems above all from the consolidation of (almost) all ILO maritime labor standards into a single 'package deal' instrument, leaving little room for flag states to pick and choose the seafarers' rights or labor norms they wish to implement. While flag states are given a certain scope of flexibility in their implementation with MLC, 2006 standards, such as the allowance for them to adopt 'substantially equivalent' national provisions, the seafarers' rights enumerated in the mandatory parts of the Convention are not subject to selective flag state waiver. Consequently, any country that ratifies the MLC, 2006 must put in place the appropriate national infrastructure to ensure its compliance with the Convention as a whole, including setting up an effective system of inspection and certification, bearing mind that the MLC, 2006 encompasses the full spectrum of global labor standards across 68 ILO instruments that have been consolidated. At the international level, the consolidation of standards in the MLC, 2006 also reinvigorates the supervisory role of the ILO, raising the profile of flag state accountability in the organization's 'decent work' agenda in very substantial ways. One new mechanism for this is the Special Tripartite Committee created by the ILO Governing Body, which keeps under continuous review the workings of the MLC, 2006. Another notable enhancement is the prescription of more rigorous and detailed periodic reports for submission to the ILO not only by flag states but also by port states, such reports providing information about methods used to assess the effectiveness of national systems of inspection.

The most innovative and perhaps most far-reaching feature of the MLC, 2006 to address the issue of flag state accountability regarding seafarers' rights is without doubt the wholesale recruitment of port state control (PSC) in the Convention's framework of enforcement and compliance. Since the 1980s, regionally-coordinated assertions of port state jurisdiction have been key in compelling ship operators and flag states to comply with a host of IMO technical standards covering maritime safety, environmental protection, and onboard working and living conditions/'human element' concerns. Today, PSC has become an inseparable feature of the regulatory landscape for international navigation and shipborne trade. Review of certificates, detailed ship inspections, 'no more favorable treatment' controls, correction of deficiencies on-the-spot, and sanctions, such as ship detention, naming and shaming underperforming ships, and banning, are some of the salient procedures deployed by port states to encourage and enforce compliance. The decades-long experience of PSC in addressing the central issue of sub-standard shipping have yielded sophisticated techniques and methodologies in enforcement and compliance, e.g., differentiation of inspection types, development and deployment of computer information systems, calculation of 'ship risk profiles' and 'company performance', consideration of objectively-determined 'overriding' or 'unexpected' factors justifying inspections, reporting obligations of ships, and the methodical use of white-grey-black lists to track performance of flag states and recognized organizations.

With the entry into force of the MLC, 2006 in August 2013, PSC authorities have as a matter of course incorporated its standards into their ship inspection protocols such that MLC, 2006 compliance by shipping companies and by flag states are now routinely tested and verified against a standardized checklist of PSC deficiencies. From all indications, it appears that PSC is making much headway in the monitoring, enforcement and compliance of MLC, 2006 standards. Notably, authorities in the Paris MoU PSC region carried out a three-months long 'Concentrated Inspection Campaign on the MLC' in 2016; the campaign involved a total of 3,674 inspections and resulted in 42 ship detentions, or a satisfactory rate of 1.1%, which were directly linked to non-compliance with

MLC, 2006 requirements.[1] These bare figures reveal that port state control is complementing flag state implementation remarkably well and that flag states across the board are taking their obligations under the MLC, 2006 quite seriously. On the whole, seafarers' human rights under the MLC, 2006 are being upheld and respected.

The MLC, 2006 therefore repays attention as an endeavor and as an experiment in realizing human rights at the global level. Once again, as Elisabeth observed, the oceans are a great laboratory of ideas and initiatives on global governance. On this score the MLC offers an interesting 'oceans perspective' to international regime building that may prove valuable and instructive to the mainstream international human rights movement. This movement, under the auspices of the United Nations, continues to grapple with the sovereignty conundrum, or the basic problem of effectively implementing universally agreed human rights norms in a decentralized world order of autonomous sovereign states.

The contrasting approaches to the realization human rights at sea and on land cannot be more telling. In 2006, the very same year the MLC was adopted, the UN General Assembly established the UN Human Rights Council, a turning point in UN history, marking the culmination of decades-long efforts to cement the greater involvement of international institutions in the effective realization of human rights worldwide. Without one referring to the other, the MLC, 2006 and the UNHRC are two human rights regimes born at the same historical juncture, one applicable to seafarers and the other applicable to all citizens, both enmeshed in the grand narrative of globalization. Both regimes demonstrate the warrant of direct international intervention in the sovereign affairs of states, challenging the principle of sovereignty as the bedrock of human rights protection. Both aspire for accountability and universality, but follow disparate implementation trajectories and governance techniques. Ten years on after their adoption, a complex picture of compliance and enforcement of human rights standards have emerged, providing contrasting approaches to legitimacy and effectiveness under each of these regimes.[2]

1 Paris MOU on Port State Control, "Results of CIC on MLC, 2006 in 2016," 28 July 2017, https://www.parismou.org/results-cic-mlc2006-2016.

2 *Cf.* UN Human Right Council's approach, see "Organigramme of the Human Rights Council," http://www.ohchr.org/EN/HRBodies/HRC/Pages/AboutCouncil.aspx, last accessed 26 November 2017 *vis-à-vis* the PSC approach using binomial calculus, e.g., Tokyo MOU Secretariat, "Explanatory Note on the Black–Grey–White Lists," *Annual Report on Port State Control in the Asia-Pacific Region 2016* (Tokyo: Tokyo MOU Secretariat), 55, http://www.tokyo-mou.org/doc/ANN16.pdf.

Maritime Emergency Preparedness and Management

John Dalziel and Ronald Pelot
Department of Industrial Engineering, Dalhousie University,
Halifax, Nova Scotia, Canada

> a large body of men … in constant readiness to risk their own lives for the preservation of those whom they have never known or seen, perhaps of another nation, merely because they are fellow creatures in extreme peril.[1]

Since time immemorial humans have had beneficial interactions with the sea—for food, transport, and pleasure. However, these interactions have not always been without cost—the risk of death has always been present. In the maritime fraternity, we tend to think of this risk in terms of ship incidents: capsizing, foundering, grounding, collision, fire, man-overboard. Over the past century improvements in technology, safety standards, enforcement of regulations, and education have reduced these risks for commercial vessels, and concurrently tremendous improvements have been made in rescue response. This article will focus on the improvements, past, present and future, in rescue response to maritime incidents.

In the 1820s there were about 1,800 shipwrecks each year around the British Isles alone. Amongst maritime folk the risks of going to sea were understood; significant loss of life was expected. Often in sight of a coastal community, a sailing ship would be blown aground, the crew would take to the rigging to try to survive, townsfolk would see the plight of the hapless sailors and often would put to sea, in whatever craft they may have at hand, at significant risk to their own lives. These occurrences eventually led to the first purpose-designed lifeboat, the *Original*, built on the northeast coast of England in 1789.

1 Quote of Sir William Hillary, founder of the Royal National Lifeboat Institution (RNLI), 1823, in "1824: Our foundation," RNLI, https://rnli.org/about-us/our-history/timeline/1824-our-foundation, last accessed 13 September 2017.

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Similar tragedies led Sir William Hillary to call, three decades later, for the establishment of a national organization to perform rescue around the coasts of the British Isles. The Royal National Lifeboat Institution (RNLI) was followed during the nineteenth century by similar organizations in many other countries, many private charities like the RNLI and some government funded organizations.

In the nineteenth century, lifeboats were propelled by sail and oar (with a few experimental steam-powered craft built in the latter years of the century). Shore-based apparatus, such as the 'breeches buoy' were developed and stationed with rescue crews. In some remote locations emergency huts, with supplies, were provided by the authorities for the shelter of shipwreck survivors who made it to shore. During this period the rescue of seafarers generally depended on visual contact with their rescuers. If a ship was grounded near a harbor, flares could be used to signal distress, but rescue depended on these flares being seen from shore. If the ship was in distress on the high seas, or near a remote shore, the odds of rescue were much smaller, and many ships were simply posted as 'Missing at Sea with All Hands'.

In the early years of the twentieth century, things started to improve dramatically. Some experimental internal combustion engine powered lifeboats were built. In the period between the World Wars, most rescue lifeboats were fitted with engines, taking over from sail and oar, but speeds remained slow (approximately 8 knots, about 15 km per hour). Radio was used in the rescue of passengers and crew from the RMS *Republic* in 1909; more famously three years later it played a significant role in saving lives from the *Titanic*. After the *Titanic* disaster, the International Convention for the Safety of Life at Sea (SOLAS) was introduced, improving both ship safety and rescue response.[2]

Dramatic strides have been made in safety technologies since the Second World War. The Global Maritime Distress and Safety System (GMDSS) and emergency position indicating radio beacons (EPIRBs) allow the rapid alerting of shore-based rescue resources and other ships in the event of an emergency. Dedicated rescue resources have improved dramatically. The modern rescue lifeboats, and larger sea rescue cruisers, have speeds up to 25 knots, extended range, modern electronics for searching, navigation and communication, excellent sea-keeping for operation in heavy weather, and can operate in conjunction with other rescue resources. Aircraft can fly in extreme weather

2 International Maritime Organization (IMO), "International Convention for the Safety of Life at Sea (SOLAS), 1974," IMO, http://www.imo.org/en/About/conventions/listofconventions/pages/international-convention-for-the-safety-of-life-at-sea-(solas),-1974.aspx, last accessed 13 September 2017.

conditions, travel great distances to provide oversight, and possibly drop life-rafts. Helicopters can provide rescue over reasonable distances (potentially being refueled in flight), and in areas where it may be risky to attempt a rescue by ship, such as near shore. Search and rescue (SAR) technicians, an elite group of primary care paramedics, can provide on-scene medical aid and evacuation: they can parachute from aircraft or be lowered from helicopters to assist survivors until recovery is possible.

The regulatory regime affecting maritime safety and emergency response also continues to improve. The International Maritime Organization (IMO) has continually updated SOLAS. In addition to improving ship safety, requirements mandate ships to render assistance to persons in distress when safely feasible to do so. The International Convention on Maritime Search and Rescue (the SAR Convention[3]), which entered into force in 1985, developed an international SAR plan, such that the rescue of persons in distress anywhere at sea will be co-ordinated by a SAR organization and, when necessary, by co-operation between neighboring SAR organizations. Concurrently with the revision of the SAR Convention, IMO and the International Civil Aviation Organization jointly developed and published the *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual*, with three volumes covering organization and management, mission co-ordination, and mobile facilities.

The International Maritime Rescue Federation (IMRF) represents over 100 of the world's SAR organizations—some private charities, others government organizations.[4] The IMRF is focused on the prevention of loss of life in the world's waters. To achieve this mission, it works with its members, local governments, IMO and others to encourage and promote the formation and development of maritime search and rescue services throughout the world.

Despite these advances, new maritime risks are emerging. In the developed countries, pleasure craft have increased the demand on SAR management and rescue resources. For instance, in Britain only about 10 percent of the RNLI's sorties involve commercial vessels.[5] Some offshore races have required complex rescue responses. For example, the 1979 Fastnet Race (England to Ireland) resulted in the loss of 15 lives and five yachts; numerous vessels and aircraft

3 IMO, "International Convention on Maritime Search and Rescue (SAR)," IMO, http://www.imo.org/en/About/conventions/listofconventions/pages/international-convention-on-maritime-search-and-rescue-(sar).aspx, last accessed 13 September 2017.

4 "International Maritime Rescue Federation: An Overview," International Maritime Rescue Federation (IMRF), http://www.international-maritime-rescue.org/about-us, last accessed 13 September 2017.

5 RNLI, "Annual Report and Accounts: Operational Statistics," RNLI, https://rnli.org/about-us/how-the-rnli-is-run/annual-report-and-accounts, last accessed 13 September 2017.

were involved in the rescue efforts and a significant load was placed on the rescue co-ordination resources.[6]

Terrible commercial shipping disasters have continued over the past decades. The world's worst peacetime sea disaster took place in December 1987; the Philippine passenger vessel *Dona Paz* sank after colliding with a small tanker carrying gasoline.[7] Only 26 people survived from the two vessels, while over 4,300 died. When the Senegalese ferry *Le Joola* capsized in heavy weather in 2002, nearly 2,000 died. The Worldwide Ferry Safety Association lists over 160 ferry incidents in the developing world during the first fourteen years of this millennium, resulting in 18,000 deaths. In general, there were common emergency response shortcomings in these tragedies, namely, lack of, or late, notification of the emergency, poor shipboard emergency planning and management, and lack of rescue response due to lack of resources and/or lack of rescue organization.[8]

Modern ferries have introduced another dimension to rescue requirements—large vessels, with significant numbers of persons onboard, which may rapidly require assistance due to fire or capsize. This is called a 'mass rescue operation' (MRO), where the size of the rescue overwhelms the resources available. In 1994 the 15,000 ton ferry *Estonia* sank in a storm in the Baltic Sea; out of nearly 1,000 persons onboard only 138 survived.[9] The ship rapidly capsized and then sank half an hour after the first distress message was broadcast. Although numerous vessels were at hand, it was difficult for them to rescue survivors from the liferafts in the water; about 40 were rescued by ship, the remainder by helicopter (often working in conjunction with ships). As a result of the *Estonia* disaster, the IMRF held a series of exercises to help rescue organizations plan for national and international MROs; IMO updated SOLAS requirements so that ships have plans and procedures to recover persons from the water.

In addition to passenger-carrying vessels, fishing vessels and commercial ships continue to suffer losses, some disappearing without notification thus

6 J. Rousmaniere, *Fastnet Force 10: The Deadliest Storm in the History of Modern Sailing* (New York: WW Norton, 2000).

7 "Flashback in history: Philippine ferry MV Dona Paz collision, sinking and death toll of 4,386 people—December 20, 1987," Maritime Cyprus (3 January 2016), https://maritimecyprus.com/2016/01/03/flashback-in-history-philippine-ferry-mv-dona-paz-collision-sinking-and-death-toll-of-4386-people-december-20-1987/, last accessed 13 September 2017.

8 J. Dalziel et al., "Domestic Ferry Safety in the Developing World," presentation to World Maritime Rescue Congress, Bremerhaven, Germany, 2 June 2015.

9 Joint Accident Investigation Commission of Estonia, Finland and Sweden, "7: The Rescue Operation," *Final Report on the MV ESTONIA disaster of 28 September 1994* (Estonia, December 1997), http://onse.fi/estonia/, last accessed 13 September 2017.

hampering rescue efforts. When the 260,000-ton Korean bulk carrier *Stellar Daisy* sank in the South Atlantic in early 2017, the two survivors were picked up by fortuitous circumstance; a fruitless air and sea search continued for weeks for the other crew over thousands of nautical miles.[10]

Not all rescues end in failure, as management capability and resources can alter the outcome. In 1980 the Dutch cruise ship *Prinsendam* caught fire 120 nautical miles off the coast of Alaska. The US Coast Guard quickly mobilized and co-ordinated American and Canadian air and sea rescue resources, as well as commercial ships; all 520 passengers and crew were rescued without loss of life or serious injury.[11]

In coming years, many emergency response improvements will be an evolution of initiatives already in place. The IMRF and IMO, along with other agencies, are working to improve international co-operation. This is particularly important in areas such as the Arctic and Antarctic where the following can impact SAR response: large distances, harsh weather conditions, few local rescue resources, restricted SAR response management capability, limited facilities to receive (potentially thousands of) survivors, and increasing marine vessel traffic due to climate change. Ferry safety, and the associated lack of rescue response, in the developing world is recognized as an ongoing concern. The IMRF and IMO are promoting the development of regional emergency response capabilities.

New technologies may also bring about significant improvements, both for the persons being rescued, and for the rescuers. The IMRF Future Technology Panel is investigating the use of unmanned aerial vehicles (UAVs) to assist in maritime search and rescue, particularly in situations where direct human intervention may not be wise or possible. The application of unmanned marine vehicles (UMVs) to maritime SAR is still in its infancy, however it is easy to envisage their future application, ranging from small craft dropped from aircraft and remotely piloted, to stand-alone craft prepositioned in remote locations. Numerous hurdles remain; acceptance and understanding of the strengths and limitations of these technologies is needed (for instance, can a robotic vessel rescue someone who is incapacitated?). Other technologies, such as infrared cameras and improved satellite surveillance may assist with the search function.

10 "Update: Search Continues for Missing Stellar Daisy's Crew," *World Maritime News* (10 April 2017), http://worldmaritimenews.com/archives/217281/update-search-continues-for-missing-stellar-daisys-crew/, last accessed 13 September 2017.

11 United States Coast Guard, "Top Ten Coast Guard Rescues," *OnScene*, COMDTPUB P16100.4 (Summer 2007): 39.

Emergency preparedness and management requires an ongoing investment in training and resources. Simulated and live exercises develop skills and identify potential problems, and solidify working relationships with partners. This is particularly significant for mass rescue operations, which may overwhelm the resources normally available, and emphasizes the importance of management communication and co-ordination capabilities. Education, particularly for recreational boaters, is important. The usefulness of new technologies needs to be investigated on an ongoing basis.

Finally, and perhaps most importantly, are the competent and capable personnel who have the courage and dedication to be willing to assist their fellow human beings:

> The loss of the Solomon Browne was in consequence of the persistent and heroic endeavours by the coxswain and his crew to save the lives of all from the Union Star. Such heroism enhances the highest traditions of the Royal National Lifeboat Institution in whose service they gave their lives.[12]

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12 Quote concerning the loss of the Penlee lifeboat Solomon Browne with eight crew, 19 December 1981, in "The Penlee Lifeboat Disaster," RNLI-Penlee Lifeboat Station, http://www.rnli-penleelifeboat.org.uk/About%20us/PenleeDisaster, last accessed 13 September 2017.

The Pacing of Progress as the Secret to Success for the International Ballast Water Management Regime

Adnan Awad
International Ocean Institute-Southern Africa, Cape Town, South Africa

The human-facilitated transfer of marine organisms between coastal ecosystems has become one of the more concerning issues hindering our hopes of "living with the ocean and from the ocean in a sustainable relationship."[1] Invasive species are impacting marine and freshwater ecosystems, especially areas already stressed by anthropogenic disturbance, causing irreversible changes, often with significant ecological, economic, and social impacts. Hundreds of marine species have migrated between oceans and seas following the opening of major canals around the world; furthermore, numerous species have been introduced, either intentionally or unintentionally, from fisheries, aquaculture practices and the aquarium trade. However, international shipping has come into focus as the primary vector responsible for most of the recorded marine species invasions. Commercial ships can be effective at transferring living organisms across large distances, through two equally significant mechanisms: as plankton carried in ballast water (water taken on board to stabilize the vessel at sea, an essential process for the safety of modern vessels), and as biofouling, or the species attached to the immersed parts of the vessel. Each of these vectors presents an interesting set of management challenges; however, the fact that ballast water is taken into and contained within the vessel made it the 'low-hanging fruit' that has been tackled first in response to heightened international awareness of threats from marine invasive species.

On 8 September 2017, the International Maritime Organization (IMO) International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) came into force without much fanfare, and with a long list of proposed amendments awaiting submittal and consideration. After three decades of dedicated activity by technical experts from many concerned member state delegations, this much-anticipated milestone signaled a turning of the tide in the broader context of effective

1 The working definition of the 'blue economy' coined by Dr. Awni Behnam in his book *Tracing the Blue Economy*, Lumen Monograph Series, Vol. 1 (Valletta, Malta: Fondation de Malte, 2013).

DOI:10.1163/9789004380271_083

maritime biosecurity. It is likely to be one of the more effective UN conventions at the time of its entry into force, due to the cross-sectoral nature of the issue at hand and the stimulating effect its lengthy development process has had in forging a meaningful partnership-based foundation for its implementation. Twenty-five years earlier, however, when member states agreed at the 1992 UN Conference on Environment and Development in Rio de Janeiro to work through the IMO to consider "the adoption of appropriate rules on ballast water discharge to prevent the spread of non-indigenous organisms,"[2] few could have imagined how complex the road ahead would become and how catalytic an issue this would prove to be.

The IMO had already begun work to address ballast water concerns through its Marine Environment Protection Committee (MEPC), which had adopted voluntary guidelines to reduce species transfer by ships' ballast water in 1991, an effort that unfortunately lacked buy-in and subsequent adoption by the industry and member states. In response to the Rio Conference, the MEPC Guidelines were quickly upgraded to an IMO Assembly Resolution in 1993, which were further strengthened in 1997. The effective management measure recommended in the guidelines was the use of open ocean exchange of the ballast water, on the premise that mid-ocean water presented less risk to coastal areas, in terms of species composition. Despite ongoing resistance to increased regulation of ballast water, the practice of open ocean exchange was trialed by some countries, but ultimately proved less than ideal. It soon became clear that a mandatory international instrument would be necessary to achieve the desired penetration of regulatory measures through both flag and port state control processes. Furthermore, it was evident that such a regulatory regime must target ship-board treatment of the ballast water, to the extent that organisms are removed or deactivated to below densities that could result in viable species introductions.

In 2000, the IMO partnered with the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) to launch the GloBallast Programme, designed to support developing countries in preparing for an international ballast water management convention. Countries such as Australia and the United States, where national concerns regarding species invasions had already prompted significant research and experimental regulations, were quick to collaborate and contribute lessons learned through the growing nexus of ballast water related activity at the IMO. Regional approaches

2 "United Nations Sustainable Development, Agenda 21," Division for Sustainable Development, Department of Economic and Social Affairs, United Nations, https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf, last accessed 7 October 2017.

and challenges in areas such as the Baltic and Mediterranean Seas emerged as countries generated momentum and support behind the drive to solve the conundrum of realizing viable, effective systems of ballast water management that could be standardized for implementation across the shipping industry. In 2004, the BWM Convention was adopted through a diplomatic conference of member states,[3] the same year that the GloBallast Programme came to an end. The BWM Convention had set a timeline for the phasing out of open ocean exchange, regarded as an interim measure, and established a set of standards for water quality to apply to discharged ballast water. The treatment standards represented a level of organism removal or deactivation that could not be achieved by available technologies at the time, as applied in ship-board environments (e.g., pumping rates exceeding 3,000 m^3/hr). Setting such a high bar through an international instrument effectively created a new market, presumably attainable, and a research and development race to meet it.

On the back of the momentum surrounding the adoption of the BWM Convention, the GEF announced it would be reinvesting in the established and successful partnership with UNDP and IMO, and that a second phase of the GloBallast Programme would be supported globally to focus specifically on the development of strategic partnerships at national, regional and international levels. This simple development would prove to be the gel that connected and catalyzed functional partnerships, associations and collaborations between industry and management sectors, and more significantly continued to strategically advance the development of technical capacity, particularly in developing regions, to prepare for on-the-ground implementation. As new ballast water treatment technologies emerged and were approved (the IMO established a comprehensive set of testing guidelines and a process for approval vetted by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection), institutional capacities were strengthened throughout the northern and southern hemispheres to accommodate the demand for quality and compliance testing. The 16 guidelines developed by the IMO to assist member states with implementation of the Convention,[3] were put into practice, tested and validated through the involvement and commitment of administrations around the world.

In the face of the mounting groundswell of support and progress towards a binding international ballast water management regime, the resistance from industry and heavyweight flags of convenience had to be channeled through

3 "BWM Convention and Guidelines," International Maritime Organization (IMO), http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/BWMConventionandGuidelines.aspx, last accessed 14 October 2017.

the last remaining weapon at their disposal: to delay the process of national ratifications necessary to bring the Convention into force (the BWM Convention required ratification by at least 30 member states representing at least 35 percent of registered global shipping tonnage). This manifested through the undermining of the confidence in the shipboard treatment technologies available, their applicability in real-world scenarios, and the vetting and certification processes in place for quality assurance. Potentially pivotal flag states cited uncertainties regarding the diversity of technological options for ships, a general lack of available facilities for fitting and servicing new technologies on existing vessels, and a sense of immaturity about the relevant testing procedures and international facilities involved, to justify their reluctance to move ahead with domestication of the provisions of the BWM Convention. Nonetheless, many coastal and island nations, especially those where robust ocean-based or 'Blue Economy' strategies were being pursued, had already recognized the risks to their national interests stemming from marine invasions and forged ahead to integrate ballast water management into domestic biosecurity, maritime and environmental management frameworks.

By the time the ratification threshold of 35 percent of global tonnage was met, 52 countries had ratified or acceded to the Convention, as was necessary given that not all of the big flag states had plans to act on ballast water until such time as it was commercially more favorable to be a contracting party. It was indeed telling that, immediately following the deposition at the IMO of the instrument of ratification by Finland on 8 September 2016, the action which satisfied the entry into force conditions (to be effective 12 months after that date), the government of Panama, the largest flag state in the ship registry, announced that it would be next to ratify the Convention. Four other heavyweights followed suit within the subsequent year. Now it was all happening. Convinced or not, the shipping world would be coming on board with the understanding that a standardized set of regulations would be progressively and uniformly enforced.

Of course, once in force the BWM Convention is susceptible to the proposed amendments that shall be considered at the IMO. It is, however, unlikely that any severe changes will be made in the short term, due to the extensive capacity in place for its implementation in its current form. There is a broad sense of calm readiness as administrations go about their day-to-day routines with ballast water management procedures now integrated into long lists of mandatory actions on the plates of port and flag state control authorities. Awareness of the issue at political and practical management levels has long been established, and ongoing training has evolved to focus on more detailed and practical aspects of operations and service delivery. Guidelines and tools to support policy development and technical measures have not only been applied, but have had adequate time to be tested, customized and strengthened. In many cases, co-operation agreements between states and within governments have established roles and responsibilities, facilitating ongoing collaboration from scientific, technological, environmental and maritime sectors. At the business end, commercial arrangements and supply chain developments are being put in place to ensure the provision, installation and servicing of ballast water treatment technologies to accommodate every type of commercial vessel, with over 60 type-approved technologies available on the market.

As much as global investments in ballast water management are contributing to the ever-expanding interests in ocean-based economic opportunities, concerns are growing that vulnerabilities and risks associated with marine species invasions may manifest in ways that significantly limit potential for further blue growth. Within this context, the seeds for more forward-looking and robust maritime biosecurity regimes are being sown. As such, attention is pivoting to less regulated pathways of species transfer, including the biofouling on ships, recreational crafts and all manner of ocean-going platforms. The IMO has already adopted guidelines for the control and management of ships' biofouling,[4] and the GEF-UNDP-IMO partnership has recently followed on to announce the approval of the imminent GloFouling project. Of course, ship and vessel operators of all kinds are inherently incentivized to prevent or limit marine growth on hulls and submerged areas, given that biofouling significantly decreases vessel efficiency and speed through water due to increased friction and blockages. Promising developments in hull coatings, in-water cleaning technologies, and ship design are already emerging as an indication that this management sector may advance expeditiously. However, experience from the ballast water case suggests that a mandatory international instrument will be required for universal application and assimilation of best management practices. It is seemingly likely that the foundation laid over decades of ballast water management preparations will have broad overlap with the biofouling issue, and therefore significantly expedite its further evolution and adoption.

4 "Biofouling," IMO, http://www.imo.org/en/OurWork/Environment/Biofouling/Pages/default.aspx, last accessed 14 October 2017.

Arctic Shipping: Future Prospects and Ocean Governance

*Jackie Dawson**
University of Ottawa, Ottawa, Ontario, Canada

The Last Frontier

The Arctic, despite centuries of speculation, remains one of the world's last potential shipping frontiers. The maritime potential of the region is alluring as it offers a number of shorter, and potentially more prosperous, trade routes between Europe and Asia. Proving the viability of these routes, however, has not been straightforward; rather it has been the story of few triumphs among many disasters, the most famous of which is the ill-fated Franklin expedition of 1845. The shipwrecks, grave sites, and human remains that now paint the Arctic landscape and ocean floor are proof of the region's natural prowess and strong will to remain pristine and unconquered by human pursuits of globalization.

Thick multi-year ice and a harsh and unpredictable climate have been the major factors limiting development, however this is now changing. Because of natural and human-induced climate change, the Arctic is warming at twice the rate of the global average and with this warming has come a positive feedback loop of melting sea ice—additional black space among a traditionally white landscape—causing enhanced absorption of solar radiation and subsequent warming with continued ice retreat. The open water season has increased by more than five days per decade in the Northwest Passage and by up to 19 days per decade in other regions of the Arctic.[1] Being that thick and unpredictable sea ice has historically been the dagger that slayed even the most decorated of Arctic explorers, and the strongest of ships, its retreat would seem to facilitate the long awaited opening of the region for global maritime trade and transport—the shifting of global trade patterns and with that the potential for altered global power dynamics.

* Written on Adventure Canada's *Ocean Endeavour* while transiting the Northwest Passage.

1 J.C. Stroeve et al., "Changes in Arctic Melt Season and Implications for Sea Ice Loss," *Geophysical Research Letters* 41, no. 4 (2014): 1216–1225, doi.org/10.1002/2013GL058951.

Shipping in a Changing Arctic

The link between climate change and Arctic shipping has captured popular imagination, prompting hundreds of media articles and now dozens of high profile studies in journals such as *Nature Climate Change* and *Geophysical Research Letters*. Most speculate a rapid and potentially momentous increase in Arctic shipping activity related to climate warming by the end of the twenty-first century, but the relationship between ice and ships is long-standing and complicated. Less ice could mean more opportunities, but it could also mean increased risk. Thick multiyear sea ice of the Arctic Ocean that used to be intact is now melting, calving apart, traveling south and choking up fundamental shipping routes, particularly in the Northwest Passage.

Just because travel routes through the Arctic may become more physically viable does not mean we will see an immediate or even future shift toward Arctic routes over existing southern routes, where infrastructure, tradition, and global dependence has already been established. Despite much speculation, commercial container shipping in the Arctic is still not a commercial reality, in large part because shorter distances do not always equate to quicker shipping times. In an industry where timeliness and reliability are a necessity, it is unlikely that Arctic routes, which remain plagued with uncertainty due to unpredictable ice and weather conditions as well as freezing spray that can cause delays, will emerge as a preferred route in the near-term future.[2] There are also countless other factors influencing commercial ship operations such as commodity prices, insurance structures, infrastructure needs, ship design, technology development, and regulatory regimes that will continue to limit future maritime trade in the region. In fact, until we can control the weather, the price of natural resources, and maybe even the stock market, it is improbable that climate change will itself catalyze Arctic maritime trade and commercial shipping in Arctic Canada to the extent that is often speculated.

There is, however, a class of vessels that has already increased in intensity as a direct result of changing Arctic conditions. Tourism ships, including passenger vessels (cruise ships) and pleasure craft (yachts), have increased by 75 and 400 percent respectively in Arctic Canada since 2005. Svalbard, Norway, and Greenland now attract between 20,000 and 50,000 cruise visitors annually and additional growth, especially among private yachters is anticipated.

2 Transportation Research Board of the National Academies, *Safe Navigation in the U.S. Arctic: Summary of a Workshop, October 15–16, 2012, Seattle, Washington*, Conference Proceedings on the Web 11 (Washington, DC: Transportation Research Board, 2013), http://onlinepubs.trb.org/onlinepubs/conf/CPW11.pdf.

These vessels can more easily adapt to changing conditions by altering itineraries and planned shore excursions, and in fact they often seek out versus avoid icebergs and ice flows to view ice dependent wildlife and stunning Arctic scenery. Compounding these growth factors is a new niche tourism market that has been labelled 'last chance tourism', which is a phenomena whereby tourists are visiting the Arctic with increased intensity to explicitly see the region before it disappears, melts or becomes irreversibly changed.[3]

From Ship to Shore: Regional Risks and Opportunities

In large part due to the rapid increase in cruise tourism traffic, but also because of increases in fishing ships, community re-supply vessels, and government and research activities, total ship traffic by kilometers traveled in the Canadian Arctic has almost tripled over the last 25 years. Most of the increase has occurred in the Northwest Passage, Hudson Strait, and along the eastern coast of Baffin Island (see Figure 1).[4] These trends reflect growth patterns in Arctic shipping activity that is occurring globally. For example, traffic through Russia's Northern Sea Route increased by 33 percent in 2016; non-Arctic nations such as China and South Korea are building and operating ice breakers for research and trade exploration; cruise operators are for the first time investing in and constructing purpose built ice-strengthened luxury cruise liners; and advances in technology could mean autonomous (crewless) vessels traversing Arctic sea routes within the next 30 years. Through expected technological change, political will, and under the right economic conditions we will see commercial traffic opportunities across the Arctic, and in particular through the Northwest Passage of the Canadian Arctic.

All of Canada is highly reliant upon maritime trade and transport, an industry that was valued at CA$205 billion in 2015,[5] but it is the Arctic that is perhaps the most dependent since it consists of large island chains and remote continental shoreline that in many areas is only accessible by sea or by air.

3 R.H. Lemelin, J. Dawson and E.J. Stewart, eds., *Last Chance Tourism: Adapting Tourism Opportunities in a Changing World* (London: Routledge, 2013).

4 L. Pizzolato, et al., "The Influence of Declining Sea Ice on Shipping Activity in the Canadian Arctic," *Geophysical Research Letters* 43, no. 23 (2016): 12,146–12,1541, doi.org/10.1002/2016GL071489; J. Dawson, et al., "Temporal and Spatial Patterns of Ship Traffic in the Canadian Arctic from 1990 to 2015," *Arctic* (In press).

5 Council of Canadian Academies (CCA), *The Value of Commercial Marine Shipping to Canada: The Expert Panel on the Social and Economic Value of Marine Shipping to Canada* (Ottawa: CCA, 2017), xiii.

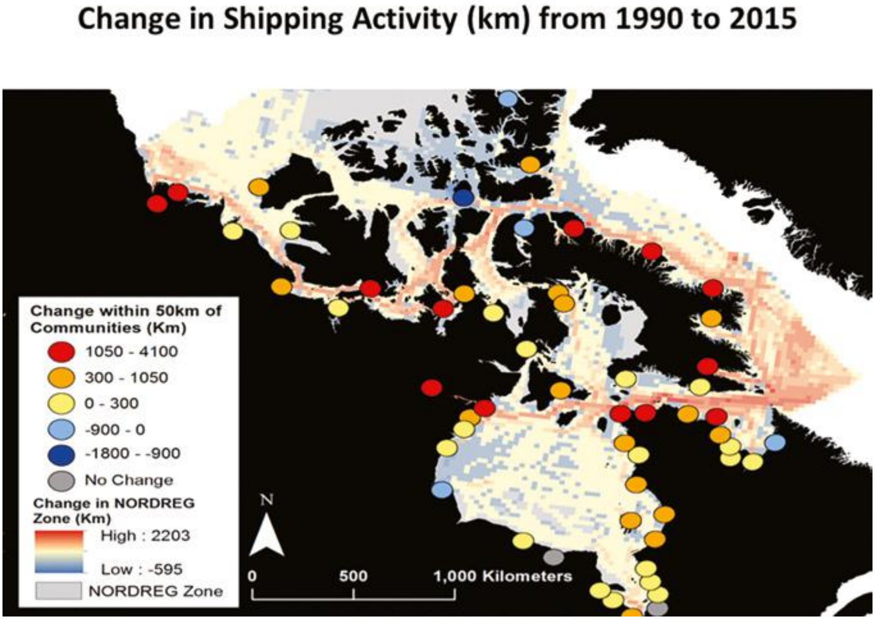


FIGURE 1 Shipping activity trends in Arctic Canada from 1990 to 2015.
SOURCE: DAWSON ET AL., *SUPRA* NOTE 4.

Increased shipping opportunities in Arctic Canada could be highly advantageous given the potential for enhanced economic development in mining, tourism, and fisheries, and for re-supply services. However, there are significant risks, including the potential for vessel incidents, safety issues and security threats, environmental disturbances, degradation of historic or culturally significant sites, and negative outcomes for local residents, especially Inuit, who continue to use the marine environment for subsistence and livelihoods. Compounding these risks are a lack of maritime infrastructure or salvage capabilities, insufficient availability of bathymetric charts, and limited search and rescue capacity.

Collaborative Governance for a Sustainable Future

Global effort is needed to establish effective governance regimes for safe and sustainable Arctic shipping that involves infrastructure investment and enhances economic and sovereignty-related opportunities while mitigating impacts related to safety, security of the environment, and protection of local culture. What makes the potential development of effective and innovative Arctic shipping governance so promising right now is the pace at which Arctic maritime trade is currently evolving and the urgency with which society has treated this challenge. Thus far, we have been afforded time and political attention in order to work together as a global community towards shared initiatives and approaches to Arctic shipping governance.

For example, in response to the 2004 Arctic Climate Impact Assessment,[6] the Arctic Marine Shipping Assessment (AMSA),[7] for the first time attempted to comprehensively examine global shipping tends across Arctic regions and to identify governance needs for the changing patterns in Arctic transportation trends. Many of the AMSA recommendations have already come to fruition including the establishment of joint search and rescue and oil spill response and preparedness agreements,[8] envisioning of an integrated Arctic shipping corridors framework for marine traffic support and management,[9] and importantly, the development and implementation of the Polar Code.[10]

The Polar Code is a mandatory international regime adopted by the International Maritime Organization (IMO) that sets out regulations for shipping in polar regions, principally relating to ice navigation and ship design. The Code, established to support safe and environmentally friendly shipping in Arctic and Antarctic waters, goes beyond existing IMO conventions (MARPOL, SOLAS, STCW)[11] and can be utilized to create a certain level of regulatory consistency among Arctic nations that complements, and in some cases extends, national level regulation. Implementation of the Polar Code is a major milestone and

6 Arctic Council, *Impacts of a Warming Arctic: Arctic Climate Impact Assessment, ACIA Overview Report* (Cambridge: Cambridge University Press, 2004).

7 Arctic Council, *Arctic Marine Shipping Assessment 2009 Report* (Arctic Council, April 2009).

8 "Agreements," Arctic Council, last updated 25 May 2017, http://www.arctic-council.org/index.php/en/our-work/agreements.

9 See R. Chéniér et al., "Northern Marine Transportation Corridors: Creation and Analysis of Northern Marine Traffic Routes in Canadian Waters," *Transactions in GIS* (2017): 1–13, doi.org/10.1111/tgis.12295; The PEW Charitable Trusts, *The Integrated Arctic Corridors Framework: Planning for Responsible Shipping in Canada's Arctic Waters* (April 2016), http://www.pewtrusts.org/~/media/assets/2016/04/the-integrated-arctic-corridors-framework.pdf, accessed 21 November 2017.

10 "Shipping in Polar Waters: Adoption of an International Code of Safety for Ships Operating in Polar Waters (Polar Code)," International Maritime Organization (IMO), http://www.imo.org/en/mediacentre/hottopics/polar/pages/default.aspx, accessed 21 November 2017.

11 "List of IMO Conventions: Key IMO Conventions," IMO, http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/Default.aspx, accessed 22 November 2017.

represents an excellent foundation as the first mandatory and internationally implemented requirement for ships operating in polar waters. However, more work is needed to strengthen the Code in areas where consensus among flag states was not found, to enhance enforcement capabilities, and to deal with emerging issues such as heavy fuel oil and black carbon among other environmental protection provisions. One particular criticism of the Code is that the consensus-based nature of its development has led it to be 'watered down to the lowest common denominator'. Some already existing national level shipping governance regimes are more stringent than the Polar Code leading some proponents to question the utility of the Code generally. Regardless, the world is making significant steps forward to the safe and sustainable management of shipping in Arctic waters via collaborative initiatives and shared visions for governance.

It is incumbent upon all of us to put in the necessary time and sustained effort to making sure the Arctic marine environment does not become an example of how integrated and shared leadership frameworks for Arctic shipping governance have failed, but instead as an analogue for innovative and adaptive governance in the face of rapid global environmental and economic change. Much of the world has been explored and discovered but the Arctic remains a frontier in many regards and as such presents us with the opportunity to establish effective, innovative, and tailor-made governance approaches. Commercial ship traffic is increasing in Arctic regions albeit at a pace that is much slower than many have speculated. Yet, there is no doubt that the commercial Arctic traffic will, at some point and through a variety of influencing factors beyond just climate change, increase in the future. We need to be ready for this eventuality.

Autonomous Vessel Technology, Safety, and Ocean Impacts

Donald Liu
American Bureau of Shipping (retired), Seattle, Washington, United States

Introduction

In this age of automation and robotics, it is not surprising that maritime shipping, one of the oldest and most conservative of industries, is looking to modernize and transform itself by applying autonomous technology to ships much like the automobile industry with self-driving cars and trucks, and the commercial aircraft industry with its aircraft drones. There are two types of autonomous vessel technology currently being explored by various research projects in Europe. One is a vessel operated remotely by a shoreside operator, and the other a vessel operated completely independent of human control; the second has advanced decision support systems onboard undertake all the operational decisions independently.[1]

The primary driving forces for autonomous ships are twofold: (1) to reduce operating costs as a result of increased operating efficiency, decreased crew and shipbuilding costs that reduce the cost per ton mile of cargo carried, and (2) to reduce potential accidents due to human error, as about 75 to 96 percent of marine casualties are caused, at least in part, by some form of human error.[2] The motivation is not to just reduce operating costs and human error but to create a real transformation in the industry. Without humans being physically onboard, the deck house, crew quarters and related ventilation, heating, and sewage systems can be eliminated. Ships can be lighter and more aerodynamic thereby reducing fuel and construction costs and increasing cargo capacity. Those developing autonomous designs anticipate that the remote operations of ships will occur initially, and eventually move towards full autonomy of ships.

1 H.C. Burmeister, "Autonomous Navigation Results From the Munin Testbed," Autonomous Ship Technology Symposium, Amsterdam, Netherlands, 21–23 June 2016, https://www.cml.fraunhofer.de/content/dam/cml/de/documents/Sonstiges/MUNIN - 160621 - ASS - MUNIN - final.pdf, last accessed 8 September 2017.

2 A.M. Rothblum, "Human Error and Marine Safety," Bowes-Langley Technology (undated), http://bowles-langley.com/wp-content/files_mf/humanerrorandmarinesafety26.pdf, last accessed 8 September 2017.

 | DOI:10.1163/9789004380271_085

Challenges

Although the technological building blocks are all in place for the adoption of a new technology of autonomous ships, the maritime industry is not yet ready to accept such ships. There remain a number of significant and unresolved challenges to be dealt with before such ships can ply the high seas with their cargo. These challenges, although non-technical in nature, offer perhaps greater impediments to autonomous ships than the development of the autonomous technology itself. Of the many challenges, three critical ones rise to the top of a long list: operational, regulatory, and safety considerations.

Operational Challenges

Every ship has to comply with the International Regulations for Preventing Collisions at Sea (COLREGS), which sets out, among other things, the 'Rules of the Road' or navigation rules to be followed by ships and other vessels at sea to prevent collisions between two or more vessels. The rules are predicated on having persons on board to make sure these regulations are adhered to. With autonomous ships a critical issue in avoiding possible collision is how manned and unmanned vessels interact with one another, especially when operating in congested traffic areas or in confined waters where the environment can change abruptly due to unexpected events. Verbal communications between manned and unmanned ships are critical and mutual agreement on the course of action to be taken between ships may be necessary to manage traffic.

A remotely operated ship will be limited in the situational awareness needed for making appropriate decisions based only on the information presented on displays. Accuracy of information on displays on a manned ship is validated by actual visual observation. In a remotely operated ship this primary means of validation of the information displayed does not exist. In fully autonomous ships, which are dependent on algorithms for ship detection and classification to obey maritime traffic rules of the road, avoid obstacles, and support decision-making, will the artificial intelligence always make the 'right' decisions in possible collision events? Limited situational awareness concerns also apply to the weather and sea state and their impact on the ship.

Displays on screens do not fully characterize or simulate the motions and physical forces of the sea acting on a ship's hull, which can be critical for safe ship handling in heavy weather and rough seas.

Operations such as docking and undocking are also problematic for autonomous ships. These and other issues related to the operational safety of navigation of an unmanned ship are challenges yet to be resolved.

Regulatory Challenges

Not only are there operational impediments, the current international maritime laws, rules and conventions under which ships and crew operate at sea such as COLREGS, the United Nations Convention on the Law of the Sea (UNCLOS), the International Convention for the Safety of Life at Sea (SOLAS), the International Convention on Standards of Training, Certification and Watchkeeping (STCW), and the International Safety Management (ISM) Code do not even recognize the existence of autonomous ships.

These regulations presuppose that a master, officers, and crew are operating a ship. With no humans onboard, autonomous ships are effectively prohibited. International law stipulates that the master has command of the ship. Who is the commander of the ship when it is an unmanned ship? The remote operator? The programmer who designed the computer system that runs the autonomous ship? In the event of a shipping accident, where does liability fall?

The STCW for example sets qualification standards for masters, officers, and watch personnel and applies only to 'seafarers serving on board seagoing ships'. What are the standards of training and competency for a remote control operator and other shore-based personnel if they are considered to be in command of the unmanned ship? The ISM Code, which already imposes obligations relating to the shore-based personnel of shipping companies, would need revision so that the work, responsibility, qualifications and certification of shore-based controllers are properly included in a company's safety management system. An important and needed change to be made in COLREGS is to insure that all autonomous vessels be identified as a specific ship type so as to be readily identifiable by other ships in night and day conditions, such as by some characteristic lighting and daytime visual display marks or shapes.

In addition to the abovementioned international regulations that need revision, coastal states have national regulations that regulate the operation of manned, but not unmanned, vessels in their waters, which add another layer of regulatory impediments to autonomous ships. Clearly significant steps must be taken to revise and create new regulations that include autonomous ships. Some small steps are being taken to address these regulatory gaps related to autonomous ships. The International Maritime Organization (IMO) as a specialized agency of the United Nations is responsible for promulgating the regulations for ships and their safety, security, and pollution prevention. In 2018, the IMO will begin to address the regulatory gaps by exploring how existing international regulations can be applied to autonomous ships and maritime technologies. Because of the number and extent of regulations involved, it is anticipated that the IMO effort of revising existing regulations, as well as adding new regulations to address autonomous ships will require at least eight to ten years to complete. With such a long timeframe it is likely that autonomous ships will face the same fate as has occurred with driverless cars and unmanned commercial aircraft drones: the autonomous technology for ships will mature much faster than the development of sufficient safety regulations. Compounding the problem is the fact that not all international conventions and regulations that come into force are adopted by all maritime countries. For example, the United States has not adopted UNCLOS. Even when regulations that come into force are adopted by all countries party to the regulation, there may be delays in enforcement, such as with STCW.

Safety Challenges

Safety challenges related to conventional manned ships include ship safety, cargo safety, maritime traffic safety, environmental safety, human safety, and security. These sectors can be particularly challenging for autonomous ships. For example, SOLAS regulations require that a master or person in charge of a ship is to respond to persons who are in distress at sea and is bound to proceed with all speed to their assistance. It is questionable whether an autonomous ship can render assistance as effectively as a manned ship, either in search or rescue situations.

While autonomous ships will keep seafarers safely out of harm's way, there are other safety risks that will increase as a result of having no crew. In the age of unmanned shipping, it would be naive to expect that pirates and terrorists will disappear from the high seas. They may even think that such ships will be new and softer targets. Without a crew, an autonomous ship is likely at greater risk of being hijacked with the purpose of stealing the cargo or kidnapping the vessel for ransom or terrorist purposes. Vessels carrying explosive, inflammable or toxic substances could be used as weapons by terrorists. Because of their dependence on automation systems and artificial intelligence, autonomous ships are much more susceptible to hijackers of another form: hackers. Even as conventional ships become increasingly connected and reliant on software-dependent systems, cybersecurity is already receiving increasing attention by shipping companies. With autonomous ships, cyberattacks will pose an even greater risk to safety and require new and innovative ways to defend against such attacks.

The cybersecurity vulnerability of global shipping was recently highlighted by the cyberattack on container-shipping giant AP Moller-Maersk in June 2017 when a cyberattack downed its online booking and other internal platforms, forcing it to halt operations at some container terminals. The cyberattack caused a loss of up to US$300 million and disrupted operations for two weeks.[3]

Conclusion

Rolls Royce, one of the companies at the forefront of development of remote controlled and autonomous ships, envisions that a remotely controlled vessel operating in local coastal waters (the first stage of autonomous ships) will be in operation by 2020. By 2025 the company hopes to have a remotely operated autonomous ship in international waters, and by 2035 a fully autonomous unmanned ocean-going ship.[4] Once autonomous shipping becomes a reality, there will always be manned vessels as not all ship types lend themselves to autonomous operations (e.g., large passenger ships, ships carrying highly hazardous cargos) so it is essential that autonomous ships be able to co-exist and safely interact with manned ships.

Although the shipping industry's adoption of autonomous ships may be inevitable, the uncertainty regarding the safety of autonomous ships compared to conventional ships will be tested over time. The common wisdom is that autonomous ships must be at least as safe as conventional ships. One of the greatest risks faced by autonomous vessels will be cyber risks. Cybersecurity will be critical to the safe and successful operation of remote and autonomous vessels. Because of the uncertainty and unknown risks associated with ships having no crew aboard, public sentiment may demand that autonomous ships be even safer than conventional ones.

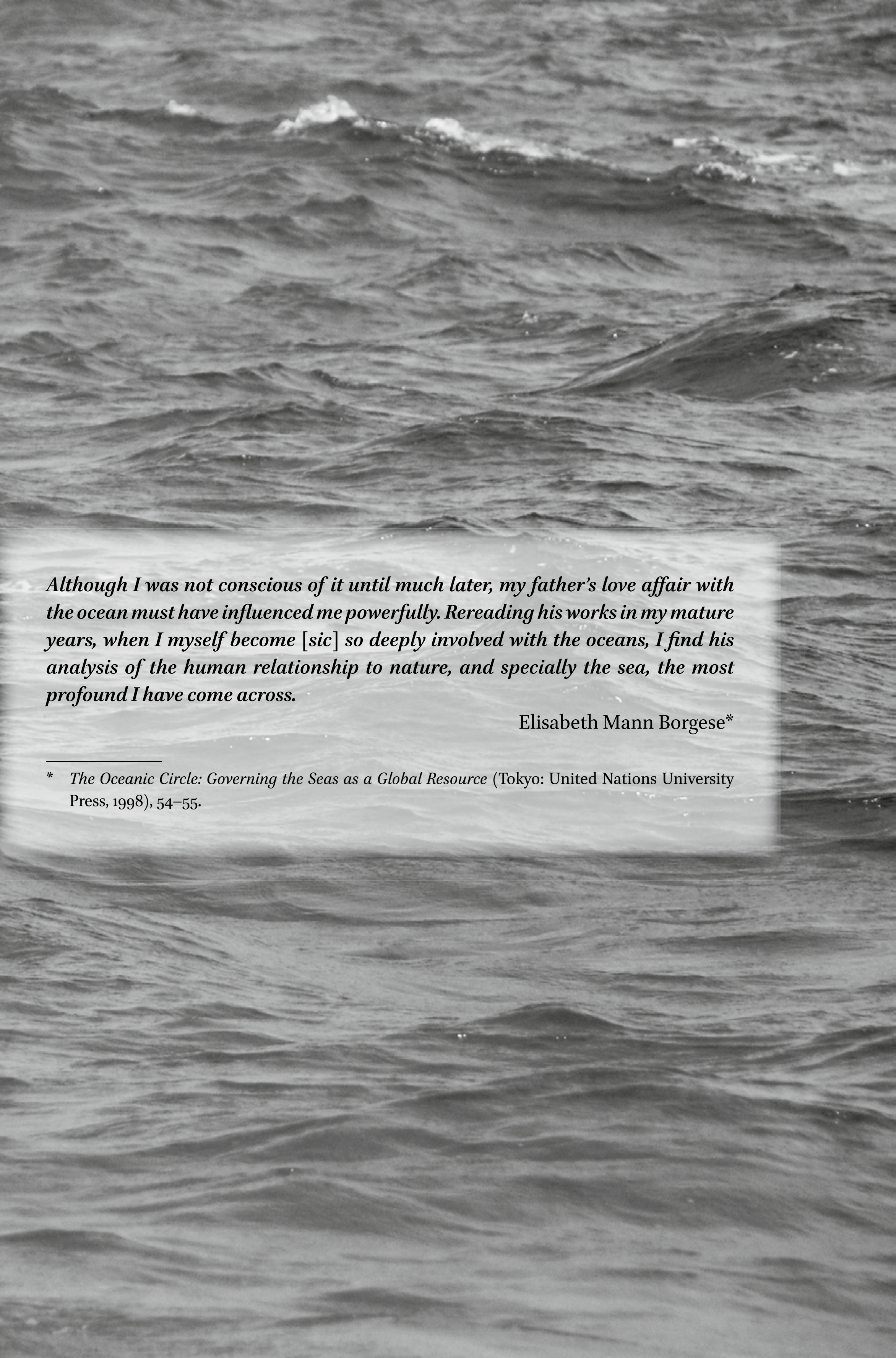
Even if the technology is perfected, companies are not going to use remote and autonomous ships unless the laws are changed to allow them to operate. Regulations will have to be revised; rules will need to be rewritten. Until that happens, the timeline when these ships will be permitted to operate in ocean trades remains uncertain. Autonomous shipping will happen; it is just a question of when, where, and how.

3 J. Leovy, "Cyberattack Cost Maersk as Much as $300 Million and Disrupted Operations for 2 Weeks," *Los Angeles Times*, 17 August 2017, http://www.latimes.com/business/la-fi-maersk-cyberattack-20170817-story.html.

4 Rolls Royce Advanced Autonomous Waterborne Applications Initiative, "Remote and Autonomous Ships—The Next Step," White Paper, Autonomous Ship Technology Symposium, Amsterdam, Netherlands, 21–23 June 2016.

PART 10

Communication and Negotiation



Although I was not conscious of it until much later, my father's love affair with the ocean must have influenced me powerfully. Rereading his works in my mature years, when I myself become [sic] so deeply involved with the oceans, I find his analysis of the human relationship to nature, and specially the sea, the most profound I have come across.

Elisabeth Mann Borgese*

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* *The Oceanic Circle: Governing the Seas as a Global Resource* (Tokyo: United Nations University Press, 1998), 54–55.

Introduction

Editors: Paul R. Boudreau and Ian Porter

Good communication is an essential ingredient for responsible ocean governance, as governance is informed by and relies to a great extent on public engagement and support for formulating law, plans and actions, and for making decisions. In that context this part deals with the public from different points of view to explore how processes of communication, engagement, and negotiation contribute to the exchange of ocean-related knowledge and the realization of sustainable ocean benefits. For many of us, engagement is based by and large on intangible and often literary or philosophical connections. In the first two essays, writers are conveying the human 'sense' or 'experience' of the ocean and ocean activism to their readers. For others our connection comes through formal and informal education or exposure in the course of professional activities. In recent years, important communication and engagement tools are classed as social media. The final essay in this part deals with the very formal negotiation process as a tool to resolving ocean conflicts. Together, these essays show the different ways that non-experts and experts connect to the ocean and relate to the complexities of ocean governance.

Sing to Me of the Oceans, Muse: The Poetry of the Sea

Harry Thurston
Tidnish Bridge, Nova Scotia, Canada

The sea and poetry have always gone together.

The earliest epic poems take us on long sea voyages. The first of these in classical literature is *The Odyssey*. Dating to the sixth or seventh century BCE, it is attributed to the blind Greek poet Homer who wrote down the minstrels' tales of the hero Odysseus on his ten-year-long voyage from Troy to his home island of Ithaca. He sails through 'the wine-dark sea', encountering many obstacles and temptations along the way. The word 'odyssey', in English, as defined by Webster, means "a series of adventurous journeys usually marked by many changes."

And so the poet sets the stage for this tale, this voyage he is about to take readers on as virtual crew:

> Sing to me of the man, Muse, the man of twists and turns
> Driven time and again off course…[1]

Other epics and epic poets followed in Homer's wake. In the waning years BCE, the Latin poet Virgil penned *The Aeneid*, which traces the Trojan hero Aeneas' voyage on his "seven long years [of] unhappy wandering … tossed by storms, and scattered through the main,"[2] en route to the founding of Rome.

Far to the north, at the end of the first millennium, in The Icelandic Sagas, poets recorded the voyages of the Vikings across the North Atlantic, giving us a first glimpse in literature of what became known as The New World. We marvel with these early voyagers at the long white beaches and the marine bounty of this new land where they found "no lack of salmon … larger than they had ever seen before."[3]

Finally let me mention, in this very brief survey of epic poetry and its watery origins, *The Lusiads* by the Portuguese poet Luis Vaz de Camoes.

1 Homer, *The Odyssey*. Translated by R. Fagles; introduction and notes by B. Knox (New York: Viking Penguin, 1996).
2 *The Works of Virgil*. Translated by J. Dryden (London: Oxford University Press, 1906).
3 *The Sagas of Icelanders, A Selection*. Preface by J. Smiley (New York: Penguin Group, 2000).

First published in 1572, it recounts the voyage of Vasco da Gama around the Cape of Good Hope to India in 1497–1498. Camoes, the one-eyed poet—like a Homeric Cyclops—was well qualified to imagine this epochal voyage because he did it himself over half a century later, making it as far as the Mekong delta where he was shipwrecked. He is the first of the southern European poets to take us out of the Mediterranean, as well as the first to take us across 'the burning line' of the Equator—into the southern Atlantic, the Indian Ocean, and the Pacific.

It is Vasco da Gama's voyage "from Portugal's far western shores/ By oceans where none had ventured… Among far distant peoples, to proclaim/ A New Age…."[4] that signals the beginning of the Age of Discovery and the revelation that we live on a planet that is largely watery—and salt.

These last two, more 'modern' epics span the North Atlantic and the two places I call home: Atlantic Canada, the Vinland of the sagas, where I was born and have lived most of my life, and Portugal where I have spent winters during the last decade near Cape St. Vincent "where the land ends and the sea begins."[5] This cold tempestuous ocean has been a major influence on my life as a poet and environmental journalist and nature writer. And it is through the prism of this first-hand experience and practice that I view the subject of ocean literacy and literature—how we understand the sea through words.

With this in mind I want to briefly consider two classic texts that take the oceans and their impact on the planet and its living things as their primary subject.

The first, of course, is Charles Darwin's *Voyage of the Beagle*,[6] the record of a five-year-long voyage by a twenty-something-year-old man, suffering from the common malaise of young people, then as now, of what to do with one's life. In his autobiography, he wrote that "the voyage of the *Beagle* has been by far the most important event in my life and has determined my whole career." That experience would not only change Darwin's life, convincing him to give up the notion of entering the ministry for a career in science, but change our fundamental understanding of how life on Earth came to be what it is, and how it continues to change and evolve through the process of natural selection.

At the end of his life he wrote that the success of "my first literary child always tickles my fancy more than that of any of my other books,"[7] among them *On the Origin of Species*. What is striking to me as a poet and nature writer is his use

4 L. Vaz de Camoes, *The Lusiads*. Translated with an introduction and notes by L. White (Oxford: Oxford University Press, 1997).

5 Id.

6 C. Darwin, *Voyage of the Beagle*. Edited and abridged with an introduction by J. Browne and M. Neve (London: Penguin Books, 1989).

7 Id.

of the term 'literary child' to describe his writing. It is an accurate description of the text, which was received enthusiastically by Victorian readers when it was first published in May 1839, as it still is today, nearly two centuries later. It is eminently readable in the great tradition of nineteenth-century naturalists, a tradition that lamentably has less contemporary currency.

Darwin was first a naturalist, so on landing on the Galápagos Islands, where the seeds of his theory of natural selection will be sown, he describes their geology ("The constitution of the whole is volcanic"), their climate ("Considering that these islands are placed directly under the equator, the climate is far from being excessively hot; a circumstance which, perhaps, is chiefly owning to the singularly low temperature of the surrounding sea"), and their flora ("The dry and parched surface, having been heated by the noonday sun, gave the air a close and sultry feeling, like that from a stove; we fancied even the bushes smelt unpleasantly. Although I diligently tried to collect as many plants as possible, I succeeded in getting only ten kinds; and such wretched-looking little weeds would have better become an arctic, than an Equatorial Flora"). It is figurative flourishes that mark this text as something more than a mere accurate and plodding record of place.

This question of literary style leads me to a consideration of the next great book about the oceans, excepting Herman Melville's *Moby Dick Or, The Whale*, that hybrid fiction-natural history masterpiece, Rachel Carson's *The Sea around Us*, first published in 1950, more than a century after Darwin's classic.

Like Darwin, Carson was a biologist first, though she was also a professional editor for the United States Fish and Wildlife Service and she would write four books, three about the sea and seashore, and her last, *Silent Spring,* in 1962. Her meticulously researched, damning critique of the chemical industry and its indiscriminate use of pesticides would birth the modern environmental movement, and like Darwin's *Origin of Species* would change forever the public's view of our role in the natural world. However, it was her first book (and her favorite), *Under the Sea Wind* that brought her to public attention and established her as a writer who could combine science and poetry, a new aesthetic to raise awareness about the power and beauty of the natural world.

From that book, here is a sample from her essay "Undersea," which first appeared in *The Atlantic Monthly* in 1937:

> The ocean is a place of paradoxes. It is the home of the great white shark, two-thousand pound killer of the seas, and of the hundred-foot blue whale, the largest animal that ever lived. It is also home of living things so small that your two hands might scoop up as many of them as there are stars in the Milky Way... Drifting endlessly, midway between the sea

> of air above and the depths of the abyss below, these strange creatures and the marine inflorescence that sustains them are called "plankton"—the wanderers.[8]

Carson has been called "the twentieth century's science-enchanter par excellence."[9] In her acceptance speech for the National Book Award for nonfiction, given to *The Sea around Us*, she elucidated how poetry is the agent of science, and how these two seemingly incompatible disciplines are in fact complementary to each other and indispensable to her worldview as a writer:

> The winds, the sea, and the moving tides are what they are. If there is wonder and beauty and majesty in them, science will discover these qualities. If they are not there, science cannot create them. If there is poetry in my book about the sea, it is not because I deliberately put it there, but because no one could write truthfully about the sea and leave out the poetry.[10]

Even in her last book, *Silent Spring*, with its unrelenting expose of how pesticides were insidiously accumulating in organisms, including humans, and altering whole ecosystems in the process, she protested that "I myself never thought the ugly facts would dominate. The beauty of the living world I was trying to save has always been uppermost in my mind…"[11]

In a prescient way, Carson put her finger on the nature writer's dilemma in the modern age, in the Anthropocene, when we are experiencing a sixth mass extinction due to human activities and the very biosphere is threatened by anthropogenic-induced climate change. It raises the question, as Moira Farr did in her essay, "The Death of Nature Writing"—"whether the genre is still legitimate in the face of the kind of destruction humans are visiting upon the Earth?" Or are we witnessing "the passing of a way of seeing."[12]

While we can no longer write about nature as if it were whole and unsullied, the British Columbia nature writer Peri McQuay offers this counterargument: "Recognizing our despair over the ravages to the biosystem is necessary. However, when we become paralyzed by despair, we opt out of the organism which

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8 R. Carson, "Undersea," *Atlantic Monthly* 78 (1937): 55–57.

9 M. Papova, "Rachel Carson on Writing and the Loneliness of Creative Work," Brain Pickings, https://www.brainpickings.org/2017/08/28/rachel-carson-house-of-life-writing-loneliness/.

10 Id.

11 Id.

12 M. Farr, "The Death of Nature Writing," *Brick* 47 (1993): 16–27.

is our proper home and become part of the destructive force."[13] That is why, she says, we still need 'the poets of ecology', perhaps more than ever.

It is that special way of seeing—in a word, literature—that makes us aware of the ocean as a place of adventure and discovery, and of wonder and mystery, and ultimately makes us want to conserve and care for it.

As a nature writer who was first a poet and later wrote a number of science-based books on the sea and the seashore, I try to honor the legacy of Carson who found the poetry in science, and who argued vigorously that there could be "no separate literature of science," since science and literature had the same aim, "to discover and illuminate the truth."

Unlike Darwin in his day, or Carson in hers, few scientists now have the luxury of writing for the public about their discoveries. It falls to nature/science writers. In doing so, I am always aware of Carson's example. But I also remember old Homer who begins his epic poem with the charge—'Sing'!

Singing the poetry of the sea is a bearing we need more than ever—as the oceans are emptied, acidified, and fill with plastics—if humankind, like Odysseus, is to find its way back to its true home.

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13 P. McQuay, "Seizing the Strawberry," in *Living in Harmony: Nature Writing by Women in Canada*, ed., A.P. Leibowitz (Victoria, BC: Orca Book Publisher, 1996), 215–224.

Journalistic Challenges in Speaking for the Ocean: A Personal Acquaintance with Elisabeth Mann Borgese

Paul Kennedy
IDEAS, CBC Radio, Toronto, Ontario, Canada

I'm a journalist.

In that context, almost twenty years ago, it was my enormous pleasure to savor many dozens of precious hours in the illuminating presence of Elisabeth Mann Borgese. At the time, I was working on a seven-part radio documentary series called 'Learning from the Oceans'. I knew that Elisabeth hadn't exactly written 'the book' about oceans, although she had written at least three books on oceanic subjects, and there was a broad consensus that she'd been a major force behind the 'Law of the Sea'. In my imagination, I cultivated the delusional dream that I might somehow become her 'Boswell', while she would be my 'Johnson'.

Our first face-to-face meeting occurred on 6 April 2001, in Halifax, Nova Scotia. I had agreed to moderate a public forum featuring fisheries experts, marine biologists, and ocean scientists from all parts of Atlantic Canada. Similar sessions were subsequently scheduled for Victoria, on the Pacific coast, and Iqaluit, on the Arctic coast, thereby covering all three of Canada's oceans, and theoretically giving me a kick-start introduction to the topic at hand.

My notes from that Halifax session are characteristically vague. To tell you the truth, it feels like a miracle to me that those notes still exist. Journalists are hacks. They tend to forget everything about whatever they are doing almost as soon as they accept their next assignment. Mostly I recall that there were two men and two women on the Halifax panel. Gender parity was good. I felt vaguely uncomfortable in my role as 'chair' of what almost seemed like a roving Royal Commission about Canada's oceans. My biggest memory from the entire evening was being blown away by Bernadette Dwyer, who was then the Director of the Fogo Island Cooperative Society, on the biggest island off the coast of the island of Newfoundland. Since then, after something like several dozen visits to that province—including at least six or seven excursions to Fogo itself—I have come to consider 'da Rock' as something of a second home. The connection seems almost genetic. The amniotic fluid in every human womb apparently resembles the chemical composition of ancient sea water. Mother Ocean has been calling me.

In any event, Elisabeth reigned supreme that evening in Halifax. All the panelists automatically deferred to her, even though she didn't actually say very much. My almost illegible notes indicate that all the other people on the panel looked in her direction whenever anything controversial (or even interesting) was mentioned. She got a lot of attention. At the end of the evening, I sought her out, and modestly suggested we should spend some serious time together, and probably plan a feature interview for some point further along in the process. Elisabeth invited me for dinner the following night.

Her place was on the ocean, south of Halifax, not far from the spot where the first trans-Atlantic communications cable came to shore. We walked that gorgeous coastline with her dogs, and we watched the sun set over the North American continent. I was way too shy to mention that I knew she was the daughter of the German writer and Nobel Prize winner Thomas Mann. We talked instead about her husband, who had been a world-famous World Federalist, before his death in 1952. Giuseppe Antonio Borgese probably prompted Elisabeth's later lifelong interest in the oceans. It was his consuming commitment to 'the commons', and his passion for international governance, that ultimately and inevitably led Elisabeth to the law of the sea.

Over dinner, we discovered our mutual love for single malt Scotch whisky. We discussed the magical ways that the waters of the North Sea infuse the flavors of our favorite drams. We probably drank too much. Before the night was over it was agreed that there was iodine in the ocean air that ultimately made its way into each whiff of ten-year-old Laphroaig. By the end of the evening, we were swearing that it was even possible to smell and taste the essence of Hebridean kelp in every sip of sixteen-year-old Lagavulin. A tentative connection was established.

Our next meeting took place on International Oceans Day, in Vancouver, British Columbia, that June. Canada's federal Minister of Fisheries and Oceans had invited me to attend a very special meeting of the National Oceans Advisory Group. Elisabeth was part of an elite assemblage of Ocean Ambassadors, including whale biologist Jon Lien and sustainable development expert Art Hanson, who were automatically part of the group. The Minister himself, The Honourable Herb Dhaliwal, acted as host and chair, with other high-level federal officials, as well as various provincial politicians and bureaucrats filling out the roster. Because I was nothing more than a mere journalist, I had completely forgotten the name of the hotel where the opening cocktail party was supposed to convene. Being a complete hack, I made the mistake of calling a press officer at the ministry in Ottawa.

Our conversation was polite and personable until I mentioned the meeting. I was asked how I'd learned about it. I replied that many of the people I had been interviewing were expecting to attend, and hoping to see me there. I was told that the meeting was being held in Vancouver. I replied that I was already at Toronto Pearson International Airport, waiting to board a westbound plane. At that point, I was automatically and authoritatively informed that journalists were absolutely forbidden from attending the meeting. There were no exceptions. It was suggested that I should cancel my flight. When I protested, that the Minister himself had invited me, I was informed that there must be some mistake.

I boarded the plane.

On arrival in Vancouver, I checked into my hotel and called a local friend whom I suspected might be on the list. She told me where the meeting was, and when it was supposed to start. When I arrived, only a few minutes late, Elisabeth saw me at the door and came running from across the room. She grabbed me by the elbow and took me immediately to meet the Minister. It suddenly felt like we three were allies, although I alone understood that I was not supposed to be there, because I was a mere journalist.

My closest (and longest) encounter with Elisabeth was scheduled for several months later, in New York City. She invited me to 'shadow' her at a meeting of the Ad Hoc Working Group for the United Nations Convention on the Law of the Sea. Plenary sessions were scheduled for every afternoon, over a three-day period. I met Elisabeth for lunch, just before noon on the first day, and we walked to UN Plaza together. People started to recognize her even before we approached the main building. This was immediately prior to the September 11, 2001 attack on the World Trade Centre, but security seemed exceptionally tight. There were numerous metal detectors and repeated pat-downs.

Elisabeth walked right through. The guards seemed to know who she was, and automatically granted some form of super-diplomatic immunity, just for her. By the afternoon of the second day, with five or six security gauntlets behind us, it felt almost like I was being granted a form of reflective respect. For the guards, I was becoming the Canadian guy who is shadowing Elisabeth Mann Borgese. There were fewer pat-downs; then briefer and more perfunctory pat-downs; and then none. I guess nobody told them I'm a journalist.

Once through the security, inside the actual 'Law of the Sea' meetings, Elisabeth and I sat near the back of a huge room, but at the front of a bunch of non-governmental organizations and other interested participants. People all over the room, from all corners of the ocean continent, turned around to try and make eye contact with Elisabeth. Whenever the discussion—which was simultaneously translated into all six UN official languages—progressed towards any sort of vote, each member nation expressed its franchise in alphabetical order … Afghanistan … Albania … Algeria … Andorra… Many of the national representatives would stand and turn towards Elisabeth before they voted. There was something about her particular smile that told them everything they needed to know.

If I learned anything about the United Nations, on that particular visit, it was that most votes were usually foregone conclusions almost as soon as the alphabet arrived at the Chinese delegation. China wasn't just China. China was 'China and the Un-Aligned Nations', and many if not most of the member nations were mysteriously aligned to China, although officially somehow 'unaligned'. However China voted, so went the majority, 99 percent of the time. The Chinese representative turned and looked at Elisabeth, who smiled her special smile. The representative voted, knowing that Elisabeth approved. As a non-governmental organization she never got her own vote. But she often got her way.

At the end of the meetings, after the third day, Elisabeth was flying to Geneva and I was returning to Toronto. We found a bar, somewhere east of Broadway on 42nd Street. She ordered an Ardbeg. I asked for a Bowmore. We toasted the oceans, and went our ways.

In the end, as a journalist and documentary maker, I do not remember using anything much from the many hours I spent with Elisabeth Mann Borgese. She gave me all that time, in so many extremely different but fascinating contexts, because I was in the process of making a seven-hour radio series called 'Learning from the Oceans'. We never did sit down to record the substantial, face-to-face, profile interview that we had been discussing from the very beginning. When everything went to air, Elisabeth ultimately got something like a 47-second sound bite, buried somewhere in the third hour of the series:

> I want to conclude with a fish story. It is a true story that occurred some fifty years ago, when I was studying in Austria. A biologist was doing research about where the feeling for social responsibility was located in the brain of a fish. He proceeded to surgically remove that part of the brain, and then put the fish back into the school from which it came. The fish was immediately and automatically declared to be the leader.

That was all the airtime she ever got from the hundreds of hours that we spent together. But I'm happy to tell you that the essential spirit of EMB was deeply infused into every nanosecond of my work on oceans—certainly in all seven hours of the 'Learning from the Oceans' series, and in fact in everything that I've done ever since.

Elisabeth taught me that the beauty and the power of the ocean is inside each and every person on the ocean planet.

I will never forget it. Even though I'm only a journalist.

Oceans Day: A Personal Reminiscence of Its Initiation

Peter MacLellan
Raeberry Communications, Smiths Cove, Nova Scotia, Canada

"How's your Portuguese?" I was asked on the way out of the office.

"Non-existent," I replied looking back over my shoulder.

"Well, better brush up on some rudimentary conversation, I think we'll be taking you with us."

The voice belonged to Dr. Judith Swan, an internationally respected figure in marine law circles and at the time the Executive Director of the Oceans Institute of Canada (OIC).

We had just met in the OIC office sequestered away on the fifth floor Dalhousie University's heating plant building on Henry Street, Halifax, Nova Scotia. It wasn't a familiar spot for me. I really didn't have much to do with oceans management, policy studies or anything related to academic inquiry in that regard.

I was a senior executive at the region's largest public relations and strategic marketing agency and I had been directed to meet with the OIC folks by my president after he had received a request for possible communications services.

"You teach at university, and enjoy that scene," he said as he dropped the phone message slip on my desk, "Drop by and see what they need and what we can do for them."

So here I was.

It was March, 1992 and we had been discussing the upcoming United Nations Conference on Environment and Development (UNCED), also known as the Rio Conference or Earth Summit, depending on your level of gravitas or, in my case, scientific sophistication; a major global event scheduled to be held in Rio de Janeiro, Brazil, from 3 to 14 June 1992.

The Earth Summit was going to examine and discuss a number of emerging and important global issues including biodiversity, deforestation, desertification, and, yes, climate change. It would produce benchmark conventions and declarations including Agenda 21, the United Nation's environmental and sustainable development plan for the twenty-first century.

But the Government of Canada wanted the OIC to get a heightened profile for the oceans at UNCED, because they knew we were facing a crisis of sustainability. I was there to suggest ways to get that visibility and build international 'buy-in' at the event for the Canadian agenda. Somehow I was convincing on

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the tactical approach, and displayed at least an informed understanding of the issues; so our firm was retained to develop that strategy.

And I was invited to join the team on their way out the door.

Now, when I say that I hadn't any knowledge of oceans issues and strategic imperatives, it was not entirely true.

Over the past few years I had come to know the redoubtable Elisabeth Mann Borgese, defender of the oceans, internationally recognized expert on maritime law and policy, and founder of the International Oceans Institute (IOI), while she was a professor at Dalhousie University. She and I were regular guests at weekly soirees hosted by our mutual friend Dr. John Godfrey when he was president of the University of King's College, Halifax, Nova Scotia, and we would often chat about her work and the issues she was addressing.

I was also happy to work with the Mayor of Halifax to infer special civic citizen status upon Elisabeth while she was with us.

She was a brilliant and engaging person and I really liked her. And I would listen intently as she discussed and delineated legal and environmental marine issues, and her global role with *Pacem in Maribus* ('Peace in the Oceans').

Because of Elisabeth Mann Borgese, through meeting her and most all through listening to her, I was able to acquire a sufficient understanding of the issues and challenges facing the OIC mandate to take part in their Rio mission.

After leaving that first meeting with Judith Swan and some of her team members, I waited by the elevator to head back to the office. On the bulletin board was a poster that promoted the upcoming Earth Day, April 22nd.

> A light went on.
> I turned and went back into the OIC office.
> "Is there an Oceans Day?" I asked Dr. Swan.
> "No, why?" she replied.
> "I think it's something we should discuss," I said.

And we did, many times, as we prepared to go to Rio, until it became a centerpiece of our strategic agenda.

We accepted the idea to declare an Oceans Day and present it for global consideration. It was well received by the federal government. The federal Minister of Fisheries and Oceans loved it, and told me so on a number of occasions when we were doing media work at the Earth Summit. We were encouraged to put it out there as a focus of Canadian concern and commitment.

But when? What would be the day?

Over a couple of social libations and discussing a possible date for the Oceans Day activities, Judith Swan and I discussed the activities planned for the two weeks in Rio and I said that I was available to assist the delegation for the entire time, I just had to take time to call my wife on June the 8th because it was our wedding anniversary.

> "Can you repeat that date again?" she asked.
> "June 8th," I repeated, "Why?"
> "Because that's my birthday as well," she said.

Judith Swan had a respected background as a legal scholar in the field of marine affairs, and an impressive knowledge and grasp of international oceans issues. I assumed that's why she was awarded the position she currently held.

But I also came to learn that she had a mystical side that appreciated apparent karmic confluence.

"Well that's got to be it then," she declared as if it was meant to be.

The date was subsequently proposed and accepted, and the launch of the Oceans Day proposal was written into the agenda.

It would take a lot of work and planning by a superb team of scholars and policy experts assembled as part of the OIC team. And it was done over an incredibly short period of time. Focus and realistic expectations were essential. Personal, pedantic, and organizational agenda were to be set aside.

The progress and planning towards what became Oceans Day perhaps received its best summary in a recent comment article posted in the Victoria, British Columbia, *Times Colonist* on 7 June 2017, the day before Oceans Day, by Dr. Carol Amaratunga, one of the leading Canadian delegates to the 1992 UNCED conference and a key member of our team.

Dr. Amaratunga is a freelance writer and social-policy researcher who served as the Director of the Inter-regional and Cooperative Activities Division, International Centre for Ocean Development (ICOD), in Halifax, Nova Scotia, between 1986 and 1992 and with OIC between 1992 and 1994.

Her submission was entitled "Comment: Keeping True to the Spirit of World Oceans Day," and she stated, in part:

> A quarter of a century ago, on June 8, 1992, at the Earth Summit in Rio de Janeiro, a dedicated team from Canada's International Centre for Ocean Development and the Ocean Institute of Canada launched the first World Oceans Day … Oceans Day 1992 called upon world governments to remediate the early signs of global warming and climate change. Our objective was to move the oceans from the fringe to the centre of intergovernmental sustainable-development discussions and policy. …

> In planning Oceans Day 1992 our subject was simply: The Blue Planet and the Earth Summit. Our goal was to engage the public and support scientists, community leaders, and decision makers to affirm the world ocean as a global engine that drives and supports life on this planet.[1]

On Monday, 8 June 1992, a day-long Oceans Day at the Global Forum seminar entitled 'The Blue Planet: Oceans and the Earth Summit' was held. The seminar was planned and hosted by the OIC team and chaired by Dr. Swan. The agenda featured a long list of internationally renowned speakers, and was fully attended by oceans policy-makers, researchers, educators, politicians, and media from around the globe.

The focus of the agenda was to address a ten-point 'Call for Commitment' drafted by the organizers. Those ten points were listed under a series of lofty and inclusive sub-headings that included management of the high seas, global institutional arrangements, global integrated actions, high seas fishing, land-based sources of pollution, and coastal zone management.

But it was particularly the tenth, and final, point in that Call to Commitment that I will always remember. That final sub heading was entitled 'Annual Oceans Day' and read as follows:

> 10. The international community should declare an annual Oceans Day, dedicated to directing global attention to the oceans, and monitoring post UNCED oceans agenda progress.

I can still remember reading and re-reading Article 10 of that statement, as I walked to the shore on that brilliant morning. All that week in Rio, and in the months before in Canada, I had been impressed, even humbled, by the knowledge, experience, and tenacious commitment I witnessed in the people I met and with whom I worked on developing the Oceans Day agenda, and the seminar going on in the lovely facility behind me.

But Article 10, well, I was able to play a part in that one.

"The international community should declare an annual Oceans Day." It had only been a few months since that day in March—but there it was.

And I had a part to play in its appearance at an international forum of such global import. I considered at the moment that I never had a chance to be part of any remotely seminal moment in history, and likely never would again. I smiled to myself.

1 C.M. Amaratunga, "Comment: Keeping True to the Spirit of World Oceans Day," *Times Colonist*, 7 June 2017, http://www.timescolonist.com/opinion/op-ed/comment-keeping-true-to-the-spirit-of-world-oceans-day-1.20453333.

And it would take a while before the 'international community' would act on that recommendation, but finally, in 2008, World Oceans Day was formally acknowledged and adopted by the United Nations.

World Oceans Day has grown and gone on to become a major event in celebrating our oceans heritage and dedicating efforts to preserve that priceless potential.

Since that day in 1992 I was honoured to be asked to teach communications management as part of the Masters of Marine Management at Dalhousie University, an assignment I loved and would perform for almost two decades. I still have the wonderful assignment of teaching the subject as part of the international summer programme conducted by the International Ocean Institute-Canada at Dalhousie University.

Over that period of time I have looked forward to the opportunity to share with my students my peripheral perspective on the story of the genesis of Oceans Day. They always seem to find it interesting and, in my accounting, somewhat amusing. Occasionally I get anniversary greetings from former students around the world. And, as on that wonderful day in Rio, I smile to myself.

Cetaceans in the Media: A Right Whale of a Story

Ian Porter
Halifax, Nova Scotia, Canada

Introduction

It was like a multiple murder mystery. Who or what was killing North Atlantic right whales in the Gulf of St Lawrence? Why so many? And—in the summer of 2017—what were so many whales even doing in the Gulf?

By September, 12 whales had been found dead and news of each tolled like a bell. Cetacean biologists say that barely 500 North Atlantic right whales remain. Hunted almost to extinction two centuries ago, their survival as a species is an issue of urgent concern for marine scientists and environmentalists. The deaths were a staggering loss for an endangered species and they caught international media attention.

In Atlantic Canada, the whales' plight became the 'Story of the Summer'. Print, broadcast, and online media had news about them almost daily. Reports told of observers' surprise at their large numbers in the Gulf and of speculation about the effect of climate change on migration patterns. Environmentalists blamed some deaths on entanglement in fishing gear. Necropsies implicated 'ship strikes'—hit-and-run collisions with tankers, cruise ships and other large vessels. Chasing so many leads was a tough test of the capacity of the news media to cover events out of sight of land. For members of the ocean community—scientists and environmentalists—it was an opportunity to deploy impressive media skills on behalf of animals they had come to know well through years of research and activism.

As Told through a Lens

A stream of visuals sustained the momentum of the media coverage. Pictures of whales are compelling. They are elite mammals, enormous, smart, and talkative. They travel in families and surface for photo ops. Pictures of whales, living and dead, and of people looking at whales and the remains of whales told the story on television and in social media and drew readers to folio features in newspapers. By itself, a 60-tonne whale pulled up for a necropsy on a beach is an arresting image, especially when people in protective scrubs are slicing into the huge body and using the arm of a backhoe to roll back thick layers of blubber. Crowds of onlookers complete the impression of communities energized by wonder and pity.

Fresh images from many sources kept the story from fading. Without pictures, reports of a whale floating lifeless at sea are worth, at most, a few lines of script. Newsroom budgets rarely provide for the boat or helicopter needed to shoot events out of sight of land. Increasingly, producers rely on outside sources for pictures to tell ocean stories.

The federal Department of Fisheries and Oceans (DFO) supplied one widely shared image, that of pathologist Dr. Pierre-Yves Dumont squatting precariously on a whale carcass awash in the Gulf.[1] The Marine Animal Response Society (MARS) and the World Wildlife Fund (WWF) also provided the media with boat-based video. Environmental groups understand well the value of visuals as support both for advocacy and fundraising. As one reporter puts it, offshore video that tells a story is like 'catnip' to television programmers.

Commitment and Complexity

A striking example of media reliance on outside sources came with the death of Joe Howlett, a fisherman from Campobello Island, New Brunswick, who was killed 10 July while freeing an entangled whale in the Gulf. News coverage focused on his commitment and sacrifice. Tributes that showed him in action on a whale-rescue boat used pictures from a promotional video posted on YouTube the year before by the International Federation for Animal Welfare. His death had an immediate impact. Authorities in both Canada and the United States quickly suspended all further whale-rescue activity.

Across Atlantic Canada, local broadcasters, newspapers, and Canadian Press bureaus all scrambled to tell their own right whale stories. There were dead whales off northeast Newfoundland, necropsies on Prince Edward Island, and fears about the impact of conservation measures on the lobster and crab fishery in Cape Breton, Nova Scotia. Taken together, the stories were practically a lecture-hall illustration of the densely woven complexity of coastal ocean issues.

The media were hard put to connect so many dots. Marine beat reporters—specialists in ocean science or policy—always rare, are now almost extinct in news organizations. Journalism-schooled generalists are skilled at assembling

1 A. Auld, "Seventh right whale found dead in Gulf of St. Lawrence," *Toronto Star*, 7 July 2017, https://www.thestar.com/news/canada/2017/07/07/seventh-right-whale-found-dead-in-gulf-of-st-lawrence.html.

facts and making them accessible to readers and viewers. Few have the experience and contacts within the ocean community to go much deeper. And in summer, veteran reporters go on vacation. For their replacements, the discovery of yet another dead right whale was sometimes their first big saltwater story.

What the Sources Said

So it was that the credibility of the coverage became dependent on scientists who have invested their careers in right whale research. Shore-side reporters had few grounds to question their opinions about what should be done and none to challenge their urgency. A key source was Montreal-born Dr. Moira Brown, a senior scientist at the New England Aquarium in Boston, Massachusetts. She was a veteran of a campaign fifteen years earlier to protect right whales endangered by shipping in the Bay of Fundy and south of Nova Scotia. She was someone who could tell the story of the right whales in words that reporters can use. "My job," as she puts it, "is to be a scientist. A scientist who can interpret science."

Others frequently in the coverage included Sean Brillant of the Canadian Wildlife Federation in Halifax, Nova Scotia, and, in dozens of news clips and interviews, Tonya Wimmer, a biologist at Dalhousie University in Halifax and the founder of MARS. Her organization had reported the death of three whales in the Gulf two years earlier and had predicted more as migration routes reached colder waters. Her concern was the lack of a 'top-down commitment' by government to change fishery and shipping regulations to reduce entanglements and ship strikes.

Canada's species at risk law does prescribe intervention, but Ottawa cannot easily ignore its economic impact. Protected feeding grounds for whales could be off limits to snow crab fishermen and other inshore groups. Cutting cruise ship speeds would win no welcome in an industry that understands time as money.

Weighing against these concerns was a potential public relations disaster. Inquiries about whales from newsrooms across North America and Europe were flooding the DFO office in Moncton, New Brunswick, more calls—said one communications officer—than in the previous two years combined: "We would have our cell phones to our ears with our desk phones ringing and e-mails backing up on our screens."

The impact of stories about dead whales in Canadian waters was the stuff of a political nightmare. Never mind the message to tourists coming for a whale-watching cruise. What if the stories triggered demands from American conservationists for sanctions against imports of Canadian crab and lobster?

Fast Action at Last

Political hesitation ended on 11 August on a government wharf in Shediac, New Brunswick. "Canada takes the protection, conservation, and recovery of endangered species very seriously," declared Transport Minister Marc Garneau. "The recent deaths of several North Atlantic right whales in the Gulf of St. Lawrence are extremely concerning."[2]

The minister announced new restrictions on vessel speeds in the Gulf. To reduce entanglements, DFO Minister Romeo Leblanc had already closed one snow crab fishery and now promised to limit or delay others. He also pledged to keep better watch on whales in the Gulf and keep mariners better informed of where they were feeding. For scientists and environmentalists, the federal commitment was a measure of success. Ms. Wimmer was pleased to concede "we've never had action that swift before."

Moira Brown also looked back with satisfaction. She had done more than thirty media interviews. With many of her colleagues, she shares a perception that what you say to a reporter is rarely how it will be reported. Still, she felt obliged to respond when they called about 'the carnage in the Gulf'. And in the end, she said, it worked out for the whales.

"I think the news coverage has been good for increasing awareness of right whales," Brown said. "The media plays a role in public engagement for protection measures. This story went around the world and the politicians pay attention."

The story, of course, was far from over.

In September, the CBC New Brunswick produced an in-depth podcast series entitled "Deep Trouble: North Atlantic Right Whales in Peril."[3] Ships in the Gulf quickly put the new speed limits to test and federal authorities fined four—including a Canadian Coast Guard vessel—for ignoring them. Rather than slow down, cruise lines opted to stay out of the Gulf, a painful setback for

2 Government of Canada, "Statement by Ministers Garneau and LeBlanc on actions taken to address the deaths of whales in the Gulf of St. Lawrence," Transport Canada and Fisheries and Oceans Canada News Release, 11 August 2017, https://www.canada.ca/en/transport-canada/news/2017/08/statement_by_ministersgarneauandleblanconactionstakentoaddressth.html.

3 The "Deep Trouble" podcast series is available at http://www.cbc.ca/radio/podcasts/new-brunswick/deep-trouble/.

shopkeepers in Charlottetown, Prince Edward Island, and the Port of Gaspé, Quebec. The cruise industry argued it needed longer notice because tour schedules are set two years before sailing dates.

Four fatalities in American waters brought the death toll among North Atlantic right whales to 16 for the year. In October, DFO and environmental agencies issued a joint report. Necropsies had identified at least seven fatalities as the result of industrial activity: four by ship strikes and three by entanglement in fishing gear. Of the seven, five were males and two were females with ages ranging from two years to 37.[4] As Ms. Wimmer observed, "This makes this pretty much the deadliest year we've seen since the days of whaling."

A Sad Story with Progress?

A sad story, then? A story of too little, too late? Not entirely, not if it includes the impact of media coverage on this complex ocean issue. One measure was the response to "Let's Talk Whales," a public consultation the DFO initiated in August. In three months, more than 20,000 people responded with 200-plus suggestions about how to help the survival of not only right whales in the Gulf but also belugas in the lower St. Lawrence River and southern killer whales on the west coast of Canada. At an international whale conference in Halifax, scientists agreed the survival of the right whale species will require a management plan for the entire range through which the animals move rather than only the specific areas where they tend to congregate at different times of the year.

For government, the challenge was to translate this sense of urgency into action and to consolidate support for the measures announced in August. Early in 2018, well before a new snow crab season, DFO Minister Leblanc announced rule changes requiring fishermen to reduce the lengths of rope floating on the surface, maintain closer count of their traps and report any missing gear. Protecting endangered whales is, he said, "a responsibility that weighs heavily on all of us" and he described the rules as "meaningful action to address the threats to whales in a way that is also mindful of our partners."[5]

4 P-Y. Daoust, E.L. Couture, T. Wimmer and L. Bourque, *Incident Report: North Atlantic Right Whale Mortality Event in the Gulf of St. Lawrence, 2017* (Charlottetown, PEI: Canadian Wildlife Health Cooperative, Marine Animal Response Society, and Fisheries and Oceans Canada, 2017).

5 Government of Canada, "Minister LeBlanc announces new protections for whales," Fisheries and Oceans Canada News Release, 23 January 2018, https://www.canada.ca/en/fisheries-oceans/news/2018/01/minister_leblancannouncesnewprotectionsforwhales.html.

Complicating all plans, of course, were the right whales themselves. Acoustic monitoring of their calls had shown noticeable changes in migration patterns between 2010 and 2014.[6] In general, the places where they tended to gather had shifted further north along the Atlantic seaboard and for longer periods. In 2017, observers in the Gulf of St Lawrence counted 114 migrating right whales, the most ever, with some remaining in the area into October. Looking ahead, the story would be where they returned, in what numbers, and how well we learned to protect them.

6 US National Oceanographic and Atmospheric Administration, Northeast Fisheries Science Center, "Shifting Presence of North Atlantic Right Whales Tracked with Passive Acoustics," EurekAlert!, 15 November 2017, https://www.eurekalert.org/pub_releases/2017-11/nnfs-sp0111417.php.

Social Media and Twenty-First Century Public Engagement

Paul R. Boudreau
International Ocean Institute-Canada, Halifax, Nova Scotia, Canada

There are many competing ways for modern audiences to receive information and news of interest and importance to them. Researchers publish in scientific literature. Politicians and managers receive briefing notes from staff. The general population continues to receive information from radio, television, newspapers, and journals.

In 1998, in the foreword to Elisabeth Mann Borgese's book *The Oceanic Circle*, Ruud Lubbers wrote, "The new information and communication technology gives enormous possibilities to connect people and to empower people. Therefore the world is not any longer only a total of the nation-states; it is also about participatory democracy globally, and global sovereignty of peoples." This statement predates the widespread development and use of the Internet and in particular the twenty-first century phenomena referred to as 'social media'. I ask here whether we are in a position to see social media as addressing the possibilities envisaged by the Club of Rome in 1998.

At face value, social media is free to access, easy for individuals to contribute to and potentially more engaging than traditional sources, as it can be fine-tuned to the specific interest of the reader. But there is a question about this relatively new phenomenon: Is it a help or a distraction in regards to exposing and engaging the general public to the benefits and challenges facing our coasts and oceans? What roles might it play in responsible ocean governance?

One of the first issues concerning this question is the definition of social media. As a relatively new and quickly changing technology, it is difficult to strictly restrict the topic to present day online applications. Social media truly began to be a global communication tool with the launch and subsequent growth of Facebook, which started in 2004. Other common present-day tools include:

1) LinkedIn—launched in 2003
2) YouTube—launched in 2005
3) Twitter—launched in 2006
4) WhatsApp—launched in 2009
5) Instagram—launched 2010
6) Snapchat—launched 2011

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But this is by no means a complete listing. Sina Weibo is a social media tool that functions primarily within the regulations and policies of China. Even Wikipedia (launched in 2001) can be considered social media as it is built on contributions from individuals, albeit with a rigorous peer review process.

New and slightly different applications/apps continue to be tested in the marketplace. Snapchat, launched in 2011 with its temporary posting of images, appeals to users who are not interested in providing a lasting record, but just sharing transient moments of their lives. It is reasonable to believe that this class of communication tools will persist and evolve beyond the present-day collection.

The key characteristic of social media is that users are able to contribute to the online content. This can be done relatively easily and without cost by clicking on a button to indicate their like or dislike, or by providing their own text, photo or video. All of the content, published by individuals and organizations to a system, becomes accessible by anyone else on the system. Search engines such as Google facilitate access by indexing and allowing users to find material of which they may not otherwise be aware.

The key to the general success of social media is the removal of a burdensome review and approval process. In the case of the 'Arab Spring' in 2010, social media played a role in circumventing the intervention of the controlling political establishment by allowing direct communications with others of like-minded aims and goals. Social media, along with the replacement of desktop computers with powerful hand-held cellular phones, showed how it could affect the real change wished for by the people involved.

In regards to exposing society to critical information concerning the importance of the world's coasts and ocean, there are several challenges for social media. The first is the sheer volume of material published on social media. As the ease with which users can publish material increases, so does the volume of information online increase. This ultimately makes it more difficult to get any attention amongst competing interests. The challenge of 'big data' is a key concern for the technology and algorithms of the Internet, and gives large corporations and organizations the advantage in getting their message out. Individual users likely need to sort through the advertisements and pop-ups to get information from friends and family.

A second challenge related to the manipulation of social media content by corporations is the uneven playing field presented by their financial resources. Dedicated commercial interests expend great amounts of money and effort to sell their products. They are professionals with commercial aims that can outcompete for users' interest. Groups and organizations that are interested in promoting the various aspects of responsible ocean governance are not usually so well financed. Social media presence often competes with the many other applications of resources.

A third challenge of using social media as a means of communicating about the ocean and engaging the public in its governance is that users are becoming conditioned to be entertained, titillated, as well as informed. It is easy to raise a laugh with a video of a skateboarder crashing into a fence or to elicit a sigh from a kitten video, but for complex topics such as ocean governance or difficult questions requiring scientific research, it is a challenge to provide the right level of detail. Subtle research results or complex socio-political situations might be summarized down into a 140-word Twitter post, but it will certainly lose a lot in the translation. Yes, social media can present both sides of the story from pristine beaches to islands of plastic, but they exist amongst many more pet videos than informative and motivating oceans videos. With all of the published material from grandchildren photos to pornography, it takes dedicated effort to get responsible ocean governance properly presented.

Another challenge of social media use is the emphasis on the negative. In much of the discussion of ocean governance, there are often two or more sides to a challenge or issue. A public and open discussion online often has a tendency to trend towards the lower of the social interactions such as personal attacks. The anonymity of users is often seen as a mask behind which to hide the negative and derogatory comments that might never be voiced in face-to-face interactions.

On the plus side, social media in support of ocean governance has the same benefits as other fields of interest. For those already predisposed to the issues, social media provides a way of connecting without having to be physically geolocated. Now, interested individuals can establish, maintain and grow social connections wherever they live and work. For those who do not have the resources or inclination to travel to a scientific or policy conference, YouTube and Skype provide a means of participation. For those who can travel, social media tools may allow participants to maintain links beyond the end of the meetings.

As mentioned above, a reader's view of information on social media can be tailored to their interest. Thus, rather than relying on news editors and producers to select what information is to be presented in standard formats, the individual can ensure that the relevant information is being accessed. Additionally, Internet search tools such as Google can facilitate the identification and selection of new and additional useful sources of information that can be added to a user's portfolio. All of this helps those interested in the ocean and its governance keep in touch with the latest issues.

So, in the twenty-first century, what role can social media play in effective ocean governance? At the base of governance, is the interest and engagement of people. In democratic situations, including the shared resources of the world's oceans, it is critical for people to be aware of and interested in the costs, benefits, and sustainability of the services and resources that the oceans and coasts can provide. The basis of ocean governance is a knowledgeable population, making informed decisions and choices.

Social media provides an effective method for such engagement and provides a mechanism for sharing information broadly through simple and inexpensive tools such as the ubiquitous mobile phone. For illiterate populations, social media can provide information in audio and video forms—the latter being very effective when presenting scenes of dying, blood-soaked sharks or dying whales on a beach.

But the application of social media requires attention, awareness, and practice. These tools are constantly changing and effective users need to take full advantage of the changes. Users need to be aware that their efforts can be filtered and sorted so as to be less of a distraction to the other more powerful users. Social media requires the skills of translators who can communicate complicated and timely information in a fashion that will be recognized and picked up by users.

In summary, the relatively modern development of online electronic social media tools has to play a role in supporting responsible ocean governance, but it is unclear how it may be most effective. Social media can provide accessible, understandable content and engage broader audiences in a free and easy-to-use format, but it is not a simple task.

The Marine People Partnership: Building a Workforce for Our Ocean Industries through Ocean Literacy

Sherry Scully
Centre for Ocean Ventures and Entrepreneurship (COVE) and Marine People Partnership, Dartmouth, Nova Scotia, Canada

The announcement in 2010 of the National Shipbuilding Procurement Strategy[1] triggered murmurs of excitement across the broader marine industry in Canada. Embedded in this contract was a promise of meaningful contribution, beyond Canada's navy, to amplify benefits across the tiers and sectors of the marine industry. It also signaled a concomitant investment in the development of a present and future workforce to support these burgeoning industries. The announcement soon triggered ripples of additional federal and provincial investment and attention to ocean activities relating to research and observation, ocean technology innovations and entrepreneurship, and marine renewable energy. As the ripples of interest amplified across secondary and tertiary ocean sectors, optimism swelled at the possibility of establishing an integrated, modern, and sustainable national marine industry. But infusion of funding could only breath air into the lungs of the industry. It needed to be animated with people.

The need for an experienced and available workforce quickly became a much-debated topic that sparked predictions of skills shortages and competency gaps. These shortages and gaps were as much related to succession interruptions arising from a long prelude of relative inactivity in the central industry (i.e., shipbuilding), as they were to the reticence of employers or potential employees to pursue the type of deeply marinized training and specialization required to elevate workforce skill to the vanguard of the industry. Challenges of looming mass retirements were predicted, while entry level roles went ignored by a young cohort of new talent lured to higher profile industries. A robust national workforce strategy for the broader industry would have had

1 The National Shipbuilding Procurement Strategy was announced by the Canadian government for a new fleet of naval and Coast Guard ships. It is now referred to as the National Shipbuilding Strategy.

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to consider roles ranging from new apprentices and Red Seals[2] on the skilled trades side, as well as the engineering technicians, engineers, and other traditional professional roles on the design and innovation side. Add to that list the numerous operational, management, supervisory, business development, and project management roles that sustain these sectors and, finally, the research and observation roles that carve the academic anchors to the industry. In other words, just about every role that can conceivably be done in, on, or around our oceans. Perhaps because of this complexity, a robust national workforce strategy has yet to be launched.

With so much opportunity, it was hoped, and perhaps expected, that recruitment would present the lowest hurdle. But, for an industry that has been beset by disheartening cycles of boom and bust, repatriation of experienced workers from more stable or lucrative industries presented a daunting and immediate challenge. Any optimism in the ease of recruitment was doused by the reality that the industry, lacking visibility and prominence, was simply not on the career radar of our next generation of workers.

The Marine People Partnership (MPP) was formed in 2014[3] to examine these workforce challenges, focusing research and program development on building national workforce pipelines for the future. What became evident early in the project was the critical role that ocean literacy and career literacy would play in both re-orienting experienced domestic talent towards marine careers, and in cultivating sustainable succession by attracting new young talent. MPP activities, with an eye on the future workforce, have focused primarily on the latter group. The principal query being, how to engage future workforce in an industry that is prolific and yet invisible?

A study of more than 14,000 youth across the province of Nova Scotia challenged several prevailing assumptions, including that young people have (a) ample exposure to, (b) high levels of awareness of, (c) strong interest in, and (d) positive attitudes towards our oceans and their industries; all common prerequisites for career consideration.[4] Surprisingly, the study found that youth in the region do not have much exposure to oceans. Indeed, during the

2 The Interprovincial Red Seal Program was established to help harmonize training and certification requirements for skilled trades across Canada.

3 The Marine People Partnership was formed with support from Irving Shipbuilding as part of their value proposition commitment to strengthen the Canadian marine industry under the National Shipbuilding Strategy.

4 S. Scully, *Student Intentions and Perceptions Study: Findings, Analysis and Recommendations* (Halifax: Institute for Ocean Research Enterprise, June 2016), http://iore.ca/marine-people-partnership-mpp/.

pilot study conducted in Antigonish, Nova Scotia, a disproportionate number of students indicated that they had not visited the ocean in the past year, and most students could not recall the last time they had had an ocean encounter. Correspondingly, in the Primary to Grade 12 school system, few ocean concepts are included in the curriculum. Apart from an optional, non-academic science course offered in grade 11, there are limited opportunities to explore ocean sciences in the public-school system. These findings underscore the point that our youth have had limited opportunities for planned or spontaneous learning about our oceans from the two most obvious channels to do so.

The study also revealed low levels of awareness of the myriad marine sectors and careers, many of them operating literally in the students' backyards. Data from surveying more than 14,000 students indicated highest levels of awareness for traditional marine careers such as the Navy (87 percent), shipbuilding (64 percent), and commercial fishing (75 percent), but little awareness of other newer, non-traditional ocean careers such as ocean robotics (32 percent), ocean technologist (35 percent), and marine fitter (underwater welder—16 percent). This data suggested that public understanding of what comprised the region's marine industry had not progressed much beyond the turn of the century—the other century!

In a region surrounded by water, it is easy to assume that youth interest in oceans is both inherent and unavoidable. However, the study showed that only 13 percent of youth indicated they would be interested in a career in the marine industry. Even more disheartening were their explanations. Nearly 40 percent of open-text responses conveyed apathy or lack of curiosity towards oceans. The responses included:

- Grade 7 male, "because I don't have enough interest in the sea and stuff that has to do with that job"
- Grade 8 female, "I do not care about the ocean or anything that it inhabits. If jobs in the marine industry is all Nova Scotia has to offer, then I won't be living here"
- Grade 7 female, "because I don't have any interest in marine science"

Perhaps even more alarming was the 37 percent of youth who provided disparaging or fearful responses:

- Grade 9 female, "fish are gross and I don't care about whales"
- Grade 7 male, "because I hate fishing and getting dirty"
- Grade 6 male, "because I don't like being around the water where it's really cold"
- Grade 7 male, "because I don't like water its spooky"

Such fear, apathy or disdain for a resource that should inspire inquisitiveness and adventure must give pause to those of us tasked with educating the next generation.

Overall, open-text responses revealed that perceptions and intentions were subject to early bias formed from lack of information or misinformation:

– Grade 8 female, "because I am interested more in jobs that involve math and science"
– Grade 6 male, "because I would like to be an engineer when I grow up and I don't really like marine jobs in general"

Not only did these responses express opinions that were misinformed, they demonstrated that perceptions of ocean careers among this cohort remain anchored to stereotypes of traditional, brawn-oriented versus contemporary, brains/high tech-oriented careers. A second 2017 study, with Indigenous youth from Mi'kmaq community schools found similar results, demonstrating that these biases, in addition to being formed early, are pervasive across regional cultures.[5]

In addition to lack of exposure, awareness, misinformation, and lack of curiosity-born interest, another surprising factor at play was the region's marine heritage. A common assumption was that the region's long history of marine activities would work to favor attitudes and interest. Heritage seemed to work counterintuitively, reinforcing negative and narrow stereotypes and assumptions, and denigrating ocean careers rather than legitimizing them. Some youth indicated that they were directly coached by parents to not pursue ocean careers:

– Grade 9 male, "A large amount of my family has had a job related to the marine industry so I am aware that it would not be in my best interest to pursue one."

This revealed additional hurdles: (1) negative narration and (2) parental influence. Both point to a stark need for ocean literacy and career literacy for youth and their parents.

Formal ocean education has typically focused on life science and ecological concepts, as these present compelling and accessible curricular entry points. Ocean literacy is necessary to build awareness of other concepts and disciplines within the ocean domain, including marine engineering, technology, ocean economics, and other career themes. Several marine sectors lend themselves to an integrated curriculum that can include concepts relating to engineering, ecology, economy, and sustainability, as well as culture and society, and innovation and entrepreneurship. Where teachers themselves might not be well informed about regional ocean industries, several groups exist, like

5 S. Scully and A. Naylor, *Student Intentions and Perceptions Study: Mi'kmaq Schools. Report of Findings, Analysis, and Recommendations* (Halifax, NS: Institute for Ocean Research Enterprise, 2017), http://iore.ca/marine-people-partnership-mpp/.

MPP, OCEANS-NS, and Techsploration to provide the professional development and resources to support teachers in delivering experiential instruction.

We also need to look to extracurricular activities and programs like those offered through Nova Scotia Sea School to contribute to the ocean literacy offerings with experiential and hands-on opportunities.[6] A robust ocean education in school, coupled with extracurricular programs, can have expanded reach and impact, particularly to under-represented workers, including First Nations youth, females, new immigrants, and African Nova Scotians.

But a focus on ocean literacy in schools will only solve half of the problem. Studies have found that parents are the strongest influencers in young peoples' career decisions. Their influence is irrefutable and constant, from extra-curricular choices, to course selection, to spontaneous experiences and conversations at home, and of course, to post-secondary and career pathways. As the adage goes, a little information can be a dangerous thing, and in this case, it may inform negative narration that explicitly or implicitly steers young people away from emerging and fascinating marine industries. Ocean literacy initiatives must be augmented to have a dual focus that includes parents to help them build awareness, overcome bias of traditional industries, dispel perceptions of more privileged pathways, and to provide the endorsement that our young people need to consider an ocean career.

For some, interest and curiosity in the ocean is born from some exceptional experience that sparked a desire to know more. For some, their involvement in oceans has been serendipitous and uncalculated. Indeed, this has been true for many entrepreneurs in ocean technology and marine energy sectors who had a good idea that took off once applied to a marine environment. For others, it was the absence of direct experience that generated intrigue, letting imagination turn vicarious two-dimensional experiences into pivotal career deciding occurrences. This reminds us that the opportunity to engage youth does not require coastal access. Experiential learning is not reliant on 'sand between the toes'. It requires 'hands on' and 'heads on' exploration that can occur in any classroom or region.

Perhaps the most disheartening finding from the study discussed here, was that so many youth were dismissing an entire industry of potential career options for themselves because of lack of awareness, misinformation, and bias. Opportunities to cultivate engagement and curiosity had gone unexploited. Ocean literacy coupled with career literacy can address these issues and build awareness of the 'new' ocean careers and pathways. It can highlight the innovative and high-tech reality of modern-day ocean careers, unite previously

6 "Our Programs," The Nova Scotia Sea School, http://www.seaschool.org/programs.

polarized sentiments relating to ocean ecology and ocean economy, and leverage curiosity and cultivate it into passion. Marine careers aside, our youth simply need to be more informed about a key resource that covers 70 percent of the planet, of which less than 5 percent has been explored! Ocean industries generate C$4.5 billion for Eastern Canada's regional economy,[7] and provide approximately 35,000 jobs to families in the region.[8] We owe it to our youth to give them an opportunity to understand this resource and this industry better, so that even if they choose not to explore a marine career—it will at least be an informed 'no'.

7 Halifax Partnership, Halifax Investment Profile (2016).
8 "Halifax: Canada's Ocean City," Halifax Partnership, 2017, http://CanadasOceanCity.com.

Towards Ocean Peace: Resolving Disputes Cooperatively and Empathetically through Negotiation

Nayha Acharya
Schulich School of Law, Dalhousie University, Halifax, Nova Scotia, Canada

Introduction

Oceans have immeasurable value. They are replete with natural resources and food sources; they enable transportation and recreation; they regulate earth's climate. In sum, they make invaluable contributions to our physical, economic, and political well-being. And wherever there is something valuable, there are disputes over how that value should be maintained, grown, owned, and distributed. Internationally, disputes over maritime boundaries, access routes, drilling rights, and resource exploration are prolific. A sizeable bulk of international litigation is generated by ocean disputes. In the domestic context, disagreement among stakeholders as to environmental quality and pollution, natural resource management and conservation, geo-engineering, and ocean-based research and technology, are just some arenas of ocean-related disputes. Given the inevitability of such conflicts, it is prudent to consider how we ought to resolve our disputes when they arise. In this essay, I offer some reflections on the utility of informal dispute resolution through cooperative negotiation as a means of resolving ocean-based disputes responsibly and peacefully.

I note at the outset, though, that formal processes of dispute resolution, that is adjudication through a court or tribunal, are necessary for effective governance.[1] Formal processes produce binding outcomes and set legal precedents, their outcomes are public, and the procedural safeguards that characterize formal dispute resolution can help prevent abuses of natural justice and ensure the rule of law. Without formal dispute resolution mechanisms in place if needed, negotiated outcomes are less likely to be fair and equitable—absent any formal oversight, a more powerful party can easily force an agreement

1 Part XV of the United Nations Convention on the Law of Sea, Montego Bay, 10 December 1982, 1833 *U.N.T.S.* 397 [UNCLOS], contains complicated dispute resolution stipulations. It includes a formal, mandatory process for dispute resolution, while anticipating that states will pursue consensual, informal methods of disputes resolution, with an emphasis on diplomatic negotiation; see N. Klein, *Dispute Settlement in the UN Convention on the Law of the Sea* (Cambridge: Cambridge University Press, 2005).

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upon a less powerful party. But the necessity for robust formal processes should not be taken to mean that they are the most preferable means of resolving disputes. Formal processes tend to be expensive, slow, adversarial and antagonistic. Moreover, they are limited in terms of remedies, because decisions tend to be of an 'all or nothing' nature—one side will win and the other will lose. Resolving disputes through negotiations, on the other hand, offers faster decision-making, a more cooperative and empathetic process, and the possibility of jointly crafting creative win-win solutions. As such, the relationships between parties to the dispute, be they international or domestic, have a better chance of remaining amicable, mutually beneficial, and peaceful for the long term.

Theoretical Approaches to Negotiation

Negotiation strategies and their underlying theories can be divided into two categories: distributive models and cooperative models. Distributive models are sometimes referred to as competitive, positional, or adversarial. They are characterized by the idea that negotiation involves a fixed amount or benefit, so the more one side loses, the more the other gains. Given this basic assumption, negotiators focus on getting the biggest piece of the pie. Negotiators may employ tactics and strategies including opening with a strong position that is likely higher than their estimate of what they can realistically achieve; they may give very small concessions to the other side; they may withhold certain key information. Such a negotiator may come across as tough, demanding, adversarial, and perhaps unempathetic to the other party. That negotiator may seem ideal to her own constituents because of her commitment to maximizing her gains. But there are risks associated with this negotiation style: it may cause an early impasse and prevent a settlement, it may result in exploitive behaviour, or it may damage important relationships.

Cooperative negotiation, sometimes called integrative negotiation or problem-solving negotiation,[2] is foundationally different. This model has become widely popular through Fisher and Ury's classic best-seller *Getting to Yes*.[3] In this model, negotiation involves parties seeking to cooperatively maximize joint gains. It encourages participants to move away from seeing negotiation as positional and competitive, and seeing it instead as interest-based and

2 C. Menkel-Meadow, "Toward Another View of Legal Negotiation: The Structure of Problem Solving," *UCLA Law Review* 32, no. 4 (1984): 754–832.

3 R. Fisher, W. Ury and B. Patton, *Getting to Yes: Negotiating Agreement without Giving In* (New York: Penguin Books, 1991).

cooperative. That is, parties should try to understand one another's interests and brainstorm mutually beneficial solutions that are objectively advantageous for everyone. That underlying approach to negotiation sets the stage for negotiators aiming to achieve principled outcomes rather than seeking to 'win' a negotiation.

One of the central features of integrative negotiation is that participants focus on the interests at stake rather than the positions of the parties. Fisher and Ury provide a classic example to illustrate the difference between positions and interests: two sisters are fighting over a single orange. Ultimately, they decide that the best solution is to cut the orange in two with each receiving half. One sister then squeezes the orange for a juice and discards the peel. The other sister grates the peel for her baking and discards the pulp. Both sisters took the position that they wanted, and were entitled to, the entire orange. But if they had discussed their interests in the orange, i.e., why they wanted the orange, both could have benefitted more—one sister could have had all the pulp, and the other could have had the entire peel. This simple example illustrates one of the central messages of cooperative negotiation: when we focus on interests instead of positions, we have a better chance at maximize the value of the resource being sought. This is sometimes referred to as 'expanding the pie'. It is not difficult to imagine a similar, albeit very simplified, example in the ocean's context: one state may be interested in sovereignty over waterways for political advantage, while another may prioritize its interest in resources. Understanding differences in the interests that underlie the party's positions paves the way for creative, mutually beneficial solutions.

Uncovering interests is best achieved through an empathic probing into why a party takes a position, and determining what needs are being satisfied through that position. There are a variety of interests and associated needs. Naturally, economic needs are prevalent, but there are others. Some disputes involve process interests, where parties have a stake in ensuring that disagreements are resolved in a manner they consider fair. This was the case during policy negotiations around the type of dispute resolution process that should be stipulated in the United Nations Convention on the Law of Sea (UNCLOS). In some disputes, parties may have a special interest in preserving an ongoing relationship. This may be relevant in ocean-use agreements between neighboring states, or disputes involving the federal government and aboriginal groups in a fishing related dispute, for example. Disputes may even involve personal interests, where a party needs to feel respected, or feels they must preserve their reputation. Some such personal interests may have cultural nuances, which could be especially relevant in international ocean negotiations, so increasing one's cultural intelligence can be a key part of achieving effective negotiation as well as maintaining positive relationships. Ultimately, cooperative bargaining demands an astute awareness of the interests and needs of all parties, and views negotiation as an opportunity to create value through uncovering interests that may be complementary to each other. The bottom line: the more effort we make to understand each other, the more likely we are to get to effective settlements.

To some, this may seem idealistic. The theory of cooperative negotiation has been criticized as being descriptively inaccurate because it downplays the prevalence and even the benefits of distributive bargaining.[4] Critics suggest that no matter how much one 'expands the pie', eventually the pie must be divided up. Sometimes, negotiations simply come down to a zero-sum game in the sense that the more one party loses, the other party gains. For instance, in an ocean boundary dispute, one mile gained is one mile lost for the other side. In that context, critics ask, what is the place of cooperative bargaining? Would it not be beneficial to take a competitive stance and maximize one's own gains?

It is undoubtable that settlement of disputes will involve some distributive elements.[5] But proponents of cooperative negotiation would suggest that even in situations that are purely distributive in substance, parties do have at least one significant joint interest—an interest in resolving the difference quickly and amicably to settle the dispute and preserve the relationship between parties, if possible. As such, the parties must cooperatively engage in a process that will enable a quick and fair solution. And although the substantive issue may be distributive in nature, competitive, hard bargaining is not the only possible process for resolving the dispute. Perhaps parties appoint a facilitator or mediator to assist in their negotiation. Or perhaps they appoint a jointly acceptable arbitrator and agree to be bound by the decision. Such processes may satisfy both parties' procedural and relational interests and can ensure that the ultimate distribution of value will be fair. So, even in distributive situations, parties can still benefit from committing to a cooperative relationship.

Moreover, cooperative negotiating does not imply over-accommodation, nor does it advocate for prioritizing opposing interests over one's own. Part of the cooperative negotiator's tool kit is to rely, and insist, on objective criteria to justify the positions and interests they have, and to assess the legitimacy of

4 For a well-known debate, see J. White, "Pros and Cons of 'Getting to Yes'" and R. Fisher, "Comment on White's Review," *Journal of Legal Education* 34 (1984): 115.

5 See D. Lax and J. Sebenius, *The Manager as Negotiator: Bargaining for Cooperation and Competitive Gain* (New York: The Free Press, 1986) for an early integration of cooperative and distributive negotiation models.

the position and interests that other parties have. Such objective criteria may include opinions of scientific experts, jointly or independently obtained data, or the likely outcome of a formal dispute resolution process. Adopting such objective criteria to explain and evaluate positions taken can help to maintain legitimate outcomes, which may even include walking away from a negotiation.

The fundamental point is that when parties adopt a cooperative approach to negotiation, they commit to the values and ideals that inhere in that model—like empathic listening, mutual problem-solving, avoiding exploitation of parties or resources, and obtaining objectively legitimate outcomes. Adopting those principles makes for strong and responsible settlement of conflicts. It would also be in line with the spirit of the UNCLOS, which was "promoted by the desire to settle, in a spirit of mutual understanding and cooperation, all issues relating to the law of the sea…"[6]

Final Comment

Humanity owes its existence to the oceans. In grateful recognition of that, we should strive to ensure that when we quarrel over the ocean, we do so gracefully and peacefully. This requires solid formal procedures in place for when disputes break out, but it equally requires that we learn to manage our conflicts cooperatively. The theory of principled, cooperative negotiation offers useful guidance. It highlights the need for a clear awareness of the shared interests we have in our oceans. It demands that we are empathetic to those whose interests may compete with our own. It calls on us to be imaginative and creative to maximize the oceans' value for all of us without abusing it. Embracing these demands as we work to resolve conflicts would best enable us to make a necessary promise to preserve our oceans and maintain *pacem in maribus*, peace in the oceans.[7]

6 UNCLOS, *supra* note 1, preamble.

7 *Pacem in Maribus* is the title of the series of 34 conferences focused on peaceful use of the sea, initiated by Elisabeth Mann Borgese under the auspices of the International Ocean Institute in 1970.

SYNTHESIS

Looking Ahead: Ocean Governance Challenges in the Twenty-First Century

Dirk Werle, Paul R. Boudreau, Mary R. Brooks, Michael J.A. Butler, Anthony Charles, Scott Coffen-Smout, David Griffiths, Ian McAllister, Moira L. McConnell, Ian Porter, Susan J. Rolston, and Peter G. Wells
International Ocean Institute-Canada, Halifax, Nova Scotia, Canada

In her career, Elisabeth Mann Borgese provided an eloquent and enduring analysis of ocean governance. This collection of over eighty essays endeavors to honor, update, and advance her exceptional contributions. The contents of this book also reflect, to a considerable extent, substantial elements of the International Ocean Institute's long-standing training programs which she initiated. In this final chapter, we offer a synthesis of the essays, highlighting some of the most significant future challenges of ocean governance and, by implication, capacity development.

Our approach involves two basic steps. First, we identify major present-day pressures, problems, and concerns that are raised repeatedly in this book and link these concerns to fundamental and persisting ocean governance themes, originally highlighted by Elisabeth Mann Borgese. Chief among these are the progressive development of the 1982 United Nations Convention on the Law of the Sea (UNCLOS); sustainable development of renewable and non-renewable ocean resources; conservation and protection of the marine environment; maritime security and transportation; enhancement of marine science and technologies; and addressing the interrelated problems of ocean space as a whole and their interactions.[1] Finally, we point to key questions, challenges, and opportunities that are likely to confront practitioners of ocean governance and the development of capacity over the coming decades of the twenty-first century.

When considered in their entirety, the essays in this book reveal a significant number of overarching and frequently mentioned concerns with ocean governance, the marine environment, and human use and impacts on the ocean. We suggest that they fit broadly into four major categories:

1. The first category includes major environmental problems and population pressures. As many scientific studies have clearly demonstrated, marine environments and ecosystems have been threatened for years

1 E. Mann Borgese, *Ocean Governance and the United Nations* (Halifax: Centre for Foreign Policy Studies, Dalhousie University, Revised Edition, August 1995), see p. 231, Article 20.

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and are facing daunting pressures from climate change, overfishing, and seemingly relentless urbanization and population growth in coastal areas.

2. The second category deals with institutional responses to these problems and pressures. The emergence of modern regimes of ocean governance and multi-faceted responsibilities since the implementation of UNCLOS—a multilateral treaty advanced and emphatically supported by Elisabeth Mann Borgese—led to great advances in ocean governance. However, major challenges remain, particularly in seeking its effective implementation in a globalized world.
3. The third category includes modern technology, as almost all uses of the ocean and ocean-related knowledge generation depend on it. Technology can cause many problems, but it can also be a positive force considering the almost ubiquitous reach of communications and advances in marine navigation, safety, and ocean observation capabilities. The challenge is to maximize the benefits and minimize the problems.
4. The subject matter of the fourth category relates to the principle of responsible governance itself. Past failures in ocean governance, exemplified by several high-profile fishery collapses, led to increasing attention to participatory approaches and the broad involvement of coastal communities, and civil society as a whole. Achieving the right level of such engagement remains a challenge in many countries and within many regional and global bodies.

Below, we provide a synthesis of the interrelated environmental, institutional, technological and societal issues that have a significant bearing on the future of ocean governance and, by extension, on the development of our capacity to advance its responsible application.

What Are the Major Environmental Problems and Pressures Facing the Ocean Today?

The most significant pressure and impact on the marine environment over the coming decades will be exerted by an ever-expanding human population from currently 7.5 billion people to an estimated 11 billion by the end of this century. Fundamental reforms in human society are needed if we are to shift the current trajectory based on outdated political and economic systems toward a future guided by the principles of a sustainable ecological civilization. Problems will be amplified by the fact that major population centers and related infrastructure will be further concentrated along coastal areas exposed to sea level rise in an age of global climate change. The science-related essays in this volume have identified some of the challenges facing the oceans and how leading-edge research, aided by rapid technological advances, can address them. Understanding ocean health and regular state-of-the-ocean reporting through global ocean assessments are critical to policy formulation and decision-making for effective ocean governance. As the UN World Ocean Assessment Report for 2016 has shown, the value of science and communication for pinpointing the most pressing environmental problems is enormous.[2]

Climate change generates major pressures on ocean ecosystems with significant effects on marine biodiversity. It results in changing water temperatures, sea level rise, loss of polar (Arctic and Antarctic) ice cover, increased acidification, stronger storms, and enhanced coastal erosion, amongst other impacts. This exacerbates the effects of many ocean uses. In particular, fisheries and aquaculture (especially small-scale) contribute greatly to food security in many nations. Some fisheries severely impact marine habitats and both target species and non-target bycatch species to the point where fishing is now recognized as the dominant and enduring driver of ecological change. Scientific studies have recognized other pressures as well. The ocean is too often a dumping ground, with increasing levels of persistent and bio-accumulative chemical contaminants, excessive nutrients, plastics and microplastics. Undersea noise from ships and industry is an increasing concern, as are deep-sea mining, and offshore wind farms. Coastal ecosystems will likely degrade further due to the cumulative effects of such pressures, unless more regulations are enacted and enforced under national legislation of coastal states and under established international law. Despite some progress, the human footprint remains huge, costly, and often permanent.

On the positive side, monitoring the state of the ocean using innovative tools and ecological indicators has added greatly to our knowledge of this footprint. Much of our knowledge of the above problems is gained through rapid advances in ocean technologies, such as tracking species of interest by satellite and applying genomics in marine ecotoxicology and aquaculture. Complementing the efforts of governments, educational institutes, and non-governmental organizations, such monitoring activities should engage all parts of society, allowing citizen science to play an increasingly vital role to observe and measure physical, chemical, biological, as well as ecological aspects of ocean health and coastal habitats. Notably, local communities worldwide can be involved in both monitoring and action to improve marine and coastal environments, as well as in the oversight of marine protected areas and

2 "United Nations World Ocean Assessment I," United Nations (last accessed 2 April 2018), http://www.worldoceanassessment.org.

marine spatial planning processes, integrated coastal management, ocean assessments, and marine problem resolution.

As more people live in coastal cities and on remote islands, recognizing the threats and benefits of the ocean related to public health and well-being will become a major imperative for marine environmental protection. In this century, the ocean sciences, health professions, ocean technology, and citizen science will increasingly be inter-connected and linked to the practice of ocean governance at all levels.

Are Current Institutional Arrangements and Principles Robust Enough to Deal with Future Ocean Governance Challenges?

As Elisabeth Mann Borgese advocated, the ocean has been a focal point for achieving improved global governance. A pragmatist, she understood the importance of compromise and the incremental pace of change with so many interests, institutions, and issues involved. It is positive news, therefore, that the international community has 'edged forward' in developing and integrating ocean governance principles in the legal order and related institutional arrangements, transcending the traditional concept of sovereignty. The progressive development and implementation of UNCLOS provides a framework for examining ocean governance institutional arrangements and actions at the local, national, regional, and global levels—confirming the 'commons' nature of the ocean and its resources.

Despite decades of progress, numerous issues remain inadequately addressed or are only slowly emerging in the ocean governance system. Examples include climate change and the ocean, the protection of marine biodiversity in areas beyond national jurisdiction, integrated bioregional coastal and marine spatial planning, and the Arctic regimes. Ocean renewable energy and offshore aquaculture hold great promise for addressing human security needs but will require appropriate governance. Addressing the situation of coastal communities and small island developing states in the face of climate change-related events is a priority. Exploitation of the mineral resources of the deep seabed will trigger disputes involving states, contractors, and the International Seabed Authority. Conflicting maritime boundaries and long-standing disputes, for example in the South China Sea, remain unresolved. Continuing problems such as piracy and the waves of human migration by sea illustrate the need for holistic approaches across national, regional, and international agencies.

There remains the imperative of applying the principle of common heritage in ocean management measures. A vehicle for this is Agenda 2030's Sustainable Development Goal 14 (SDG 14), "Conserve and sustainably use the oceans, seas and marine resources for sustainable development." SDG 14 explicitly recognizes the importance of oceans, and its related targets reaffirm the objective of implementing international law as reflected in UNCLOS. At the same time, a key requirement is to link together the SDGs, so that Elisabeth Mann Borgese's vision of the oceans as a means to improve social and economic justice is reflected in how SDG 14 connects to other SDGs on poverty reduction and food security, for example.

The ongoing challenge is to overcome the fragmented governance of the global ocean that has emerged. The rule of law (or rules-based order) is vital to the future stability of ocean governance. Legal institutions established under UNCLOS, such as the International Tribunal for the Law of the Sea, have helped to ensure effective dispute resolution and establishment of maritime boundaries. Key ocean governance issues for maritime transportation have been addressed through a more proactive International Maritime Organization (IMO) resulting in, for example, emission control areas and the 2004 Ballast Water Management Convention. The shipping industry has actively engaged in developing the necessary common environmental and security governance systems through entities such as the Global Maritime Forum and the IMO.

Achieving security on the ocean and along its coasts will require the adoption of a 'comprehensive human security' approach to governance. Improving enforcement and compliance, particularly on the high seas, will require inter-sectoral cooperation among governance bodies. The continuing struggle to implement modern management principles such as the precautionary approach in decision-making and the ecosystem approach affects sustainability of the broader marine ecosystem. Going forward, a coherent and integrated governance framework will be essential to achieving *pacem in maribus*.

The necessary conditions for responsible ocean governance go beyond legal and institutional arrangements and policies, although these are fundamental. Ethics and shared values are essential tools for the conduct of decision-making. Responsible governance requires the use of the best scientific knowledge, including information from Indigenous knowledge systems, to improve our understanding of ocean systems and to meet our responsibilities to all living beings and generations yet to come. Human capacity development, knowledge transfer, and enhanced public awareness are essential to broaden participation in governance institutions at all levels. Technological advancements and innovation are further avenues to strengthen institutional arrangements for ocean governance and enhance cooperation among stakeholders.

What Are the Technological Challenges and Opportunities?

Applications of science and technology are expanding in many marine domains, becoming essential information infrastructure elements for society and the individual. They manifest themselves daily in the spread of Internet connectivity, more detailed marine environmental forecasts, transportation efficiency, and renewable and non-renewable resource exploitation capabilities. Moreover, the spread of Internet connectivity offers opportunities for increasing the scope and range of capacity development and training and for transcending gender barriers.

Widespread and timely access to data and information will be key to enhancing ocean governance. Information gathering and sharing via geospatial data infrastructures will be essential not only for synoptic marine-environmental observation, state-of-the-ocean reporting, and more detailed exploration of ocean space, but also for ensuring safety and security for the growing number of marine operators and improving fisheries management practices. Designing data and information products for the purpose of decision-making and compliance monitoring will require good coordination among technology providers and users. Given the high stakes and far-reaching outcomes, they will also need political will, governance structures, and effective institutional environments. Cybersecurity will likely present critical challenges for marine operators; GPS and 'Internet of Things' hacking are key vulnerabilities for which technological solutions are still needed. In maritime transportation, blockchain technology and cryptocurrencies will alter global trade transactions. The adoption of autonomous shipping will be likely a niche opportunity for the industry, but this may change over the long term.

Spurred on by Agenda 21, Rio+20 and Agenda 2030, recognition of the societal benefits of the ocean has grown immensely, as they provide essential value to human beings, entire industries, nations, and indeed the world. However, although the reach of technology in this digital age is pervasive, the benefits are not universal, their distribution is not equal, and they come at a price, presenting ongoing and increasing challenges for governance. In the future, broad-based and equitable access to the benefits of technologies will be even more important. Digital technologies can offer many opportunities; they play a supporting, even transformative, role in bridging the scientific and technological knowledge gap between developed and developing economies and governance systems. As a case in point, the development and deployment of underwater robotics and space-based observation and navigation technologies may be the domain of relatively few actors, but use of and benefit from these systems can be realized by multiple stakeholders and broad-based communities of practice. The reach of technology will become even more pervasive, not only in spatial–temporal terms concerning frequent global and site-specific monitoring, but importantly in terms of the proliferation of users—witness the development of two-way data mapping platforms for participatory geographic information systems to facilitate collaboration and communication among governments and citizens.

It remains unclear what the evolving technology situation will be. The shipping industry, among other ocean industries, needs transition time to incorporate new technologies. Transition time is also needed to protect existing investments. The adoption of autonomous shipping, robotics for underwater observations and drones is already presenting opportunities for ocean industries, which will require new infrastructure to transfer large volumes of data. Over the long term, increasing technological capacity will broaden the scope of how we monitor and utilize the ocean; it may even transform how humans relate to and interact with ocean space. Will technology resolve the mysteries of the deep sea? Likely not, but within the confines of good ocean governance and adequate capacity development, it can illuminate them and should help to better protect and preserve the marine environment.

Who Will Shape the Future of Ocean Governance?

Addressing all of the above challenges is no simple task. Ocean governance can be a 'wicked problem', demanding a transdisciplinary perspective and embracing holistic and innovative approaches to understanding problems and finding solutions. Fortunately, there is—around the world—an 'ocean community' with the passion and ideas to take on the challenge, based on a commitment to the principle of the ocean as our common heritage and to the rule of law. The ocean community is itself made up of coastal communities, with their collective desire to maintain healthy and productive ocean environments close to home, as well as ocean users dependent on and making a living from the sea. The ocean community also includes a diverse range of actors—researchers, educators, practitioners, managers, and the public—covering many research areas, professions, vocations, cultures, and interests. There are also all the related governance institutions, funding agencies, and civil society organizations worldwide, with national, regional, and international mandates and areas of interest.

All of this complexity and diversity can create obstacles to as well as opportunities for effective cooperation. But ultimately, we have confidence in the collective action of people, their communities, and their institutions, to make the difference. There is no end to what can be achieved by a motivated coastal community, or a motivated nation.

Effective ocean governance at all levels, from the local to the global, requires identifying and agreeing upon priorities and goals. Globally, international agreements and institutions, based on UNCLOS, are effective when they have support and advocacy from the diverse ocean community. Nationally, governments can, through determined political will, take the leadership needed to meet national commitments and targets.

These global and national initiatives draw strength and support from the ocean community—those engaged in ocean concerns worldwide. As the challenges of ocean governance continue to grow, so too can the strength and support of the ocean community—through engaging more people, more coastal communities, and more institutions. In order to develop this capacity, effective communication, networking, and partnerships are needed. On the one hand, effective communication needs clear expression of goals and alternatives, and skillful storytelling by everyone in the ocean community—scientists, educators, Indigenous peoples, coastal residents, advocates and more. On the other hand, networking and partnerships build engagement and strengthen the ocean community. This comes through participatory governance—whether local, national, regional, or global—that is rooted in shared values that embrace human rights and gender equity. Such governance benefits from up-to-date connections of people and institutions, to identify and take advantage of opportunities, and to deal with threats. Particularly important are partnerships with, and learning from, Indigenous communities and organizations, which bring traditional knowledge, as well as proven approaches, to sustainability.

A final point, as we work to improve future ocean governance, is to keep in mind those who are most vulnerable among coastal residents and ocean users. This was, for Elisabeth Mann Borgese, a crucial imperative. The implication is that the impacts of ocean governance innovations must be carefully examined. In seeking to broaden the ocean community, there is a need to engage and empower the vulnerable, so that they, too, have the capacity to play their role in shaping the future of ocean governance. The complexity and the global scale of ocean issues and conflicts are causes for humility. We live in an uncertain world, so there is no obvious path to success. There is, instead, a need to be adaptive and flexible, to cope with upcoming events and crises that we cannot predict. This will be a challenging way forward, but one that the ocean community will undertake together to forge the future of ocean governance.

Looking Ahead

Looking ahead, there are numerous uncertainties in dealing with the multitude of challenges facing the ocean and advocacy for comprehensive security, sustainable development, and respect and dignity of marine and human life. Major pitfalls lie in further fragmentation of ocean governance, losing sight of the guiding principles of responsible governance, and weakening the concepts of common heritage and environmental stewardship of ocean space. The ocean community would do well to remind itself of the advice offered by Elisabeth Mann Borgese:

> A vision of the future is our best defense. … The disintegrative forces are powerful. But so are the integrative forces. Analyzing them, utilizing them, building on what they have already achieved, trying to contribute to a vision of the future ….[3]

These are tasks that we have to focus on. As an integrative force, the innovations she initiated toward developing the necessary capacity, including professional training, continuous knowledge exchange, and learning about the ocean, are in themselves essential conduits for building a successful future of ocean governance.

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3 Mann Borgese, *supra* note 1, 243 and 246.

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