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Noise Pollution, the Oceans, and the Limits of International Law

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I. INTRODUCTION

The oceans of the world are becoming increasingly noisy. The primary sources of the new noise are commercial shipping, seismic surveys, and military sonar. Many of these sources of noise appear to have a detrimental impact upon many species in the ocean. Although the scientific questions are being resolved, the legal frameworks through which this problem must be dealt are already mapped, due to the fact that the UN Convention on the Law of the Sea (UNCLOS) is very clear on both the principles to be applied and how it is to be done.[1] In this regard, the framework of UNCLOS neatly divides up the areas of concern of commercial shipping to the International Maritime Organization (IMO); of seismic testing to the sovereign state within its exclusive economic zone and the International Seabed Authority (ISA); and of pollution caused by military vessels to sovereign immunity. The problem that avails from this scheme is that none of these regimes is adequately addressing the difficulty at hand.

II. NOISE

Physically, there is no distinction between sound and noise. Sound is a sensory perception, and complex patterns of sound waves are commonly identified as sources such as music, speech, or noise. While sounds may be desired, noise usually is not and is often considered a nuisance as it is the wrong sound, in the wrong place, at the wrong time. This identification of displeasure may be because the word 'noise' is derived from the Latin word 'nausea,' meaning seasickness.[2] The link to seasickness may have developed because of the importance of the ear to both seasickness and noise.

The hearing of sound depends both on the sound frequency, which is measured in hertz (Hz), and the sound pressure on the eardrum, which is measured in decibels (dB). The unit, A-weighted dB(A), is used to indicate how humans hear a particular sound. A soft whisper at one metre is about 30 dB(A). Noise levels below 30 dB(A), although often audible, are typically recognized as 'low

[1] UN Convention on the Law of the Sea, 21 I.L.M. 1261 (1982) [UNCLOS].
[2] H. Fowler, ed., Concise Oxford Dictionary, at 804 (8th edition, 2009).

frequency.' For a good night's sleep, sound levels should not exceed 30 dB(A) for continuous background noise. Although there are some forms of low-frequency noises that may need to be lower, individual noise events exceeding 45 dB(A) should be avoided. The sound pressure level of normal speech is about 50 dB(A), but for it to be intelligible and not masked, surrounding sound levels should be less than 35 dB(A). In a busy restaurant, the level is roughly equivalent to 55 dB(A), while 75 dB(A) is approximately the noise level that can be heard at a very busy intersection. Densely travelled motorways may generate noise levels in the range of 75 to 80 dB(A), heavy industries (such as ship yards) average around 94 dB(A). Portable music devices that plug directly into the ear, and some music festivals, can exceed 100 dB(A). A chainsaw can reach 110 dB(A). 'Boom cars' equipped with powerful stereo systems can hit 140 to 150 dB(A) (the equivalent to standing next to a Boeing 747 with its engines at full throttle). To avoid acute damage to the inner ear, adults should never be exposed to more than 140 dB(A) of noise, even for very short periods. For children, the level is 120 dB(A).[3]

Noise behaves differently in the ocean. Although the ocean is relatively opaque to light, it is relatively transparent to sound. Depending on the conditions of depth, temperature, salinity, and surface and bottom conditions, sound can travel four times faster in water than in air. Depending on the variability of conditions, sound velocity reaches speeds of up to 1,600 metres per second in seawater as compared with 350 metres per second in air. Moreover, transmission loss in water is much lower. Thus, noises can be heard at great distances. It is expected that as the oceans change in terms of acidity in some places (due to climatic change), existing noise absorption of sound below 1 kHz could be decreased by up to 40 percent.[4]

Background, or ambient, noise occurs in all oceans and seas. Natural geophysical sources include wind-generated waves, earthquakes, precipitation, and cracking ice. Natural biological sounds include whale songs, dolphin clicks, and fish vocalizations. Anthropogenic sounds are generated by a variety of activities, including commercial shipping, geophysical surveys, oil drilling and production, dredging and construction, sonar systems, and oceanographic research.[5] Despite the myriad of such sources of anthropogenic noise in the ocean, this article is

[3] A. Coghlan, *Dying for Some Peace and Quiet* 195 New Scientist 6 at 6-9 (25 August 2007); R. Chepisuik, *Decibel Hell* 113 Envt'l Health Perspectives A35 at A37 (2005); World Health Organization, Guidelines for Community Noise, at 8 (2004); G. Leventhall, A Review of Published Research on Low Frequency Noise and Its Effects (2004); P. Alberti, Pathophysiology of the Ear, at 63 and 66 (2003); V. Mercier, *Is Electronically Amplified Music Too Loud?* 4 Noise and Health 47 at 48 (16 April 2002).

[4] C. Brahic, *Hearing the Carbon Jolt Loud and Clear* 199 New Scientist 6 at 10 (27 September 2008).

[5] G.L.D.' Spain et al., *Properties of the Underwater Sound Fields during Some Well Documented Beaked Whale Mass Stranding Events* 7(3) J. Cetacean Research & Management 223 at 223-38 (2005-6); P. Zakarauskas, *Underwater Acoustic Ambient Noise* 87 J. Acoust. Soc. Am. 2064 (1990).

only going to examine the three most prominent sources, namely those caused by seismic exploration, military sonar, and shipping.

Noise generated for seismic exploration is a method of exploration geophysics that uses the principles of seismology to estimate the properties of the Earth's subsurface from reflected seismic waves. This method requires a controlled seismic source of energy, such as dynamite, a seismic vibrator, or a specialized airgun. By noting the time it takes for a reflection to arrive at a receiver, it is possible to estimate the depth of the feature that has generated the reflection. Seismic surveys are central to the oil and gas industry. Seismic surveys are also used to gather data for mapping the continental shelf of countries, so they can apply for extensions to their exclusive economic zones.

The source that is most often used in geophysical surveying in the ocean is the seismic airgun. This tool largely replaced the use of dynamite for the same purpose in the 1960s. Airguns are generally used in clusters and are fired at regular intervals, up to six times per minute. The airguns release compressed air to generate the seismic signals at regular intervals, typically every twenty-five metres as the vessel moves. Each time an airgun is fired, it releases a bubble of compressed air. The sound pulse is directed down into the various geological layers in the subsurface. Despite its downward aim, it also ends up being radiated in horizontal directions. The back-scattered signals are registered by several groups of hydrophones mounted in cables towed behind a vessel. The three possible methods that utilize this technology are known as 2-D, 3-D, and 4-D, with each variant producing different types of information related to the different periods of exploration. In terms of decibels, seismic airgun arrays have maximum noise levels at source in the 200 to 250 dB(A) range. Additional tools known as 'sparkers' and/or 'boomers' are high frequency devices that are generally used to determine shallow features in sediments. Typical source levels from these tools are between 204 and 220 dB(A). Modern seismic signals, especially when generated at a lower frequency (within the 20 to 50 Hz bandwidth) may be received thousands of kilometres away from the source if spread in a sound channel. The Gulf of Mexico has the highest level of oil and gas exploration in the world, with an average of about twenty-five offshore oil exploration crews in operation at any one time, conducting over 900 seismic surveys each year. Other areas of particularly high seismic activity include the North Sea, Nigeria, Brazil, Malaysia, Indonesia, India, the northwestern coast of Australia, and Sakhalin Island (in Russia).[6]

[6] J. Hildebrand, *Anthropogenic and Natural Sources of Ambient Noise in the Ocean* 395 Marine Ecology Progress Series 5 (2009); J. Gedamke, Initial Quantification of Low Frequency Masking Potential of a Seismic Survey, Doc. SC/62/E12 (2010); S. DeRuiter et al., *Modeling Acoustic Propagation of Airgun Array Pulses* 120 J. Acoust. Soc. Am. 4100 (2006); D.E. Bain et al., *Long-Range Effects of Airgun Noise on Marine Mammals: Responses as a Function of Received Sound Level and Distance*, Doc. IWC-SC/58E35 (2006); S.L. Nieukirk et al., *Low-Frequency Whale and Seismic Airgun Sounds Recorded from the Mid-Atlantic Ocean* 115(4) J. Acoust. Soc. Am. 1832 (2004).

The utilization of noise, in either passive (just listening) or active (propagating and waiting for a reply) methods is the core of most underwater surveillance systems for most modern navies. The primary tool within all of these systems is 'sonar' (which was originally an acronym from the United States for sound navigation and ranging from the 1930s). These mechanisms, which are commonly found onboard military vessels, can also be deployed by dipping (as in, dipped from a helicopter) and sonobouys. One plane can commonly deploy up to 100 sonobuoys and thus esonify a large area.[7]

Military sonar can be conveniently categorized into mid- and low frequency. Mid-frequency active sonar (MFAS) has been used by navies all over the world since the Second World War. Over 300 ships in the United States navy alone are equipped with MFAS. MFAS employs frequencies of one to ten kHz and typically can detect objects one to ten nautical miles away. According to testimony from the United States navy, MFAS is 'mission critical' as it is the only proven method of identifying submerged diesel-electric submarines operating on battery power. As such, MFAS is 'essential to national security.'[8] Low frequency active sonar (LFAS) uses sound frequencies of less than 1 kHz. This lower frequency suffers less attenuation in seawater and, hence, allows the detection of objects up to 100 nautical miles away. LFAS is currently operational on two ships in the United States navy and on one ship in the British navy. A variation on LFAS working from a vessel is LFAS surveillance-towed array sensor system (SURTASS). SURTASS-LFA 'sends out intense sonar pulses at low frequencies that travel hundreds of miles in order to timely detect increasingly quiet enemy submarines.'[9] SURTASS-LFA utilizes a vertical line array of up to eighteen source projectors suspended below a vessel. The sonar beam is omnidirectional (that is, a full 360 degrees), at a nominal depth of 122 metres. A complete sequence of transmissions is known as a 'ping' and lasts from six to 100 seconds. The time between pings is usually between six and fifteen minutes. The source level of an individual projector is approximately 215 dB(A), although it is believed to have 'an effective sound level' of 230 to 240 dB. This figure would equate to about 180 dB(A) at one kilometre from the source; to 173 dB(A) two kilometres from the source; to about 165 dB(A) seventy-four kilometres from the source; to around 150 dB(A) up to 160 kilometres from the source; and to some 140 dB(A) up to 640 kilometres from the source vessel.[10]

[7] D. Owen, Anti-Submarine Warfare, at 39-42 (2007).

[8] *Winter, Secretary of the Navy et al. v. Natural Resource Defence Council et al.*, 555 U.S. 7 (2008) at 3, 15, 16 and 17 [*Winter*].

[9] This quote is from the case of *NRDC v. Evans*, No. C-02-3805-EDL, 316 F.3d 904 (9th Cir. 2003) [*NRDC*]. For commentary on the *NRDC* case, see C. Mongeon, *NRDC v Evans: Northern District of California Delivers 'Sound' Judgement in Protection of Marine Wildlife* 15 Villanova Envt'l L.J. 394 (2004).

[10] Department of the Navy, Chief of Naval Operations, Final Comprehensive Report for the Operation of the Surveillance Towed Array Sensor System Low Frequency Active Sonar under the

The final noise source of concern is that generated from shipping. While the utilization of military sonar and seismic exploration are largely ad hoc, the emissions from shipping are relatively constant. It is estimated that the cumulative result from shipping accounts for more than 75 percent of all human sound in the sea. In the northern hemisphere, shipping noise is dominant and ranges from ten Hz to 200 Hz. In the southern hemisphere, the noise in the oceans is less dominated by shipping. However, in both hemispheres, there is considerable variation, with the maximum ambient noise lying close to the major shipping lanes. It is estimated that overall from 1950 to 2000, there was an increase of sixteen dB(A) in low frequency noise in the oceans. During this period, the number of ships in the world tripled (from 30,000 to 87,000), and the gross tonnage increased from eighty-five to 550 million gross tons. Shipping's contribution to ocean noise has been projected to increase greatly, especially in coastal areas, in the next twenty years. This is not particularly surprising since, by their nature, large vessels tend to be very noisy. Shaft-line dynamics, air conditioning, manoeuvring devices, cargo handling and mooring machinery, intakes, exhausts, and thrusters all generate noise. However, it is the engines, propellers, and vibration that are usually the principal sources of noise onboard vessels. The average noise levels on board a vessel are around eighty-five dB(A), while the noise levels in the engine room may be as high as 114 dB(A). Beneath a ship, their sound signatures are somewhat different. Supertankers moving at speeds of 20-23 knots generate noise in the 190-200 dB(A) range.[11]

III. THE IMPACTS OF NOISE POLLUTION UPON OCEANIC SPECIES

It has been known for hundreds, if not thousands, of years by hunters from all over the world that animals exhibit adverse behaviour when confronted with high intensity loud noise. The scientific study of noise pollution upon non-human animals has been proceeding since the 1950s. This work began (and has continued) with respect to endangered terrestrial species, particularly

National Marine Fisheries Service Regulations, at 1-2 (2007); J. Van Dyke, *Active Sonar* 14 Col. J. Int'l Envt'l L. & Pol'y 1 (2003).

[11] M. McDonald, *Increases in Deep Ocean Ambient Noise in the Northeast Pacific* 120 J. Acoust. Soc. Am. 711 (2006); B. Southall, Shipping Noise and Marine Mammals, Final Report of the National of the National Oceanic and Atmospheric Administration (NOAA) Symposium, 18 May 2004 (2005); R. Heitmeyer, *Shipping Noise Predictions: Capabilities and Limitations* 37 Marine Technology Soc. J. 54 (2004); Anonymous, *Boats Drown Out Orcas Cries* 182 New Scientist 19 (1 May 2004); Anonymous, *Not So Pacific Ocean* 173 New Scientist 23 (30 March 2002); R. Andrew, *Ocean Ambient Sound: Comparing the 1960s with the 1990s for a Receiver off the California Coast* 3 Acoustics Research Letters Online 65 (2002); P. Marks, *Cracking Up: Is the Din in the Arctic a Headache for Beluga Whales?* 167 New Scientist 12 (20 September 2000); J. Carlton, *Ship Vibration and Noise*, in Lloyds Maritime Academy, ed., First International Ship Noise and Vibration Conference, 1 at 1-10 (1995); World Health Organization, Occupational and Community Noise, WHO Doc. no. 258 (2001).

to birds.[12] The first study of the impact of ocean noise on marine biodiversity was conducted in 1971.[13] In the four decades since then, a large collection of ad hoc studies of the impacts of marine biodiversity has been produced.

The strong interest in the relationship between seismic noise and marine mammals is because the acoustic output of underwater seismic energy at relatively low frequencies of ten to 200 Hz overlaps extensively with the low frequency sound produced by baleen whales in the twelve to 500 Hz bandwidth. The studies suggest that the effects of this overlap span from negligible to fatal. At the fatal end, a few cases of beaked whale strandings appear to have coincided with seismic surveys.[14] However, there is no conclusive evidence of a link between sounds of seismic surveys and the direct mortality of any marine mammals. There is, however, a substantial amount of research that suggests that seismic surveys do create behavioural responses (in terms of avoidance reactions, such as change in abundance, direction, speed, as well as change in blow interval and dive time), abandonment of habitat, and/or 'masking' or the obscuring of natural sounds. Behavioural changes in reaction to seismic noise are evident in some whale (and seal) species, namely grey, bowhead, blue, sei, and minke. Some species, such as fin, appear to stop vocalization across areas of up to 10,000 nautical miles while seismic surveys are ongoing. Impacts upon the communication of some species, such as blue whales, which are known to emit sound in order to communicate over hundreds of miles, have also been observed. Small odontocetes show the strongest lateral spatial avoidance in response to active airguns, while mysticetes and killer whales tend to show more localized spatial avoidance. However, depending on the scale and proximity of the noise, some species such as male (but not female) humpbacks and some sperm whales reflect evidence of relative toleration of seismic sources. Questions of whether biologically significant impacts of seismic surveys (following strong mitigation techniques) have actually occurred on highly endangered western grey whales have also been asked. Mixed implications of reactions have been recorded for some small cetaceans, although, depending on the sound levels and proximity, some temporary avoidance behaviours are evident.[15]

[12] A. Anthony, *Noise Stress in Laboratory Rodents* 31 J. Acoust. Soc. Am. 11 at 1437 (1959); C. Hopkins, *Effects of Noise on Wildlife* 29 Bioscience 547 (1979).

[13] See R. Payne, *Orientation by Means of Long Range Acoustic Signaling in Baleen Whales* 188 Ann. N.Y. Acad. Sc. 110 (1971).

[14] E. Parsons et al., *The Conservation of British Cetaceans: A Review of Threats and Protections* 13 J. Int'l Wildlife L. & Pol'y 29 (2007); Nieukirk et al., *supra* note 6; D. Malakoff, *Suit Ties Whale Deaths to Research Cruise* 298 Science 722 (2002); D. Palacios et al., *Cetacean Remains and Strandings in the Galápagos Islands, 1923-2003* 3(2) Latin American J. Aquatic Mammals 127 (2004); E. Mulqueen, *Whale Strandings Due to Seismic Activity*, Irish Times, 6 May 2000, A2.

[15] OSPAR, Assessment of the Environmental Impact of Underwater Noise, Publication no. 436/2009, at 34-36 (2009); K. Lucke et al., *Testing the Acoustic Tolerance of Harbour Porpoise Hearing for Impulsive Sounds* 17 Bioacoustics 329 (2008); W. Koski et al., An Update on Feeding by Bowhead Whales Near an Offshore Seismic Survey in the Central Beaufort Sea, Doc. SC/61/BRG3 (2009);

Unlike noise pollution from seismic sources, noise pollution from military sonar has a stronger linkage to whale strandings. However, this thesis is not easy to prove, as whale strandings have been recorded throughout thousands of years of history. Many of these strandings may be attributed to natural and environmental factors, such as rough weather, weakness due to old age or infection, difficulty giving birth, hunting too close to shore, and navigation errors. Against this background of natural incidents is the large question of whether noise pollution, and that which is caused by military sonar in particular, is increasing the rate of strandings. The evidence that supports this thesis began to be assembled in the early 1990s.[16] Although the evidence in this area is far from conclusive, even the United States navy agrees that mid-frequency sonar (but not low frequency)[17] can be directly linked to the strandings of marine mammals.[18] This finding is especially evident with the relatively unknown, deep diving, beaked whales in certain geographical locations.[19] This concession is consistent with mass strandings and mortality events coincident with mid-frequency sonar training exercises in the Canary Islands (2004, 2002, 1989, 1986, 1985);[20] Madeira (2000); Spain (2006); the US Virgin Islands (1999, 1998); Greece (1996);[21] and

P. Miller et al., *Using At-Sea Experiments to Study the Effects of Airguns on the Foraging Behavior of Sperm Whales in the Gulf of Mexico* 56 Deep-Sea Research 1168 (2009); C.R. Weir, *Overt Responses of Humpback Whales, Sperm Whales and Atlantic Spotted Dolphins to Seismic Exploration off Angola* 34 Aquatic Mammals 71 at 349-54 (2008); L.S. Weilgart, *The Impacts of Anthropogenic Ocean Noise on Cetaceans and Implications for Management* 85 Can. J. Zoology 1091 (2007); A. Wright et al., *Do Marine Mammals Experience Stress Related to Anthropogenic Noise?* 20 Int'l J. Comp. Psych. 274 (2007); S. Johnson et al., *A Western Gray Whale Mitigation and Monitoring Program for a 3-D Seismic Survey, Sakhalin Island, Russia* 134 Environmental Monitoring and Assessment 1 (2007); C.J. Stone et al., *The Effects of Seismic Airguns on Cetaceans in UK Waters* 8(3) J. Cetacean Research and Management 255 (2006); J. Gordon et al., An Investigation of Sperm Whale Headings and Surface Behaviour before, during and after Seismic Line Changes in the Gulf of Mexico, Doc. IWC SC/58/E45 (2006); R.A. Kastelein, *The Influence of Underwater Data Transmission Sounds on the Displacement Behaviour of Captive Harbour Seals,* 61 Marine Envt'l Research 19 (2006); Bain et al., *supra* note 6; P. Madsen et al., *Quantitative Measures of Air-Gun Pulses Recorded on Sperm Whales Using Acoustic Tags* 120 J. Acoust. Soc. Am. 2366 (2006); P.T. Madsen, *Marine Mammals and Noise: Problems with Root Mean Square Sound Pressure Levels for Transients* 117(6) J. Acoust. Soc. Am. 3952 (2005); O. Boebel et al., *Risks Posed to the Antarctic Marine Environment by Acoustic Instruments: A Structural Analysis* 17(4) Antarctic Science 533 (2005).

[16] M. Simmonds et al., *Whales and the Military* 337 Nature 448 (1991).

[17] Department of the Navy, *supra* note 10 at 48-49; Department of the Navy, Chief of Naval Operations, Final Supplemental Environmental Impact Statement for Surveillance Towed Array Sensor System Low Frequency Sonar, at 10–14 (2007).

[18] Department of the Navy, *supra* note 10 at 18-19.

[19] J. Hildebrand et al., *Understanding the Impacts of Anthropogenic Sound on Beaked Whales* 7(3) J. Cetacean Research & Management 177 (2005-6); S.A. Rommel et al., *Elements of Beaked Whale Anatomy and Diving Physiology and Some Hypothetical Causes of Sonar-Related Stranding* 7(3) J. Cetacean Research & Management 189 (2005-6); C. MacLeod et al., *A Review of Beaked Whale Behaviour and Ecology in Relation to Assessing and Mitigating Impacts of Anthropogenic Noise* 7(3) J. Cetacean Research & Management 211 (2005-6); R. Edwards, *Sonar Kills Whales* 180 New Scientist 10 (11 October 2003).

[20] Simmonds et al., *supra* note 16; V. Martin et al., *Mass Strandings of Beaked Whales in the Canary Islands* 42 Eur. Cetacean Society Newsletter 33 (2004).

[21] A. Frantzis, *Does Accoustic Testing Strand Whales?* 392 Nature 29 (1998).

around Britain and Ireland (2008).[22] Of this collection, one of the best-documented incidents occurred in the Bahamas in the year 2000 when sixteen beaked whales were stranded along fifteen miles of shoreline during a navy exercise. Following this stranding in 2000, the National Oceanic and Atmospheric Administration and the National Marine Fisheries Service issued a joint interim report. This report concluded that their navy's use of tactical mid-range frequency sonar, in this instance, was 'the most plausible source of this acoustic or impulse trauma.'[23] Further strandings that overlapped with military exercises using mid-frequency sonar off Hawaii in 2004 and North Carolina in 2005 were considered by the navy to be 'a plausible, if not likely, contributing factor in what may have been a confluence of events'[24] (in the case of Hawaii) or a possible—but inconclusive—overlap (in the case of North Carolina).[25]

To help build certainty in this area, a number of scholars have attempted to establish databases that show an overlap between military exercises using mid-frequency (not low-frequency) sonar and mass strandings of cetaceans. From such databases, a correlation has been proposed of mass beaked whale strandings along the Japanese coast near Yokosuka, which is one of the primary bases for United States naval activity in the western Pacific, with ten mass strandings reported since the early 1950s and an additional sixty-four beaked whales stranded individually. By comparison, only two other possible mass strandings of beaked whales are known to have occurred over the rest of the entire Pacific coast of Japan.[26] Similarly, a correlation appears evident with the historic strandings of beaked whales and naval operations in both the Mediterranean and the Caribbean from the early 1990s. However, in other parts of the world, such as in southern California between 1982 and 2007, there was no overlap.[27] This last example, supplemented by the omission of 'a single documented sonar-related injury to any marine mammal' of any cetacean deaths during forty years of training exercises off Southern California,'

[22] S. Dolman, *A Note on the Unprecedented Strandings of Deep Diving Whales along the UK and Irish Coast* 56 Marine Biodiversity Records 1 (2010).

[23] National Oceanic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service, Joint Interim Report Bahamas Marine Mammal Stranding Event, 15-16 March 2000, at ii (2001); J. Hecht, *Navy Accepts Blame for Whale Deaths* 173 New Scientist 15 (12 January 2001); J. Hrynyshyn, *Going Round the Bend* 171 New Scientist 15, at 17 (December 2001).

[24] B. Southall, Mass Stranding Event of 3-4 July 2004, NOAA Technical Memorandum NMFS-OPR-31 April 2006, Doc. NMFS-OPR-31, at 3 (2006).

[25] A. Hohn et al., Report on Marine Mammal Unusual Mortality Event, Doc. UMESE0501Sp: Multispecies Mass Stranding of Pilot Whales (Globicephala macrorhynchus), Minke Whale (Balaenoptera acutorostrata), and Dwarf Sperm Whales (Kogia sima) in North Carolina on 15-16 January 2005, NOAA Technical Memorandum, Doc. NMFS-SEFSC-537, at 2-3 (2006).

[26] R. Brownell, T. Yamada, J.G. Mead, and A.L. Helden, *Mass Stranding of Cuvier's Beaked Whales in Japan: U.S. Naval Acoustic Link?* 7 J. Cetacean Research & Management 1 (2004).

[27] R. Filadelfo et al., *Correlating Military Sonar Use with Beaked Whale Mass Strandings: What Do the Historical Data Show?* 35(4) Aquatic Mammals 435 (2009); M. Podesta et al., *A Review of Cuvier's Beaked Whale Strandings in the Mediterranean Sea* 7(3) J. Cetacean Research & Management 251 (2005-6).

was influential in the decision of the Supreme Court of the United States to downgrade the risks of this technology.[28]

Studies investigating sound-induced effects of noise pollution in the ocean on the less charismatic species of the ocean, as well as being less numerous, are also variable. Nevertheless, preliminary evidence suggests that certain behavioural responses among some species, such as turtles, which include rising to the surface and altered swimming patterns, may be elicited with exposure to seismic signals. Evidence of strong behavioural reactions from squid (such as firing their ink sac and possibly even stranding) to airgun sounds has also been demonstrated, with squid showing an increase in alarm responses to seismic noise sources above 156 dB(A).[29] Some species of fish, which are subject to a variety of different hearing systems and differences in physical conditions, appear to also be impacted by some sources of noise pollution. Most fish species hear noise sounds from below fifty Hz to between 500 and 1,500 Hz. If undue noise overlaps with the species' hearing band, especially if the noise is repeated and at close range, extreme damage may result. Beyond such immediate impacts, there is added uncertainty in regard to behavioural results. This uncertainty relates to whether fish will freeze or stay in place, become deafened (either permanently or temporarily), or try to flee an area. It appears that between 40 and 80 percent of some species of fish, such as cod, haddock, rockfish, herring, sand eel, and blue whiting, will leave an area (for at least five days), within a radius of up to twenty-five miles, when exposed to seismic noise. Finally, evidence suggests that the survival rate of eggs and larvae of a number of fish species, when exposed to sound levels of 120 dB or above reflect statistically significant decreases. Some species, reflect a loss of around 0.3 percent per survey. However, such contentions have been challenged.[30]

[28] *Winter, supra* note 8 at 1, 9 and 12.

[29] A. Guerra et al., A Review of Records of Giant Squid in the North-Eastern Atlantic and Severe Injuries after Acoustic Exploration, ICES Annual Science Conference, Doc. CC: 29 (2004); D. MacKenzie, *Seismic Surveys May Kill Giant Squid* 184 New Scientist 7 (22 September 2004); D. MacKenzie, *Seismic Surveys Blamed for Giant Squid Deaths* 184 New Scientist 15 (2 October 2004).

[30] A.N. Popper, *The Effects of Human Generated Noise on Fish* 4 Integrative Zoology 43 (2009); A. Popper, *The Effects of Anthropogenic Noise on Fish* 28 Fisheries 24 (2006); ICES Advisory Committee on Ecosystems, Report of the Ad-Hoc Group on the Impacts of Sonar on Cetaceans and Fish, Doc. ICES CM 2005/ACE:06 (2nd edition, 2005); A. Popper et al., *Effects of Exposure to Seismic Airgun Use on Hearing of Three Fish Species* 117(6) J. Acoust. Soc. Am. 3958 (2005); A.N Popper et al., *Effects of Low Frequency Active Sonar on Fish* 117 J. Acoust. Soc. Am. 2440 (2005); A.N. Popper et al., *Anthropogenic Sound: Effects on the Behavior and Physiology of Fishes* 37(4) Marine Technology Soc. J. 35 (2004); M. Smith et al., *Noise-Induced Stress Response and Hearing Loss in Goldfish* 207 J. Experimental Biology 207 (2003); A. Popper, *Effects of Anthropogenic Sounds on Fishes* 28(1) Fisheries 24 (2003); J. Fewtrell et al., *High Intensity Anthropogenic Sound Damages Fish Ears* 113(1) J. Acoust. Soc. Am. 638 (2003); R. McCauley, *High Intensity Anthropogenic Sound Damages Fish Ears* 113(1) J. Acoust. Soc. Am. 631 (2003); A. Banner, *Effects of Noise on Eggs and Larvae of Two Estuarine Fishes* 102 Transactions of the American Fisheries Society 134 (1973); L.P. Kostyuchenko, *Effects of Elastic Waves Generated in Marine Seismic Prospecting of Fish Eggs* 9(5) Hydrobiology Journal 45 (1973).

Although methodologies for the assessment of environmental burdens and their impact are difficult in all fields, it is especially difficult with respect to noise pollution. These difficulties are due to the multiple pathways that noise pollution can take, its cumulative impact, its failure to leave a residue, and the vast differences between and within species to the way noise is responded to.[31] Thus, it often becomes difficult, as has been pointed out in the courts of the United States, to find exactly where a level of noise is 'biologically significant' to a species.[32] That is, when exactly does noise induce the long-term abandonment of an area that is important for feeding, breeding, or rearing the young, leading to a reduction in fecundity, carrying capacity, or both? Such impacts may not become immediately apparent and could be modified by habituation, sensitization, hearing loss, physiological damage, and stress. It may be that such 'indirect' stresses are the more serious pollution on many marine species over the long term, as their efficiencies in foraging, navigation, or communication may be compromised. This may be especially so if the populations are already endangered since anthropogenic noise affects long-term reproductive success.[33] Accordingly, as the 2005 US National Research Council report on this topic explains, when trying to ascertain what have been the biologically significant impacts upon marine mammals from ocean noise, 'there was a consensus that we are a decade away or more from having the data and understanding of the transfer functions needed to turn such a conceptual model into a functional, implementable tool.'[34]

The multitude of scientific gaps in this area have been noted by the International Council for the Exploration of the Sea[35] as well as by the 1994,[36] 2000,[37] 2003,[38] and 2005[39] reports of the National Research Council.

[31] See A. Fernandez et al., *Gas and Fat Embolic Syndrome: Involving a Mass Stranding of Beaked Whales Exposed to Anthropogenic Sonar Signals* 42(4) Veterinary Pathology 446 (2005); P. Jepson, *Gas Bubble Lesions in Stranded Cetaceans* 425 Nature 575 (2003); National Research Council, Potential Impacts of Ambient Noise in the Ocean on Marine Mammals, at 6-7 (2003); ICES Advisory Committee on Ecosystems, *supra* note 30 at 2, 3, 13-15, 39.

[32] *NRDC*, *supra* note 9 at 12.

[33] State Health Agency of Baden-Wurtetemberg, Experts Consultation on Methods of Quantifying Burden of Disease Related to Environmental Noise (2007); World Health Organization, Methodology for Assessment of the Environmental Burden of Disease (2000); ICES Advisory Committee on Ecosystems, *supra* note 30 at 15-17, 36-37; National Research Council, *supra* note 31 at 4-6; National Research Council, Marine Mammals and Low-Frequency Sound: Progress since 1994 (2000) at 3.

[34] ICES Advisory Committee on Ecosystems, *supra* note 30 at 2, 10-13, 15-17, 36-38; National Research Council, *supra* note 31 at 3, 4, and 4-6.

[35] M. Tasker et al., The Marine Strategy Framework Directive: Task Group 11, Underwater Noise and Other Forms of Energy, at 33-36 (2010); ICES Advisory Committee on Ecosystems, *supra* note 30 at 12-23, 47-49.

[36] National Research Council, Low-Frequency Sound and Marine Mammals: Current Knowledge and Research Needs (1994).

[37] National Research Council, *supra* note 31.

[38] *Ibid*.

[39] National Research Council, Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects (2005).

Similar calls highlighting the scientific gaps in this area have been made by the specialist cetacean organizations that operate within international law, namely the International Whaling Commission,[40] the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area,[41] and the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas.[42] All of these bodies,[43] in addition to the European Parliament,[44] the United States,[45] and the United Nations General Assembly have all called for collaborative international scientific investigations into this topic.[46] In following through with this mandate, the Secretariat of the Convention on Biological Diversity (CBD) was instructed in 2010 to compile and synthesize available scientific information on anthropogenic underwater noise and its impacts on marine and coastal biodiversity and habitats for consideration at a future meeting prior to the eleventh Conference of the Parties.[47] Until all of the scientific difficulties in the area of underwater noise pollution are resolved, it would be appropriate for a conservative precautionary approach to be pursued. As I have explored elsewhere on this topic of precaution, the weight of the current scientific uncertainties would justify cost-effective measures to mitigate underwater noise to be immediately adopted, at least until the time that the uncertainties are removed.[48]

[40] IWC, Report of the Scientific Committee of the IWC, Doc. IWC/62/Rep 1.52 (2004); see also Doc. IWC/56/Rep 1, section 12.2.5.

[41] Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area, 36 I.L.M. 777 (1997). See Resolution 2.16 on the Assessment and Impact Assessment of Man-Made Noise (2004).

[42] Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas, U.K.T.S. No. 52 (1995). See Resolution 5 on the Effects of Noise and of Vessels, Proceedings of the Fourth Meeting of the Parties to the ASCOBANs Convention (2003) at section 3.

[43] ICES Advisory Committee on Ecosystems, *supra* note 30 at 47. IWC, *supra* note 40 at section 12.2.5; National Research Council, *supra* note 31 at 4, 7, 11. For ACCOMBAMs, see Resolution 2.16 on the Assessment and Impact Assessment of Man-Made Noise, *supra* note 41.

[44] European Parliament Resolution on the Environmental Effects of High-Intensity Active Naval Sonars, Doc. B6-0089/2004 (2004) at para. 5.

[45] See the United States statement from the International Union on the Conservation of Nature (IUCN), Third Conservation Congress, Doc. RESWCC3.068 (2004); Resolution on Undersea Noise Pollution, Congress Doc. CGR3.RES053.Rev.1, attached to the end of the resolution. See also Marine Mammal Commission, Marine Mammals and Noise: A Sound Approach to Research and Management: A Report to Congress from the Marine Mammal Commission, at iii-iv (2007); United States Commission on Ocean Policy Ocean Blueprint for the Twenty-First Century, at 315-16 (2005).

[46] See Oceans Resolution, Doc. A/RES/65/37 (2010) at para. 186. For the earlier recognition of the same point, see Doc. A/RES/64/71 (2009) at para. 162; Doc. A/RES/63/111 (2008) at para. 141; Doc. A/RES/62/215 (2007) at para. 120; Doc. A/RES/61/222 (2006) at para. 107; Doc. A/RES/60/30 (2005) at para. 84.

[47] Convention on Biological Diversity, 31 I.L.M. 818 (1992) [CBD]. New and Emerging Issues, Decision X/13 (2010) at para. 2(b). Note also Decision X/29 (2010) on Marine and Coastal Biodiversity at para.12.

[48] See A. Gillespie, *The Precautionary Principle in the Twenty-First Century: A Case Study of Noise Pollution in the Ocean* 22(1) Int'l J. Marine & Coastal L. 61 (2007); A. Gillespie, *Precautionary New Zealand* 24(3) New Zealand Univ. L. Rev. 364 (2011).

IV. THE INTERNATIONAL GOALS TO CONTROL NOISE POLLUTION

The obligations to control noise pollution and its impacts upon humans are more often than not nationally based and derived from the law of torts. This is due to the particular nature of noise pollution, which can be very locality specific. However, in some instances, when the sources or impacts of noise pollution are transboundary, international responses are required. The international interest in noise pollution can be traced to the 1972 Stockholm Conference on the Human Environment. Article 14 of the Programme of Action recommended that an

> intergovernmental body for environmental affairs ... be established within the United Nations [to] ensure that the required surveys shall be made concerning the need and the technical possibilities for developing internationally agreed standards for measuring and limiting noise emissions and that, if it is deemed advisable, such standards shall be applied in the production of means of transportation and certain kinds of working equipment, without a large price increase or reduction in the aid given to developing countries.

Since this point, the international community has both generally, and through the initiatives of specific international organizations, attempted to deal with the problem of noise pollution as a problem that impacts upon humans.[49] However, there has been very limited progress in regard to noise pollution, especially that which is of an international significance that impacts upon non-human animals and those within the ocean in particular. In large part, this lack of progress is due to both the nature of the international law of the sea (as found in UNCLOS) and its implementation.

The obligation to protect and preserve the marine environment is a key part of UNCLOS. The broad rule is that states shall take, individually or jointly as appropriate, 'all measures consistent with [UNCLOS] that are necessary to prevent, reduce and control pollution of the marine environment (especially when dealing with activities that cause pollution beyond their own territory)[50] from any source, using for this purpose the best practicable means at their disposal and in accordance with their capabilities.'[51] Pollution, as defined within UNCLOS, includes, *inter alia*, 'the introduction by man, directly or indirectly, of ... energy into the marine environment.'[52] This definition clearly encompasses noise emissions. This coverage may also be inferred by the general directive for 'all' sources of pollution of the marine environment to be 'minimize[d] to the fullest possible extent.'[53]

[49] See A. Gillespie, *The No Longer Silent Problem: Confronting Noise Pollution in the Twenty-First Century* 20(2) Villanova Envt'l L.J. 181 (2009).
[50] UNCLOS, *supra* note 1, Article 194 (2).
[51] *Ibid.,* Article 194(1).
[52] *Ibid.,* Article 1(4).
[53] *Ibid.,* Article 194(3).

There is a recurring theme of section five of UNCLOS, which deals with the international rules to prevent, reduce, and control pollution of the marine environment. This theme dictates that in addition to individual state responsibility to control its pollution of the marine environment, states should also be working through appropriate regional and/or international organizations—or establishing such organizations as necessary—to prevent, reduce, and control pollution of the marine environment. In three areas, particular problems are dealt with via specific independent conventions, whereby the parties deal, in detail, with the specific pollutant and/or its source. Accordingly, clear rules exist for the dumping of wastes directly into the ocean from vessels,[54] pollution of the ocean via the atmosphere,[55] and pollution of the ocean from land-based sources.[56] Rules also exist to deal with pollution that is coming from activities within 'the Area'[57] as well as with pollution from seabed activities subject to national jurisdiction.[58] Often, the broad rules encompassed within UNCLOS are linked to appropriate organizations that are meant to go on to deal with the specific problem in detail. Thus, the IMO is meant to deal with pollution by dumping[59] and pollution by vessels.[60] It is also the most appropriate body to deal with the topic of noise pollution from commercial vessels.

1. Noise from Commercial Shipping

Noise pollution has been a topic of concern for the IMO since 1981, when it established its first code on noise levels to protect seafarers. This code, which has been supplemented by national legislation, recommended maximum noise

[54] Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 26 U.S.T. 2403 (1972); Protocol to the London Dumping Convention, 36 I.L.M. 7 (1997).

[55] UNCLOS, *supra* note 1, Article 212. These areas are dealt with, indirectly, through the respective regimes on climatic change, ozone depletion, and air pollution. See A. Gillespie, Climate Change, Ozone Depletion and Air Pollution: Legal Commentaries with Science and Policy Considerations, at chapters 10-15 (2006).

[56] UNCLOS, *supra* note 1, Article 207. See United Nations Environment Programme (UNEP), *The Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities*, Doc. A/51/116 Annex II, 6 Y.I.E.L. 245 (1995). The 2006 Intergovernmental Review Meeting on the Implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, Second Session, 23 October 2006, Doc. UNEP/GPA/IGR.2/7 (2006).

[57] The 'Area' is the place beyond the exclusive economic zone and/or the continental shelf. The vast majority of the world's oceans exist in this space. All states and competent international organizations have the right, in conformity with the provisions of UNCLOS on the international seabed, to conduct marine scientific research in the Area and/or the water column (the water between the surface and the bottom of the ocean) beyond the exclusive economic zone. Although all states are encouraged to utilize the opportunities that were created, the exploration and exploitation within the Area is to be 'organized, carried out and controlled by the Authority on behalf of mankind as a whole.' UNCLOS, *supra* note 1, Articles 136, 150, 153, 256, and 257.

[58] *Ibid.,* Article 208.

[59] *Ibid.,* Article 210.

[60] *Ibid.,* Article 211. This area of marine pollution has been dealt with under the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978, and the associated annexes. International Convention for the Prevention of Pollution from Ships, 17 I.L.M. 1546 (1978) [MARPOL Convention].

levels (and associated safety equipment) for different parts of vessels, ranging from cabins at sixty dB(A) through to machinery spaces at 110 dB(A).[61] However, these recommendations on noise emissions are only aimed at noise levels and impacts within a vessel and do not concern the levels and impacts of noise outside of a vessel.

Although the IMO has not attempted to regulate noise pollution caused by vessels to the external environment, it has successfully regulated a number of other sources of pollution impacting on the external environment through the International Convention for the Prevention of Pollution by Ships (MARPOL Convention),[62] such as emissions of nitrous oxides, volatile organic compounds, sulphur dioxide, and as a probable stepping stone towards eventual controls, measurements, and indexing of carbon dioxide emissions.[63] The MARPOL Convention also includes regulations regarding the subdivision and stability of vessels that are designed to ensure that particular ships can survive after being involved in a collision or stranding, such as with segregated ballast tanks, the particular location of fuel tanks, and the fitting of certain vessels (such as oil tankers) with double hulls, or alternative design approved by the IMO.[64]

With this vast amount of experience in controlling other pollutants, in terms of both limits of emissions and design changes where necessary, the lessons for potential noise controls are axiomatic. Some vessels are already very noise sensitive, such as those involved in research, luxury travel, or military work.[65] Such noise reductions for ships can be achieved through design, construction, and the choice of machinery, especially in terms of the propellers, hull shapes, and other methods necessary to counter vibration and associated noise problems.[66]

Despite the possibilities in this area, it has only been in the recent century, after a number of international fora have brought this matter of noise from commercial shipping to the attention of the IMO, that the matter has been

[61] IMO Resolution A.468 (XII) on the Code on Noise Levels Onboard Ships. Also reprinted as IMO, Noise Levels on Board Ships (1982). Also IMO Resolution A.343 (IX) Measuring Noise Levels on Ships; and the British Department of Transport, Code of Practice for Noise Levels in Ships (1986).

[62] MARPOL Convention, *supra* note 60.

[63] For discussions of Annex VI, see IMO, MARPOL 73/78, consolidated edition, at 399-433 (2002). On the issue of carbon dioxide, see Anonymous, *Oslo Meeting Prepares Ground on GHG Reduction Mechanisms* 3 IMO News 7 (2008). Anonymous, *IMO Environment Meeting Approves Revised Regulations on Ship Emissions* 2 IMO News 7 (2008).

[64] Anonymous, *Amendments to MARPOL Annex* 13 IMO News 9 (2007).

[65] See K. Abrahamsen, *Noise Control for Noise Sensitive Vessels*, *in* Lloyds Maritime Academy, ed., First International Ship Noise and Vibration Conference, at 32 (2005).

[66] D. Eyres, Ship Construction, at 36-39 (2006); C. Barrass, Ship Design and Performance, at 83-92 (2002); K. Rawson, Basic Ship Theory, at 408-22 (2005); Royal Institute of Naval Architects, Noise and Vibration in the Marine Environment, at C 1-7, 15-28, 32-39, 53-69, 70-78, 84-93 (1995); E. Wijngaarden, Recent Developments in Predicting Propeller-Induced Hull Pressure Points in First International Ship Noise and Vibration Conference, at 17-23 (Lloyds Maritime Academy, ed., 2005).

taken seriously.[67] Against this background of concern, the United States proposed at the IMO in 2008 that a correspondence group be formed to begin to examine the issue of underwater noise from commercial shipping and to provide reports to the Marine Environment Protection Committee. At this stage, however, it was not proposing a new convention or an amendment to an existing one.[68] This reluctance has been due to the fact that the IMO already has the ability to deal with part of this problem via the creation of 'quiet zones' through what are, in essence, two different types of protected areas, namely special areas and particuarly sensitive sea areas (PSSAs). By 2010, the IMO had created eleven PSSAs.[69] In discussions about the formation of both of these types of areas, the IMO has recognized shipping noise as a pollutant that can adversely affect the marine environment and the living resources of the sea and that should be taken into account when creating a special or particularly sensitive sea area.[70] However, in practice, the necessity to control underwater noise pollution has not been used as a primary justification for creating either of the types of protected seascapes.

2. Noise from Seismic Exploration

In the longer term, technological advances may eclipse the current airgun seismic methods of seismic exploration, or refinements and efficiencies of the existing technologies may mean that more can be accomplished with much lower decibels of sound.[71] In the shorter term, until such advances avail themselves, seismic exploration has to be regulated in accordance with existing mitigation measures. Such regulation is in accordance with the general support for scientific work within UNCLOS (which comprises seismic exploration).[72]

[67] These include the Antarctic Treaty Consultative Meetings (see Final Report of the Twenty-Sixth ATCM (Madrid, 2003) at 20); the United Nations Open Ended Informal Consultative Process on Oceans and the Law of the Sea, Report of the UNICPOLOS at its Sixth Meeting, Doc. A/59/122, at para. 45 (7 July 2005); International Whaling Commission, Resolution 2004-1 on the Western North Pacific Gray Whale, Doc. IWC/56/26 (2004) at 66; Resolution 2005-3 on the Western North Pacific Gray Whale, Doc. IWC/57/25 (2005); Resolution 2.16 (2004) on the Assessment and Impact Assessment of Man-Made Noise, Report of the Second Meeting of the Parties to ACCOBAMS (2004); Resolution 5 on the Effects of Noise and of Vessels, Fourth Meeting of the Parties to the ASCOBANs Convention, Esbjerg (2003).

[68] See United States, Work Programme of the Committee and Subsidiary Bodies: Minimising the Introduction of Incidental Noise from Commercial Shipping Operations, Doc. MEPC 58/19 (25 June 2008).

[69] Anonymous, *IMO Confirms Environmental Credentials* 2 IMO News 7 (2008); Anonymous, Marine Environment Protection Committee Progresses Key Issues 3 IMO News 20 (2007).

[70] In particular, the IMO's Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas has identified shipping noise as a pollutant that can adversely affect the marine environment and living resources of the sea. See IMO General Assembly, Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas, 17th session, Doc. A 17/Res.720, at 8 (1997).

[71] For a view of some of the options in this area, see L. Weilgart, ed., Alternative Technologies to Seismic Airgun Surveys for Oil and Gas Exploration and Their Potential for Reducing Impacts on Marine Mammals (2010).

[72] UNCLOS, *supra* note 1, Articles 143, 238, 239, 242-45.

However, this support is conditional on the principle that all scientific research must be conducted in accordance with all relevant regulations, including 'those for the protection and preservation of the marine environment.'[73] Such conditionality was clearly hinted at with respect to coastal states being able to regulate the scientific research within their waters,[74] if the research is of direct significance for the exploration and exploitation of natural resources, whether living or non-living[75] or (in the only indirect reference to noise pollution in UNCLOS) used explosives, which were originally the preferred method of seismic testing before the popularity of airguns.[76]

In terms of possible mitigation options that may be considered within the area of scientific research, UNCLOS recognizes the idea of, *inter alia*, safety zones and warning signals.[77] Subsequent practice with respect to the mitigation of noise caused by seismic exploration, as evidenced from some regional guidelines and a much broader collection of national standards, have congregated around eight principles.[78] The first agreed principle in this area is that there should be guidelines to assist decision makers in this area. The second principle is that species that are threatened by seismic noise pollution should be protected from such noise. The third principle is that the best way to secure the protection of threatened species is via ensuring that certain areas are prohibited to seismic surveys. Given that there are very few permanent protected areas whereby seismic testing is completely prohibited, the more common way to regulate the activity is via the fourth principle, which is the creation of temporary buffer or safety zones around seismic operations. These are frequently defined as circular areas that remain around a sound source. If protected animals are located in the buffer zone, the operations should cease until the animal exits the area. Animals outside this zone are presumed not to be exposed to harmful levels of sound. Some countries adopt relatively small buffer zones of 500 metres, while others adopt buffer zones of up to four kilometres for critically endangered species. For buffer zones to effectively work, a fifth principle is recognized. Specifically, it is necessary to adopt multiple types of surveillance of the buffer

[73] *Ibid.,* Article 240(d), 263.
[74] *Ibid.,* Article 245, 246, 249.
[75] *Ibid.,* Article 246(1).
[76] *Ibid.,* Article 246(2).
[77] *Ibid.,* Article 262.
[78] For a discussion of these, see Blue Planet Marine, *Review of Seismic Guidelines and Reference Document: Discussion Paper Prepared for Department of Conservation*, Doc. BPM-10-DOC-DP-v1.0 (2010); OSPAR, Overview of the Impacts of Anthropogenic Underwater Sound in the Marine Environment, at 1419 (2009); OSPAR, *supra* note 15 at 4, 5, 24-25; C. Weir et al., *Comparative Review of the Regional Marine Mammal Mitigation Guidelines Implemented during Industrial Seismic Surveys* 10 J. Wildlife L. & Pol'y 1 (2007); M. Castellote, *General Review of Protocols and Guidelines for Minimizing Acoustic Disturbance to Marine Mammals from Seismic Surveys* 10 J. Int'l Wildlife L. & Pol'y 273 (2007); R. McCauley et al., *Marine Seismic Mitigation Measures*, Doc. IWC SC/58/E44 (2006); Joint Nature Conservation Committee, Guidelines for Minimising Acoustic Disturbance to Marine Mammals from Seismic Surveys (2004).

zones to ensure the protected animals do not enter the site. The sixth principle is that seismic operations should start slowly so that animals can leave the area before the operations reach capacity. The seventh principle is that seismic noise operations should aim to use the minimum amount of noise necessary to successfully achieve their work. The eighth, and final, principle is that all seismic operations should have a careful reporting of their activities.

Although the principles and practices by which seismic noise pollution may be mitigated are relatively clear, their implementation is not, particularly in the case of certain types of pollution originating from seabed activities subject to national jurisdiction[79] or of pollution generated from activities within the Area. In regard to pollution originating from seabed activities subject to national jurisdiction, the starting point within UNCLOS is that coastal states are obliged to enact laws and regulations to prevent, reduce, and control the pollution of the marine environment arising from, or in connection with, seabed activities, subject to their jurisdiction pursuant to the rules on exclusive economic zones and the continental shelf.[80] These rules, which should be harmonized at the appropriate regional level 'through competent international organizations or diplomatic conference' from which 'global and regional rules, standards and recommended practices to prevent, reduce and control pollution of the marine environment,' should be developed.[81] Following from the precedents noted earlier, such rules may be developed via a specialized convention or more generic guidelines, such as those adopted through the United Nations Environment Programme (UNEP) for land-based pollution of the marine environment. It is likely that this route, via UNEP, is the best approach until further evidence is adduced to see if a dedicated convention is needed in this area. It is best to wait to see if a wider-based instrument is necessary to regulate other sources of noise pollution in the marine environment, in addition to seismic sources. However, as it currently stands, no such instrument exists.[82]

With respect to any exploration and/or extraction in the Area, necessary measures to ensure effective protection for the marine environment and natural resources of the Area from 'harmful effects which may arise from such activities' must be adopted by the ISA.[83] In this regard, it is expected that international rules, regulations, and procedures will be established in accordance with UNCLOS to prevent, reduce, and control pollution of the marine environment from activities in the Area.[84] States that are also pursuing activities in the Area are expected to also adopt supplementary rules to prevent, reduce, and control

[79] UNCLOS, *supra* note 1, Article 208.
[80] *Ibid.,* Article 208(1).
[81] *Ibid.,* Article 208(5).
[82] K. Scott, *The International Regulation of Undersea Noise* 53 Int'l & Comp. L. Q. 287 at 287-324 (2004); E. McCarthy, *The International Regulation of Transboundary Pollutants: The Emerging Challenge of Ocean Noise* 6 Ocean & Coastal L.J. 257 at 257, 260 (2001).
[83] UNCLOS, *supra* note 1, Article 145.
[84] *Ibid.,* Article 209(1).

pollution of the marine environment from activities in the Area undertaken by vessels, installations, structures, and other devices flying their flag.[85] This focus is fully consistent with the strong emphasis that UNCLOS places upon co-operation and harmonized policies on a global and/or regional basis, through competent international organizations for the protection and preservation of the marine environment.[86] The difficulty is that the ISA, despite its interest in protecting the marine environment, has not recognized noise pollution as a matter of concern, despite the fact that the authority adopted a series of regulations in the years 2000 and 2010 concerning prospecting and exploration (with methods very similar to seismic surveys) of polymetallic nodules and polymetallic massive sulphides.[87]

3. Noise from Military Exercises

It is assumed that military forces will carry some of their domestic laws with them when they are operating outside of their own territories. Thus, in the case of the United States, there was an initial presumption that certain environmental laws had a global application, outside of the borders of America.[88] This was especially the case when the US military was dealing with 'trust' territories where there was exclusive control[89] but not when there were unique foreign policy considerations, which trumped the possible application of domestic environmental laws.[90] As a way to move past such potential ambiguities, President Jimmy Carter issued Executive Order no. 12,114 in 1979, which pertained to 'Environmental Effects Abroad of Major Federal Actions.'[91] The purpose of this order was to enable responsible officials of federal agencies, having ultimate responsibility for authorizing and approving actions that had 'significant effects on the environment outside of the geographical borders of the United States,'[92] to be informed of pertinent environmental considerations and to 'take such considerations into account' with other pertinent considerations of national policy.[93] By its order, it exempted a number of instances, including many of the United States national security activities abroad from the depth of scrutiny applied to domestic actions.[94] Similarly, most environmental impacts within a

[85] *Ibid.,* Article 209. Note also Article 208.
[86] *Ibid.,* Articles 194(1), 197, 208(5).
[87] See the International Seabed Authority, The Protection of the Seabed, at 2-5 (2004); International Seabed Authority, Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area (2000).
[88] *NRDC*, *supra* note 9 at 1366.
[89] See *People of Enewetak v. Laird,* 353 F. Supp. 811, 818 (D. Haw., 1973). See also *People of Saipan by Guerrero v. United States Dep't of Interior*, 356 F. Supp. 645, 650 (D. Haw., 1973).
[90] See *NRDC v. Nuclear Regulator Commission*, 647 F.2d 1345 (D.C. Cir., 1981); *NEPA Coalition of Japan v. Aspin*, 837 F. Supp. at 467 (D.D.C., 1993).
[91] The provisions of Executive Order no. 12,114 of 4 January 1979, which appear at 44 F.R. 1957, 3 C.F.R., 1979 Comp. at 356.
[92] *Ibid.,* section 2.1.
[93] *Ibid.,* section 1.1.
[94] *Ibid.,* section 2-5.

'participating' nation escape review entirely (as allied countries are assumed to have worked out, and reconciled with the visitors, such questions for themselves).[95] Despite these limits, environmental impact statements, when they deal with the global commons outside the jurisdiction of any nation such as the oceans—and especially Antarctica[96]—were mandated by this order.[97]

The actions as called for by Executive Order no. 12,114, or by other domestic environmental laws, give greater force in dealing with issues such as underwater noise from military activities than the actions called for in international law. This is because in this area of international law matters of 'public interest' are allowed to trump conservation concerns.

Exceptions for the military to take (or kill) endangered species are rarely spelled out within the international laws. Rather, military needs are assumed within some of the broader exceptions that exist within most conservation-based treaties. Thus, basic principles of conservation are nearly always peppered with exceptions, which allow important actions of the public interest to trump conservation efforts. In this context, the basic principle, as recorded in Article 3 of the CBD, is that '[s]tates have . . . the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.' However, this obligation is tempered by the general caveat that they are expected to pursue the goals of conservation, 'in accordance with its particular conditions and capabilities' and 'as appropriate.'[98] In practice, this means that conservation measures do not always trump other considerations. This practice, which began in 1916,[99] is also notable within later conservation treaties such as, *inter alia*, the Convention on Wetlands of International Importance Especially as Waterfowl Habitat,[100] the Convention on the Conservation of Migratory Species of Wild Animals,[101] and the Convention on the Conservation of European Wildlife and Natural Habitats.[102] Under such wide exceptions, military activities have been permitted by the parties to some of these conventions in contemporary times, such as between the United States and the 1916 Convention between the United

[95] S. Dycus, *Osama's Submarine: National Security and Environmental Protection after 9/11* 30 William & Mary Envt'l L. & Pol'y Rev. 1 at 26-27 (2005); K. Fair, *Environmental Compliance in Contingency Operations: In Search of a Standard* 157 Military L. Rev. 112 (1998).

[96] This question was hinted at in *NRDC v. Navy*, No. CV-01-07781 (C.D. Cal., 19 September 2002).

[97] *Environmental Defence Fund v. Massey,* 986 F.2d. 528 at 534 (D.C. Cir., 1993).

[98] CBD, *supra* note 47, Article 6.

[99] Convention between the United Kingdom and the United States for the Protection of Migratory Birds in Canada and the United States, 39 Stat. 1702 (1916), T.S. no. 628, Article 7 [Migratory Birds Treaty].

[100] Convention on Wetlands of International Importance Especially as Waterfowl Habitat, U.K.T.S. 34 (1976), Article IV.

[101] Convention on the Conservation of Migratory Species of Wild Animals, British Command Paper Cmd, Misc 11 (1980) and Cmd. 1332 TS 87 (1990) 15, Article III (5)(d).

[102] Convention on the Conservation of European Wildlife and Natural Habitats, Eur. T.S. no. 104, U.K.T.S. No. 56 (1982), Cmd. 8738, Article 9.

Kingdom and the United States for the Protection of Migratory Birds in Canada and the United States.[103]

Although these conventions have not explicitly exempted the military, international law does not have any controls in place pertaining to pollution from warships. Thus, within the multitude of treaties pertaining to matters of the oceans and oil pollution—in terms of liability,[104] outside intervention to stop,[105] other forms of marine (non-oil) pollution,[106] the dumping of waste into the ocean,[107] and even salvage[108]—none of them apply explicitly to military vessels. It is expected in all instances that flag states will attempt to adhere to the spirit of the various regimes. The overall situation was best summed up by Article 236 of UNCLOS. Namely, under the principle of sovereign immunity,

> [t]he provisions of this Convention regarding the protection and preservation of the marine environment do not apply to any warship, naval auxiliary, other vessels or aircraft owned or operated by a State and used, for the time being, only on government non-commercial service. However, each State shall ensure, by the adoption of appropriate measures not impairing operations or operational capabilities of such vessels or aircraft owned or operated by it, that such vessels or aircraft act in a manner consistent, so far as is reasonable and practicable, with this Convention.[109]

The situation for this particular problem is magnified because the conservation of marine mammals, as directed through UNCLOS, is to be undertaken by the 'appropriate international organisations.' The appropriate international organization is the International Whaling Commission (IWC). However, the IWC, although able to, and aware of the problem underwater of noise pollution, has never passed a specific resolution on (nor even acknowledged the problem of) military-generated noise.[110] Accordingly, aside from the exception granted to the military in the area of conservation within the international law of the sea,

[103] In 2002, the Congress of the United States was persuaded to alter its internal operation in terms of compliance with the 1916 Migratory Birds Treaty. This followed the successful legal action against the secretary of defence for the (incidental) killing of migratory birds located on, or near, a firing range on an island in the Marianas. *Centre for Biological Diversity v. Pirie,* 191 F. Supp. 2d 161, 2002 U.S. Dist. LEXIS 4112. The new law was found in the National Defence Authorisation Act for Fiscal Year 2003, Pub. L. No. 107-314, ss. 315, 16 Stat. 2458, 2509 (2002).

[104] See the 1969 and 1992 International Convention on Civil Liability for Oil Pollution Damage, 973 U.N.T.S. 3 (1969 and 1992), Article XI.

[105] 1969 International Convention Related to Intervention on the High Seas in Cases of Oil Pollution Damage, U.K.T.S. 77 (1971), Article 1(2).

[106] See MARPOL Convention, *supra* note 60, Articles 3 and 11(2).

[107] *Ibid.,* Articles 3, 7 and 11(2). Note the 1996 Protocol to this regime substantially reorientated the original 1972 convention and did not contain the original exception, although Article 8(2) did allow exceptions for dumping in emergencies.

[108] International Convention on Salvage, 28 I.L.M.1542 (1990), Article 4.

[109] Note also *ibid.,* Article 298 (1)(b).

[110] The parties to the International Convention for the Regulation of Whaling, 2 December 1946, 62 Stat. 1716, 161 U.N.T.S. 72, could address (but not regulate) this topic under Article VI of the convention.

the international standards to which they could be expected to act in a manner consistent with these standards simply do not exist.

Although there are no international standards in this area, some standards are appearing at the regional level. The best examples of such regulation are the regional Convention on the Conservation of European Wildlife and Natural Habitats, the Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS),[111] and the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS).[112] These are particularly interesting examples, as a large number of the members of both agreements within the European Community have actively avoided obligations in this area. Thus, while the European Community has created strong obligations relating to the assessment and management of (large-scale) environmental noise, they have also added that

> [t]his Directive shall not apply to noise that is caused by the exposed person himself, noise from domestic activities, noise created by neighbours, noise at work places or noise inside means of transport or due to military activities in military areas.[113]

Despite such concerns, in the case of the ASCOBANS, the parties have agreed to work with military authorities to introduce codes of conduct, or similar measures such as environmental impact assessments, to reduce disturbance to small cetaceans.[114] A few years later in 2003, the parties reiterated the call for further co-operation with military authorities in the area of noise pollution.[115] Going one step further, the parties of ACCOBAMs, although being fully cognisant of Article 236 of UNCLOS, issued recommended guidelines for all parties to combat underwater noise.[116] With particular regard to military sonar, the guidelines have recommended principles that largely follow what has already been agreed in the domestic setting of the United States (even though the United States is not a party to ACCOBAMS)—namely, the avoidance of key habitat areas (although the courts were much clearer on outlining the specific areas that are restricted, the guidelines have highlighted the importance of avoiding areas known for the presence of beaked whales) and the mandate of using the lowest practicable power levels. Where the ACCOBAMS guidelines have differed is in the specification of the details of the monitoring requirements (so as to ensure that cetaceans are not in the area) and the insistence of not utilizing high power

[111] Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area, 36 I.L.M. 777 (1997).
[112] Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas, U.K.T.S. No 52 (1995).
[113] EC Directive 2002/49 Relating to the Assessment and Management of Environmental Noise (25 June 2002), Article 2.
[114] Resolution 4 on Disturbance (2000).
[115] Resolution 5 on Effects of Noise and of Vessels (2003).
[116] Resolution 4.17 on Guidelines to Address the Impact of Anthropogenic Noise on Cetaceans in the ACCOBAMS Area (2010).

sources at night (because detection is difficult). They were also more prescriptive in terms of ramp up times (a slow build-up to maximum noise emissions) and power-down requirements (when a specimen was found in the zone), of which the Supreme Court of the United States specifically excluded (for some types of sonar training).

Given the international exceptions for the military, and the silence of the appropriate international organizations such as the IWC on the question of underwater noise pollution, it falls to the domestic legal responses of each country to address the problem. However, domestic conservation law tends to mirror international law on this question, and military exceptions are built strongly into the language and operation of most of these documents.[117] For example, within the United States, military considerations have often trumped the concerns of conservationists, as is seen within the *Endangered Species Act*,[118] the *Marine Mammals Protection Act*,[119] the *Coastal Zone Management Act,*[120] and the *National Environment Policy Act*.[121] Moreover, despite attempts to weaken the military exceptions in this area after the end of the Cold War, they were made even more comprehensive following the terrorist attacks of 11 September 2001, due to a fear that the military of the United States was not as prepared as it should be because of having to unreasonably comply with environmental laws.[122] Accordingly, all of the acts mentioned a moment ago, namely on endangered species,[123] coastal zone management,[124] and marine

[117] For a full examination of this area, see A. Gillespie, The Limits of International Environmental Law: Military Necessity v. Conservation [forthcoming].

[118] *Endangered Species Act,* 16 U.S.C. § 1531(b). For a good discussion of this act in this setting, see Dycus, *supra* note 95 at 30-35. See also *Sierra Club v. Dan Glickman,* 156 F.3d 606 (1998), U.S. App. LEXIS 23988.

[119] *Marine Mammals Protection Act,*16 U.S.C. ss. 1361 (1988; Supp. V 1993). For the navy's earlier conflicts with this law, see *Citizens to End Animal Suffering and Exploitation v. The New England Aquarium,* 836 F. Supp. 45 (D. Mass., 1993).

[120] *Coastal Zone Management Act,* 16 U.S.C. ss. 1451-64 (Sipp. V., 1993).

[121] *National Environment Policy Act*, 42 U.S.C. ss. 4321-47.

[122] J. Yap, *Just Keep Swimming: Guiding Environmental Stewardship Out of the Riptide of National Security* 73 Fordham L.R.1289 (2004). Note also N. Bethurem, *Environmental Destruction in the Name of National Security* 8 Hastings W. N.W. J. Envt'l Law & Pol'y 109 at 109, 115 (2002); R. Durant, The Greening of the U.S. Military, at 155-75 (2007); R. Lazarus, *A Different Kind of Republican Movement in Environmental Law* 87 Minnesota L. Rev. 999 (2003); R. Santicola, *Encroachment: Where National Security, Land Use, and the Environment Collide,* Army Law Review 1 (2006); M. Burke, *Green Peace? Preserving Our National Treasures While Providing for Our National Security* 32 William & Mary Envt'l L. & Pol'y Rev. 803, at 803, 804-6 (2008); Dycus, *supra* note 95 at 1, 2-3.

[123] See section 318 of 117 STAT 1434, Public Law no. 108-36 (24 November 2003). For earlier commentary, see N. Diner, *The Army and the Endangered Species Act: Who Is Endangering Whom?* 143 Military L. Rev. 200 (1998).

[124] Considerable uncertainty existed over the extent of the military obligations in this area. See *Friends of the Earth v. United States Navy,* 841 F.2d 927 (9th Cir., 1988); R. Kuersteiner, *Protecting Our Coastal Interests: A Policy Proposal for Coordinating Coastal Zone Management, National Defence and Federal Supremacy Doctrine* 8 Boston College Envt'l Affairs L. Rev. 705 (1980). In 2008, the secretary of commerce requested further, that the president exempt the navy

mammals,[125] through which inroads could be made in controlling aspects of the utilization of military sonar were curtailed. Moreover, with respect to laws that were not altered, such as the *National Environmental Policy Act*, the courts have consistently taken a hard line in limiting the application of such laws when priorities of conservation have come head to head with the priorities of the military. In such contexts, the courts have been particularly reluctant to demand compliance with environmental considerations when dealing with matters of military importance.[126] Accordingly, if some act is deemed 'essential' for military purposes, courts will usually permit the activity to proceed, even if the act breaches various environmental statutes. This was most evident in the case of *Winter v. NDRC* in the Supreme Court of the United States, where although it was agreed that 'military interests do not always trump other considerations' if the interests are essential or, in this case, if a certain technology (MFA sonar) was deemed (by the navy) to be 'mission-critical [and] essential to national security,' then the court concluded that the environmental injury was 'outweighed by the public interest and the Navy's interest in effective, realistic training of its sailors.'[127]

Although matters deemed essential to the military may trump environmental considerations, the latter are rarely completely discarded. Rather, the courts, as exemplified by the United States, typically try to find a balance between the interests of the military and the interests of environmental protection (as expressed by statutory obligations). While the exact balance in such safeguarding will be influenced by considerations such as exactly how endangered the species at hand is (with critically endangered species being existent of higher standards) the base response is one whereby mitigation measures are imposed on the

from section 307(c)(a)(a) of the *Coastal Zone Management Act*. See the press release from the White House, 15 January 2008, reprinted in Burke, *supra* note 122 at 831.

[125] In 2003, Congress, through the *National Defence Authorisation Act for Fiscal Year* (2004), 117 STAT 1434, Public Law no. 108-136 (24 November 2003), amendments to the *Marine Mammal Protection Act* (section 319 of the 2004 act).

[126] *Weinberger, Secretary of Defence v. Catholic Action of Hawaii,* 454 U.S. 139 (1981), 102 S. Ct. 197, 70 L.Ed. 2d 298, 1981 U.S. LEXIS 45; *United States v. 243.22 Acres of Land,* 129 F.2d 678, 683 (2d Cir., 1942); *Gilligan v. Morgan,* 413 U.S. 1 (1972), 10, 93 S. Ct. 2440, 2446, 37 L. Ed. 2d 407; *Schlesinger v. Ballard,* 419 U.S. 498, 510, 95 S. Ct. 572, 578, 42 L. Ed. 2d 610 (1975); *Orloff v. Willoughby,* 345 U.S. 83, 93-94, 73 S. Ct.534, 540, 97 L. Ed. 842 (1953); *Australians for Animals et al. v. Donald Evans in 2004 before the District Court for the Northern District of California*, No. C-04-0086, 2004 U.S. Dist. LEXIS 753; *Aluli v. Brown,* 437 F. Supp. 602 (D. Haw., 1977); 1977 U.S. Dist. LEXIS 13986; 10 ERC (BNA) 1765, 7 E.L.R. 20780; *Barcelo, Governor of Puerto Rico et al. v. Brown et al.,* 478 F. Supp. 646 at 693, 1979 U.S. Dist. LEXIS 9774, 13 E.R.C. (BNA) 2105; *National Audubon Society v. Gordon,* 422 F.3d 174; 2005 US. App. LEXIS 19277, 61 ERC (BNA) 1161, 35 E.L.R. 20183.

[127] *Winter, supra* note 8 at 16; see also 3, 13, 15, 16, 17. For commentary on this case, see J. Reynolds, *Submarines, Sonar and the Death of Whales: Enforcing the Delicate Balance of Environmental Compliance and National Security in Military Training* 32 William & Mary Envt'l L. & Pol'y Rev. 759 (2008); B. Narodick, *Winter v. National Resources Defence Council: Going Into the Belly of the Whale* 15 B. U. J. Sc. & Tech. L. 332 (2009).

proposed military activity.[128] The most common mitigation measure to be adopted is a 'least harm' rule, whereby military exercises may be continued, provided they attempt to do the least possible harm. The foremost method to be achieved is to ensure that the testing site is the best possible location in terms of the testing of the sonar, which results in the least possible environmental impact. The test for such a site is usually done via the evaluation of alternative sites.[129] In the case of low frequency sonar, the selection of a particular site means that it has been authorized by the courts for deployment in areas that are not biologically important, including a number in international waters.[130]

Once the question of alternative sites has been dealt with, additional mitigation methods tend to come into play. For example, when dealing with mitigation measures for the testing of SURTASS-LFA, in addition to the rule of seeking out alternative sites, two additional measures were added. These were measures to be adopted 'whenever feasible.' Specifically, in seeking to minimize the exposure of marine mammals and sea turtles to SURTASS levels below 180 dB(A), they mandated a two-kilometre safety zone, whereby if one of these animals was detected within one kilometre of the sonar source (the safety zone), transmissions were to be suspended. Second, coastal waters within twenty-two kilometres of the shore were not exposed to SURTASS-LFA sonar signals at levels above 180 dB(A).[131] Similar, but different, additional mitigation measures were accepted by the Supreme Court of the United States when it was dealing with MFA sonar. These measures were the imposition of a twelve-mile 'exclusion zone' from the coastline; utilizing lookouts to conduct additional monitoring for marine mammals; restricting the use of dipping sonar; and limiting the use of MFA sonar in geographic 'choke points.' The Supreme Court of the United States differed with the district court on additional mitigation measures for MFA sonar, in particular, on two additional measures of 'shutting down MFA sonar when a marine mammal is spotted within 2,200 yards of a vessel' and 'powering down MFA sonar by 6 dB(A) during significant surface ducting conditions.'[132] In regard to these two additional measures, the court, in deferring to the opinion of the navy, ordered that they did not need to be complied with since they were overtly restrictive as they were likely to affect effective and necessary navy operations. Specifically, each additional shutdown could have resulted in the loss of several days' worth of training. Such a delay could have caused operational commanders to 'lose awareness of the tactical situation

[128] *NRDC, supra* note 9.
[129] *Ibid*.
[130] *Ibid.* Outside the coastal areas, the areas identified were the 200-metre isobath of the North American eastern coast, year round; the Costa Rico Dome, year round; and the Atlantic convergence zone, October through March. It was also agreed that low frequency active sonar would not be deployed in the Arctic or the Antarctic. The court in late 2003 and again in 2005, added a further nine areas, off Japan, the Philippines, and China. Department of the Navy, *supra* note 10 at 15 to 17.
[131] *NRDC, supra* note 9 at 71-74. See also Department of the Navy, *supra* note 10 at 8-12.
[132] For the conditions, see *Winter*, *supra* note 8 at 7.

through the constant stopping and starting of MFA [sonar].'[133] The end result of this difference between the courts was that the extent of the mitigation measures against the impact of military sonar were scaled back. They were not, however, abandoned.

V. CONCLUSION

The oceans of the world are becoming increasingly noisy. The primary sources of the new noise are commercial shipping, seismic surveys, and military sonar. Many of these sources of noise appear to have a detrimental impact upon many species in the ocean, although the extent of this impact is a matter of debate. Accordingly, a number of international bodies are calling for scientific certainty in this area. Although the scientific questions are slowly being resolved, the legal frameworks through which this problem must be dealt are proving less amenable. Such is the situation despite the fact that UNCLOS is very clear on both the principles to be applied and how it is to be done. The problem is that in each area the engagement by the international community has been less than desirable.

With respect to noise caused by commercial shipping, the IMO has only just become interested in the debate. However, its commitment is questionable since it is dismissive of the idea of having a particular law or rule trying to control underwater noise caused by the vessels under their auspice, preferring to utilize existing tools that create variations of marine protected areas to address the problem. The difficulty with this option is that the current regulations on marine protected areas give little consideration to noise pollution. In regard to seismic testing, although the clear mitigation principles have applied, they have not been solidified by an appropriate body, such as UNEP, and its comparable principles on land-based pollution. Accordingly, the national and regional responses to seismic surveys are very ad hoc. However, ad hoc or not, these responses are often greatly advanced from the position of the ISA, which has proven itself to be oblivious to noise pollution. Finally, international attempts to control the impact of military sonar face the absolute brick wall of sovereign immunity for all military vessels on the high seas from any environmental responsibilities. Accordingly, it falls to each state to regulate its own military forces. The problem with this situation is twofold. First, it is customary to place the interests of the military over the interests of conservation. Thus, mitigation measures in this area are always weak. Second, only the responses of the countries that operate within relatively transparent legal systems are known. This means that while the practices and mitigation techniques of the United States are known, very little is known about the practices of all of the other navies of the world when facing exactly the same difficulties. Such a scenario is particularly

[133] *Winter*, *supra* note 8 at 15, 19.

daunting when one is dealing with navies that are not allied or practising with the United States, making any meaningful international response to one of the emergent conservation problems of the oceans in the twenty-first century particularly problematic.