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- Intergovernmental Oceanographic Commission
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Global Ocean Science Report

Dr Luis Valdés

8 June 2017

Launch of the Global Ocean Science Report
UN Ocean Conference

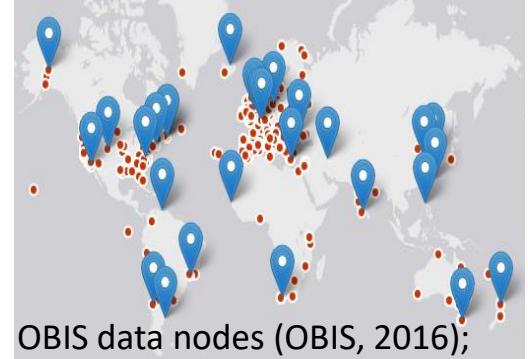
Motivation: Ocean science for sustainable development



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- Ocean science crucial for sustainable development
- Need to understand ocean science capacities - but many questions remain
- Global Ocean Science Report first consolidated assessment of ocean science:
 - Identifies and quantifies elements driving ocean science capacity (workforce, infrastructure, investment, data management), productivity (publications) and performance
 - Aims to strengthen international ocean science collaboration and science-policy interaction and support SDG14 (in particular 14.a)



OBIS data nodes (OBIS, 2016);



RRS James Cook (NERC);



OTGA, 2016



Report structure



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Ocean science categories

Ocean observation and marine data

Marine ecosystems functions and processes

Ocean and climate

Ocean health

Human health and well-being

Blue growth

Ocean crust and marine geohazards

Ocean technology

Chapters

1. Introduction
2. Definitions, data collection and data analysis
3. Research capacity and infrastructure
4. Funding for ocean science
5. Research productivity and science impact
6. Oceanographic data and information exchange
7. International supporting organizations on ocean science
8. Contribution of marine science to the development of ocean and coastal policies and sustainable development



Contributions from around the world

Individual contributors:

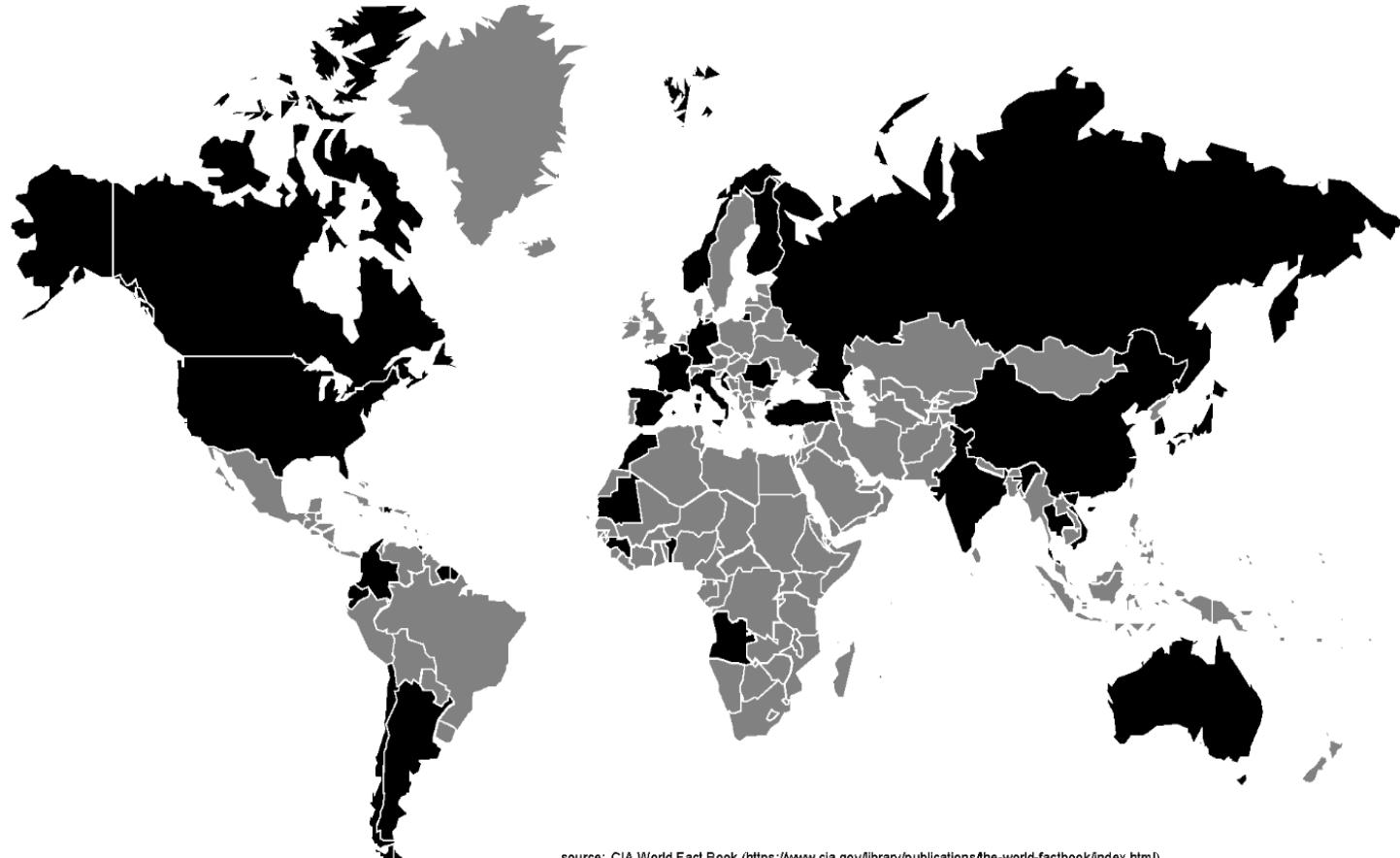
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IOC Member States that responded to the GOSR questionnaire

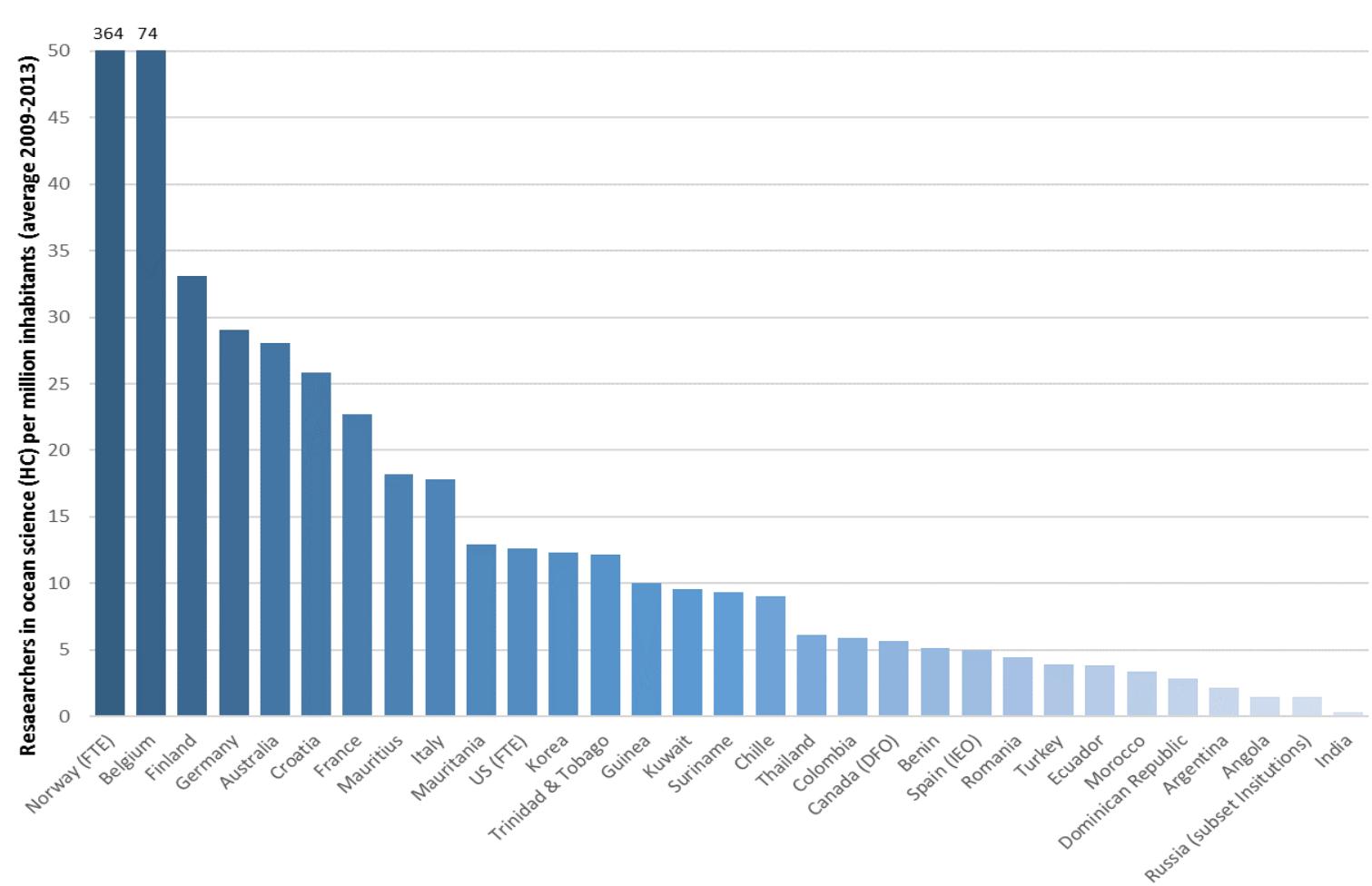


source: CIA World Fact Book (<https://www.cia.gov/library/publications/the-world-factbook/index.html>)

(34 States, 23% of IOC member states, 75% scientific literature)

Researchers

The ‘human resources’ that drive ocean science are concentrated in certain countries

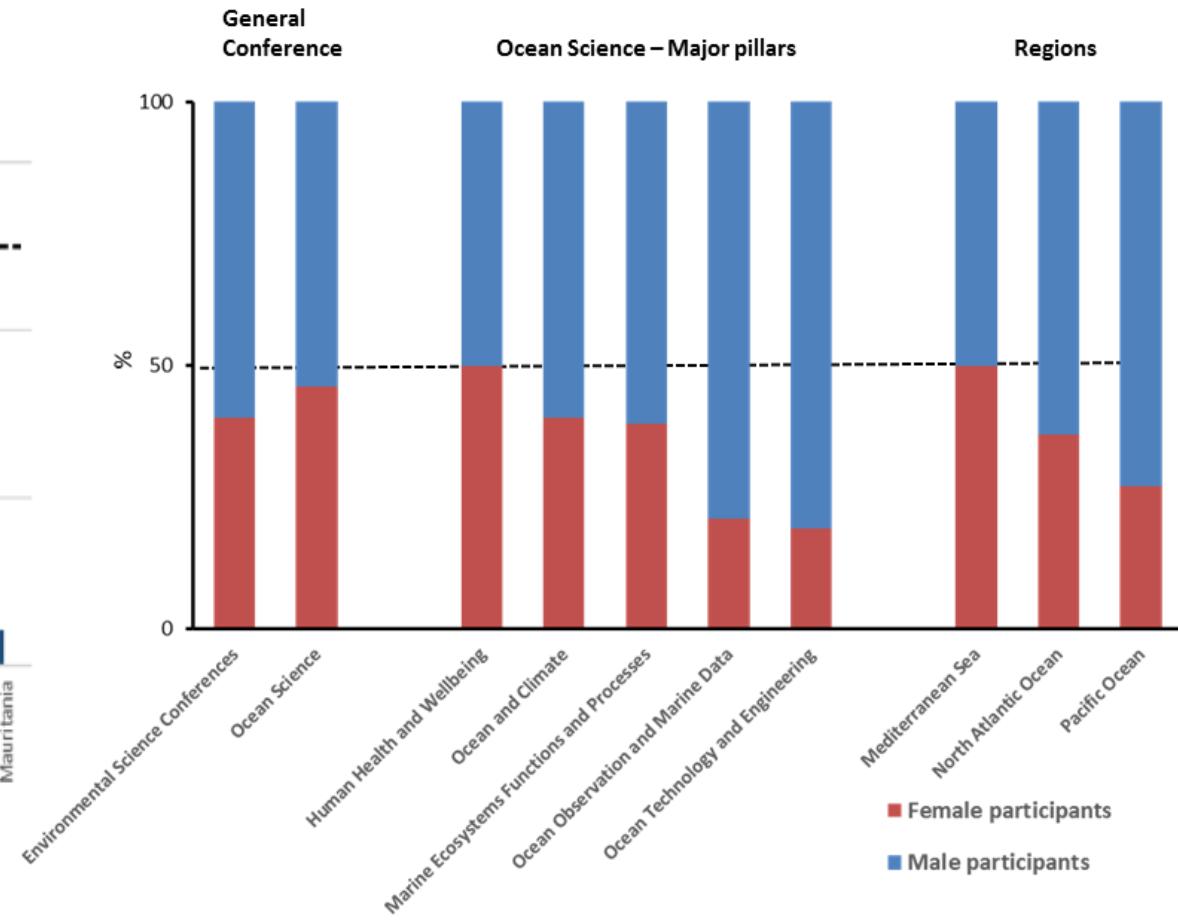
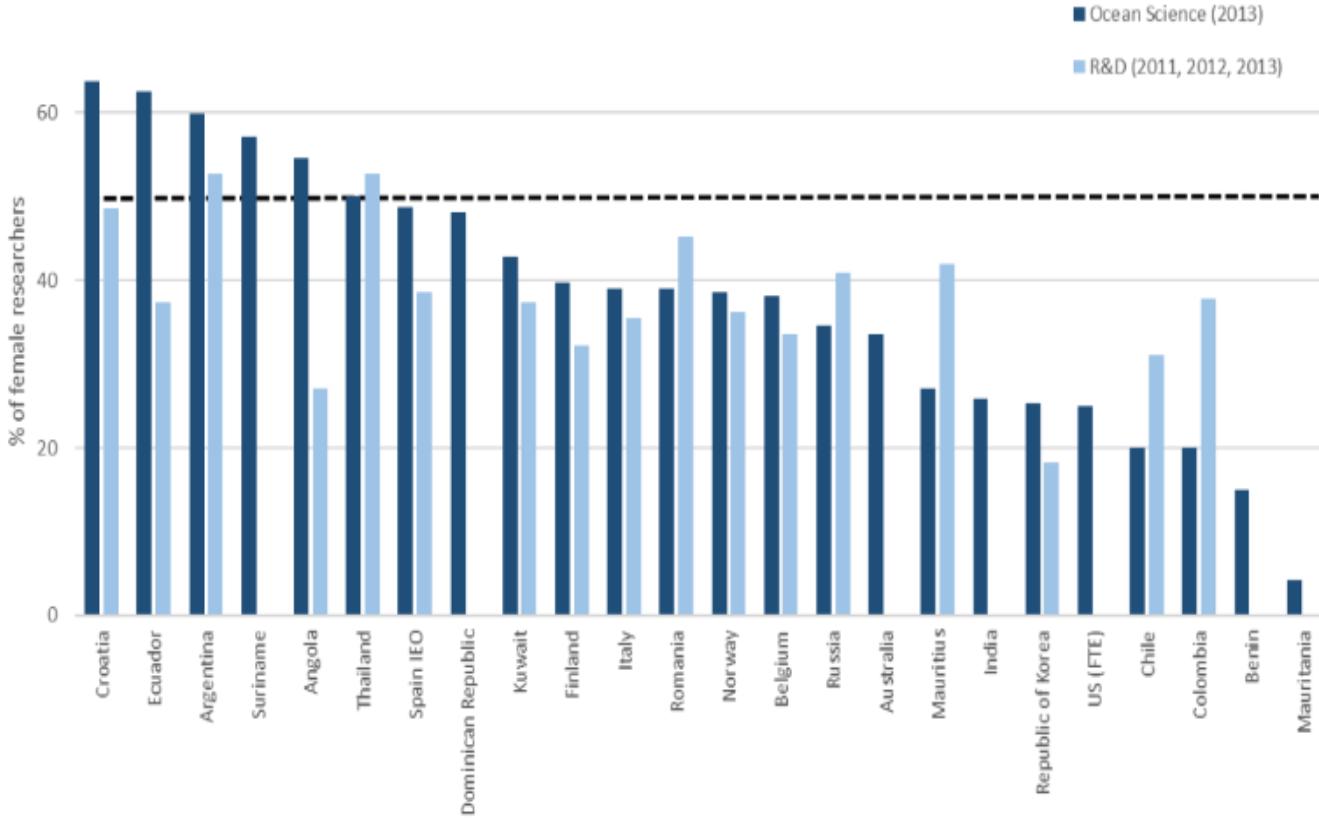


Marine scientists per million inhabitants(headcount, HC, 2009–2013). Note: in some cases, the reported information was not the national average: for Norway and the USA data represent full time equivalent (FTE) ocean research positions, for Canada HC information was provided only for Fisheries and Oceans Canada (DFO), and for Spain HC represents only the Spanish Institute of Oceanography (IEO).

Source: GOSR questionnaire, 2015; UNESCO Institute for Statistics (UIS), 2015

Gender balance

Gender balance varies between countries, regions and ocean science categories – but is more equal than in science overall

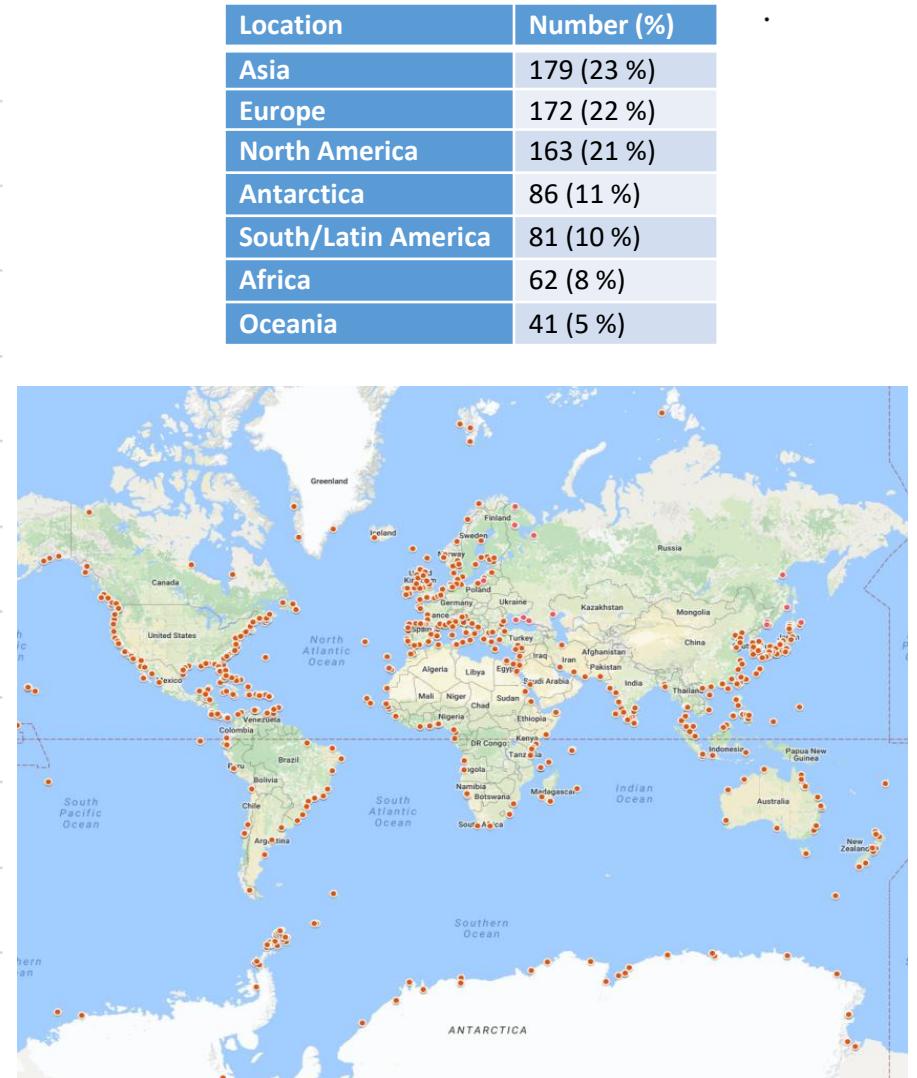
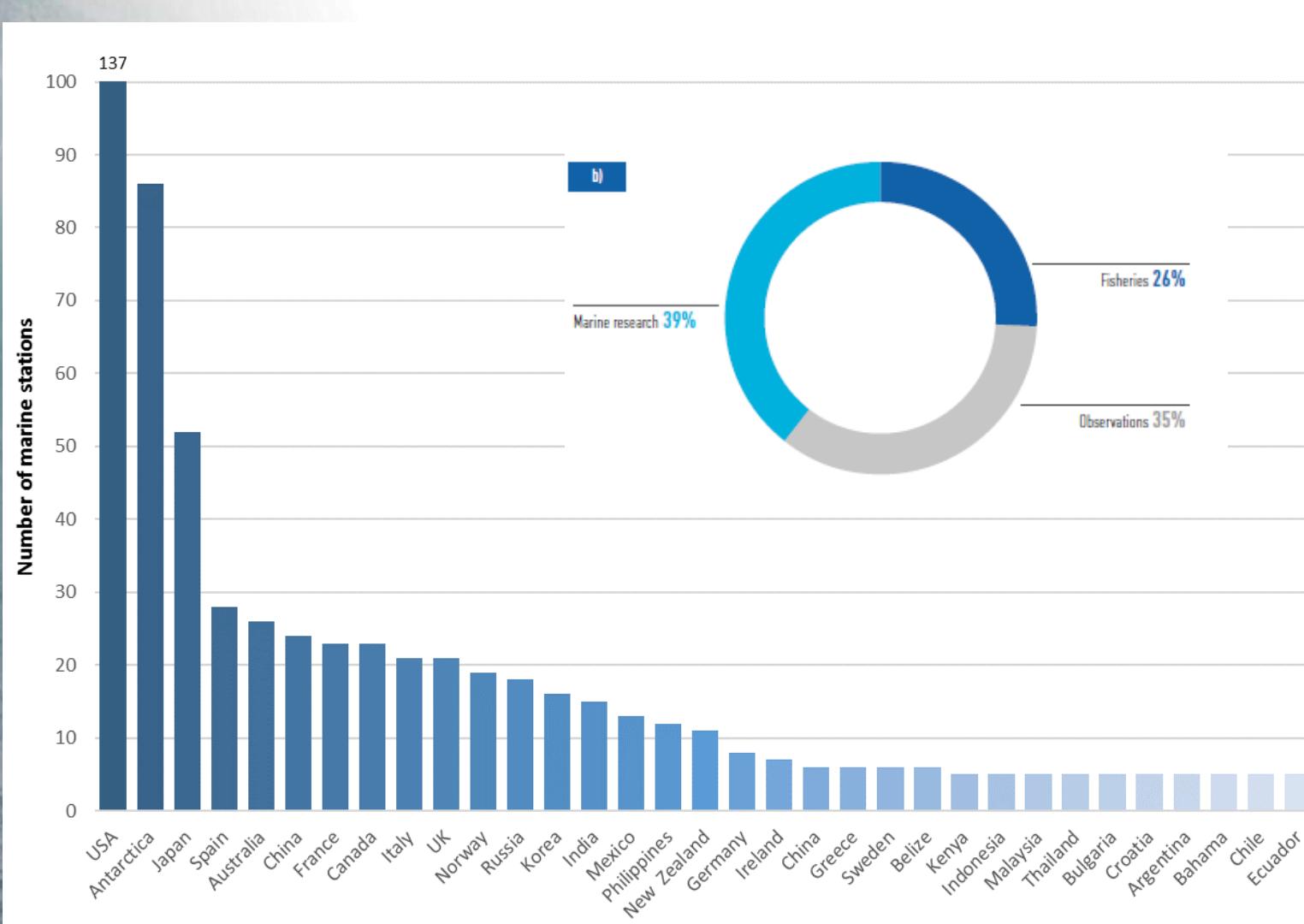


Proportion (% total) of female researchers in ocean science (headcounts; dark blue bars) and in R&D (light blue bars). Sources: GOSR questionnaire (ocean science), 2015; UIS (R&D), 2015.

Percentage of male and female participants in ocean science conferences

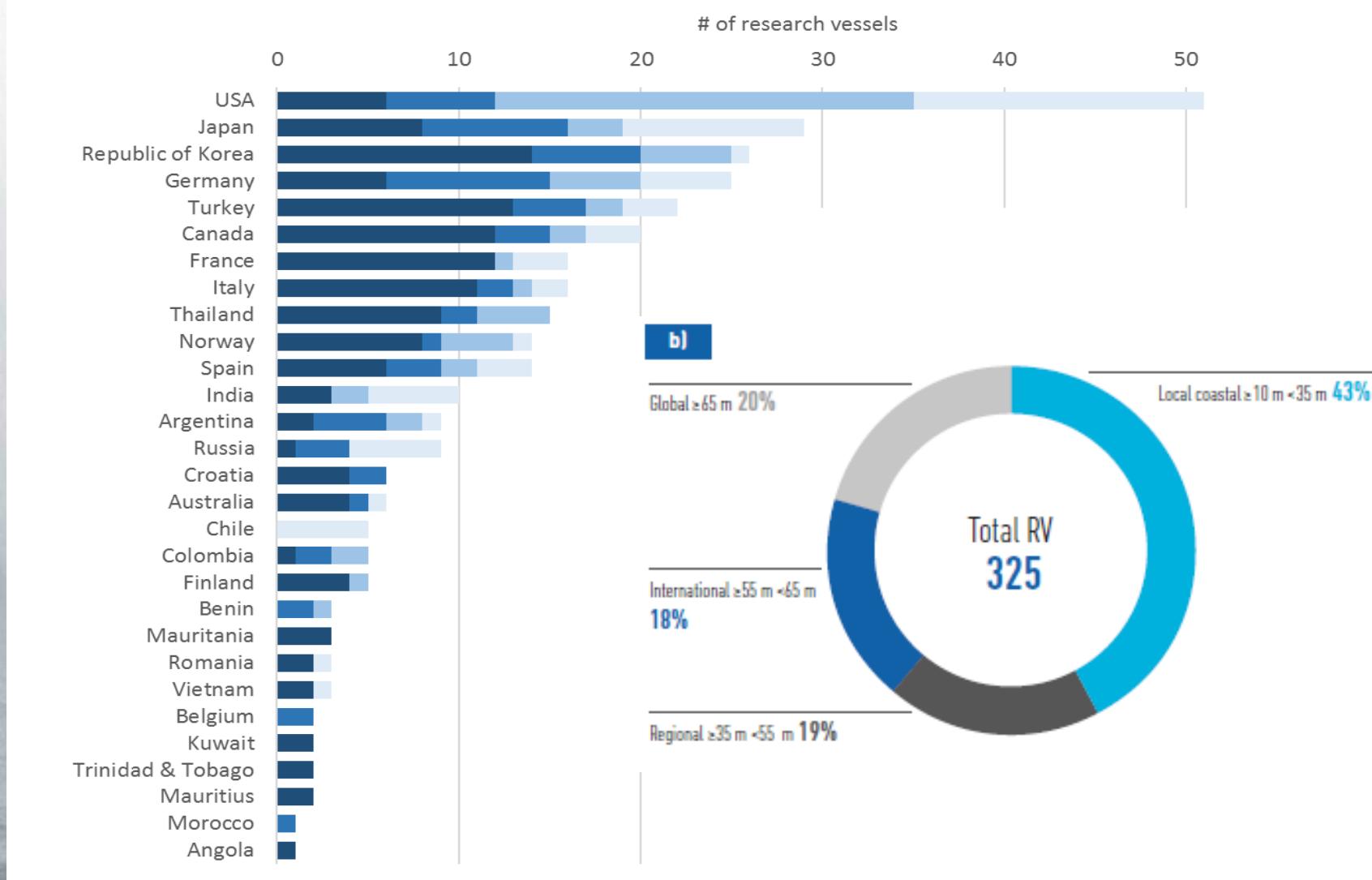
Marine stations

784 marine stations maintained by 98 countries



Research vessels

More than 320 vessels, operating at coastal, regional and global scales



Research vessels

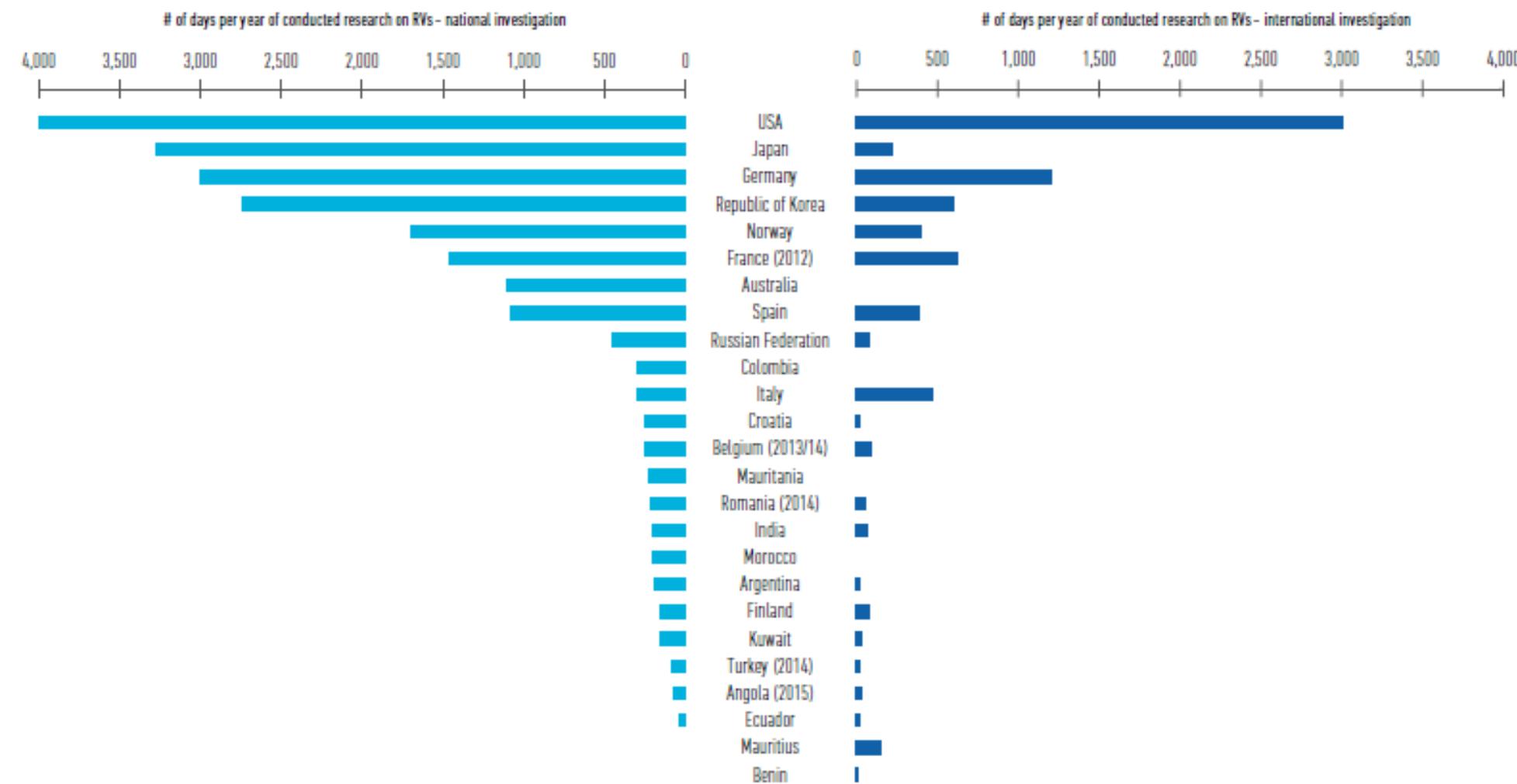


Figure 3.15. Number of days per year of research conducted from research vessels for national (left panel) and international (right panel) investigation by country (2013, or the last year with available data). Source: GOSR questionnaire, 2015.

Floats and buoys

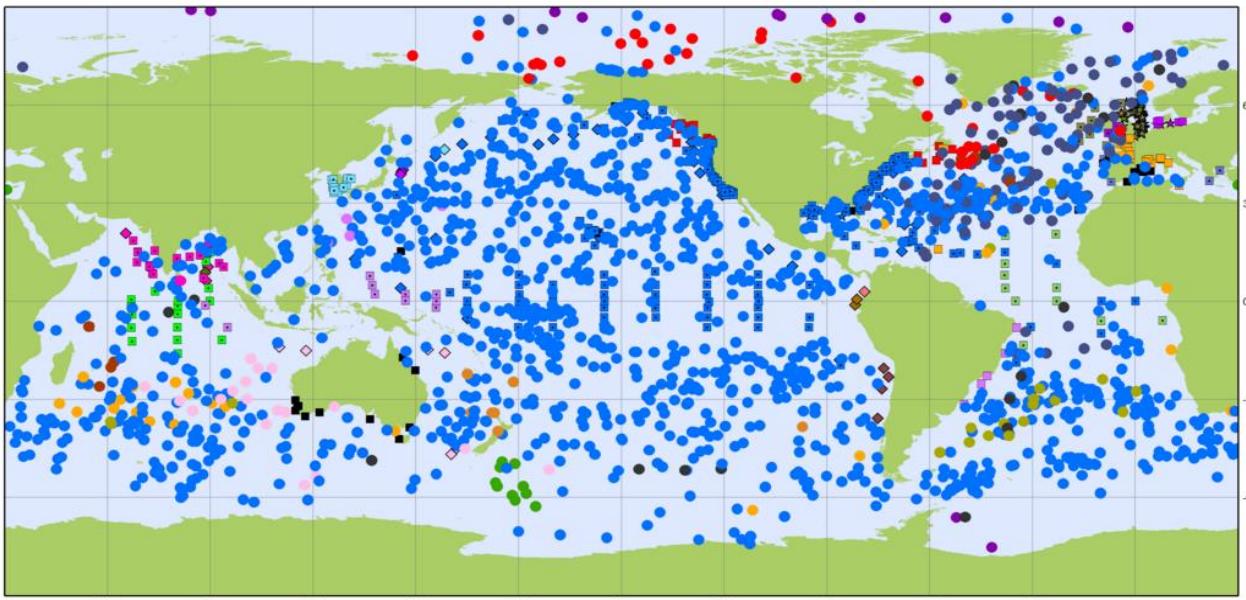
Argo Floats



Argo



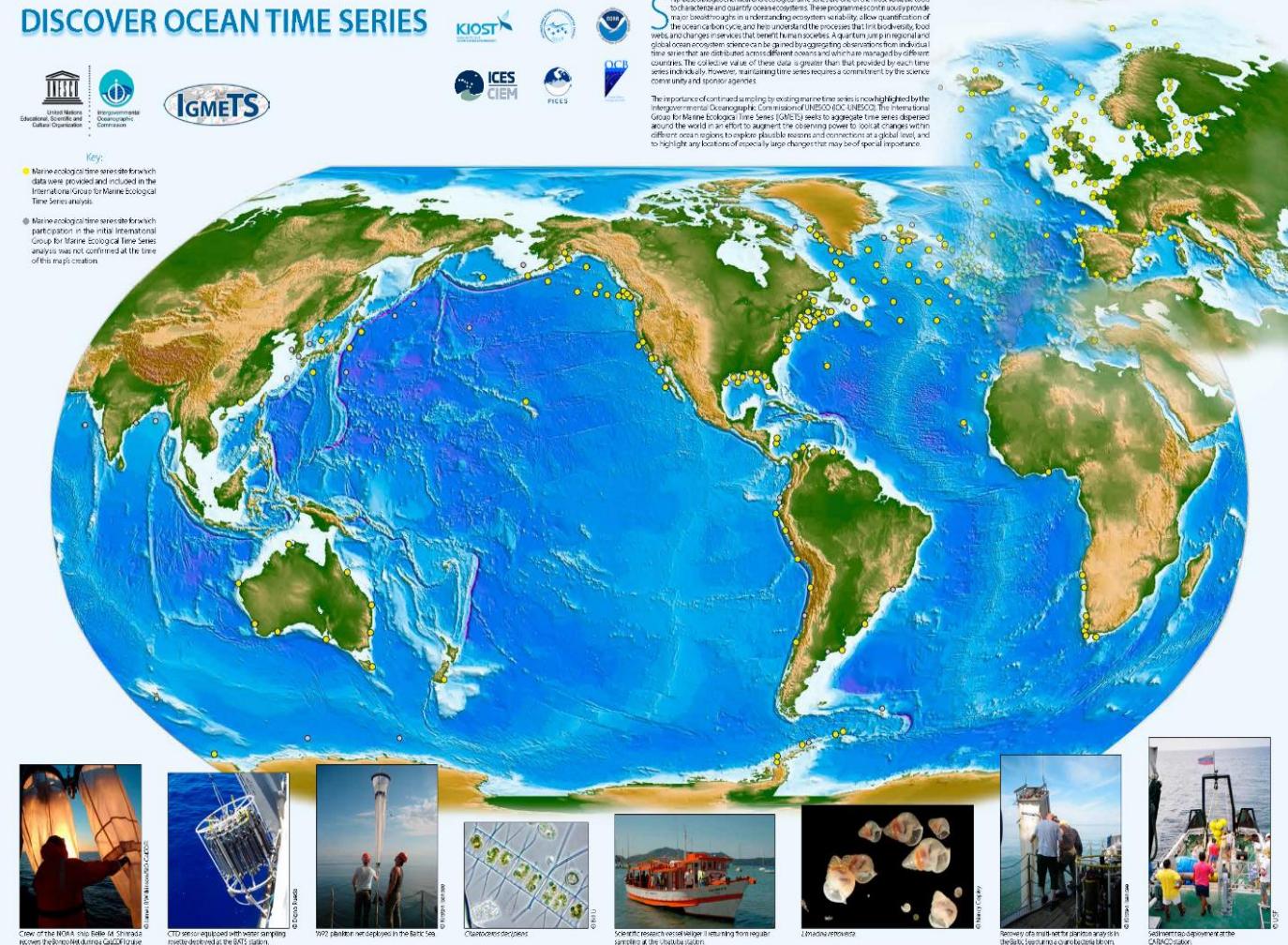
Data Buoys



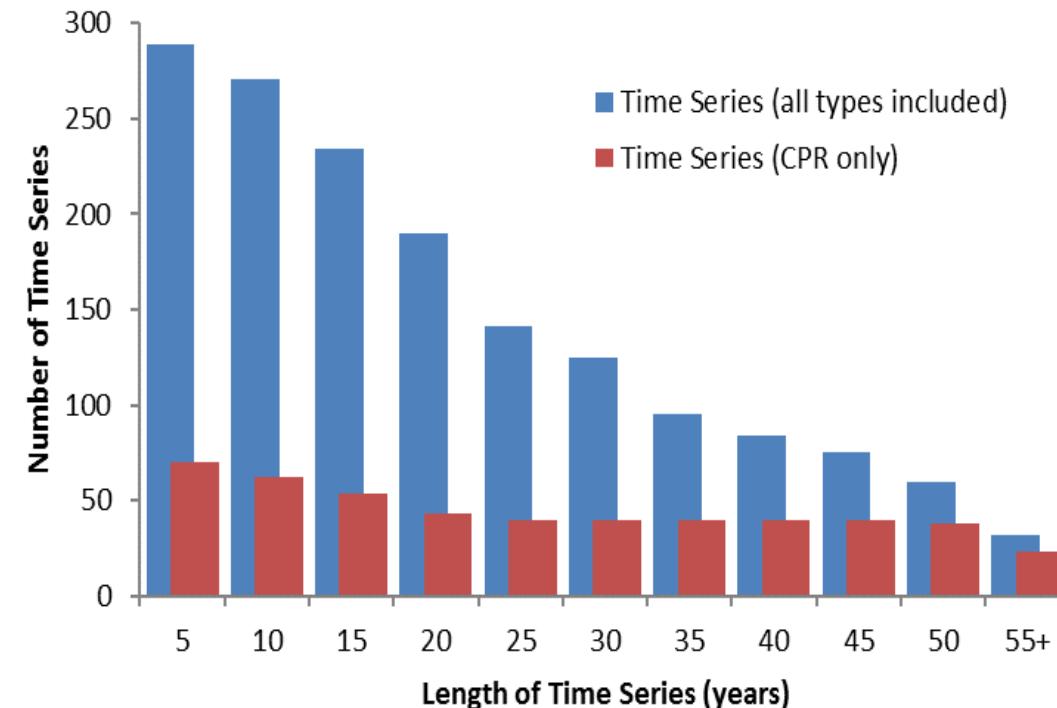
Time series

Sustained time series measurements detect changes over time and enable investigation of remote ocean locations.

DISCOVER OCEAN TIME SERIES



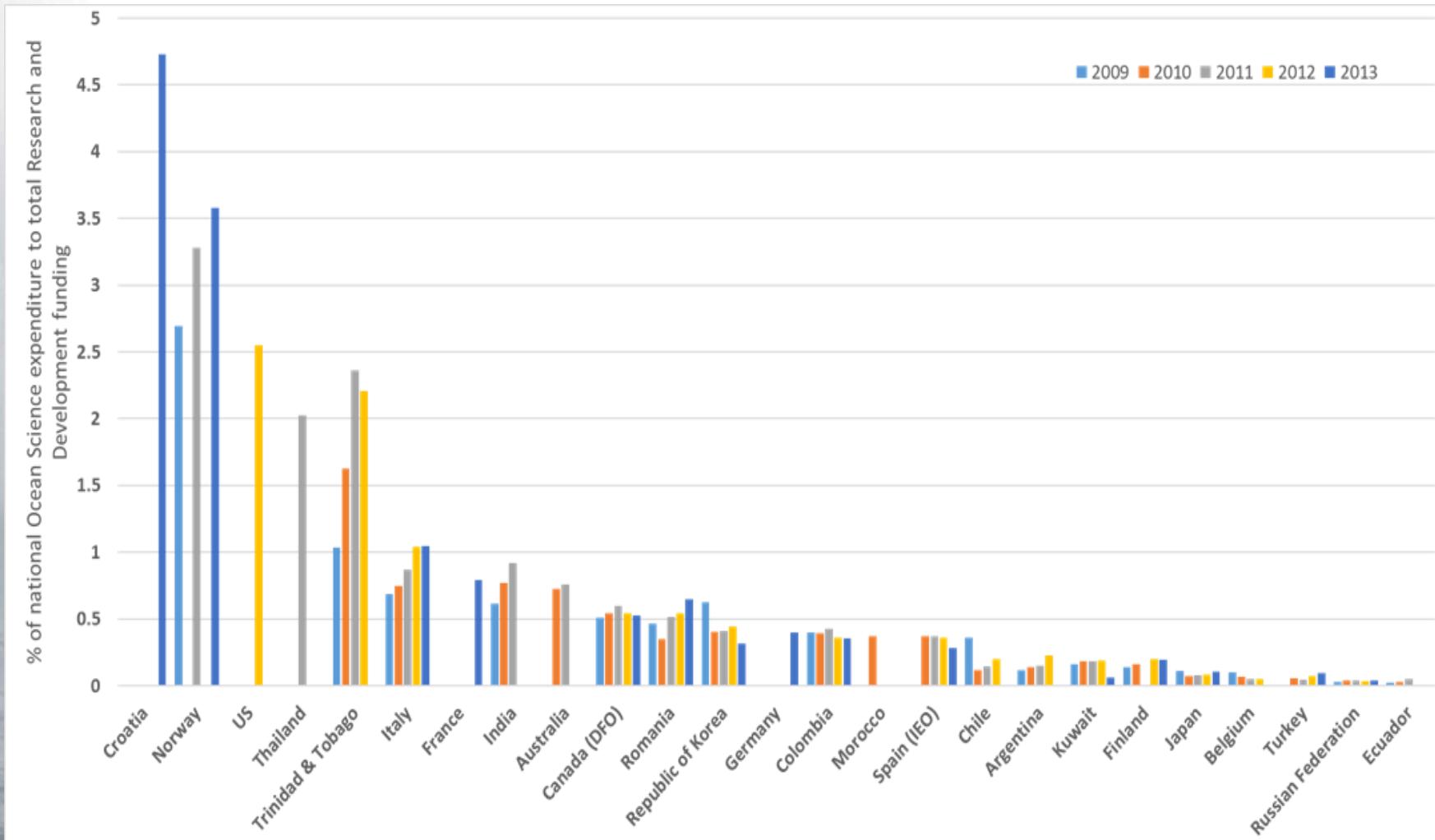
341 ship-based time series around the world



Ship-based time series (2012), including Continuous Plankton Recorder (CPR).
Source: IGMETS, 2016.

Expenditure

National funding for ocean science funding varies between countries - from more than 4% to less than 0.04% of national R&D funding



National expenditure in ocean science as a percentage of national research and development (R&D) expenditure for 25 countries which answered the GOSR questionnaire and provided information regarding national governmental funding for ocean science. Sources: GOSR questionnaire (ocean science funding), 2015; UIS (R&D funding), 2015.



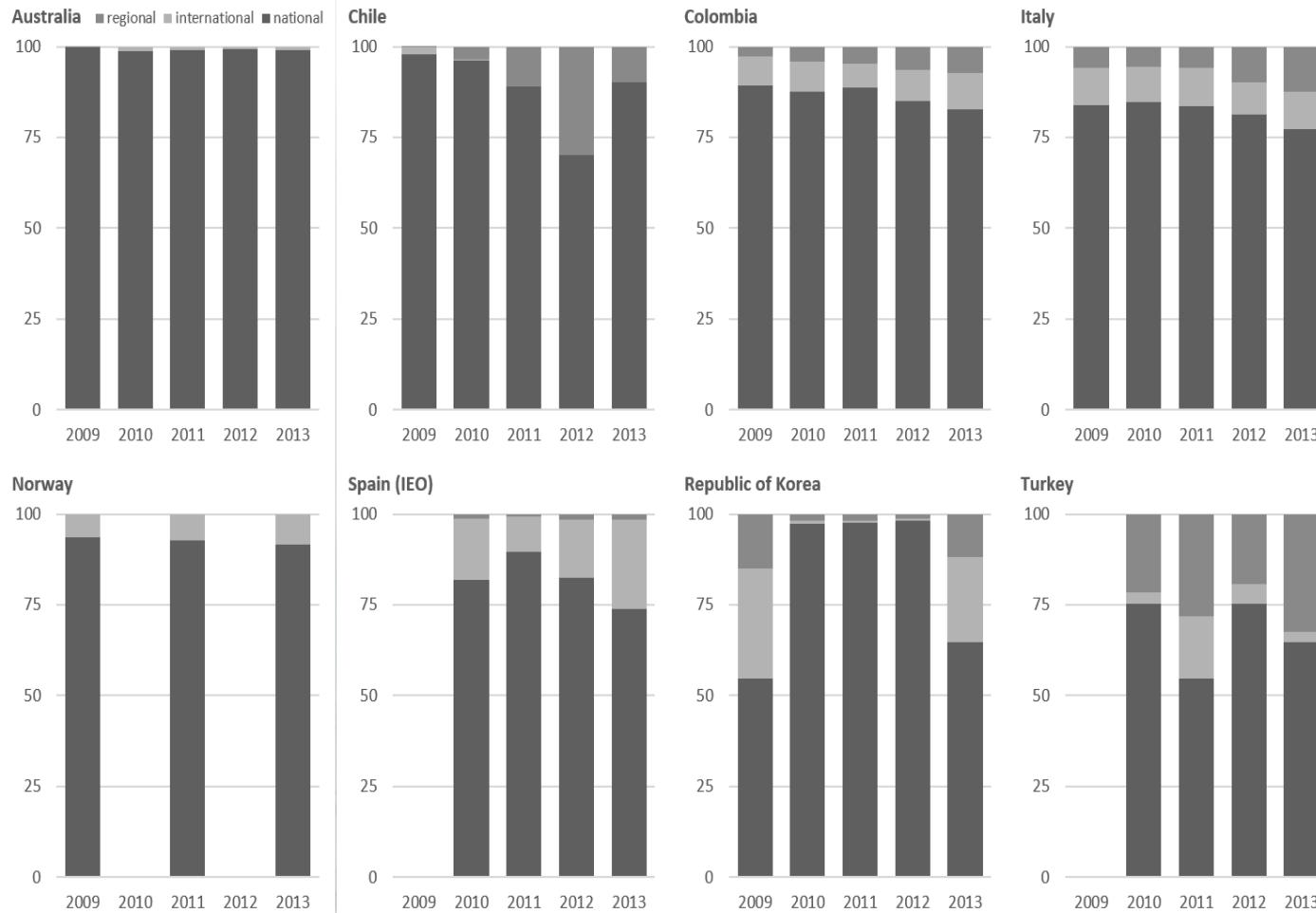
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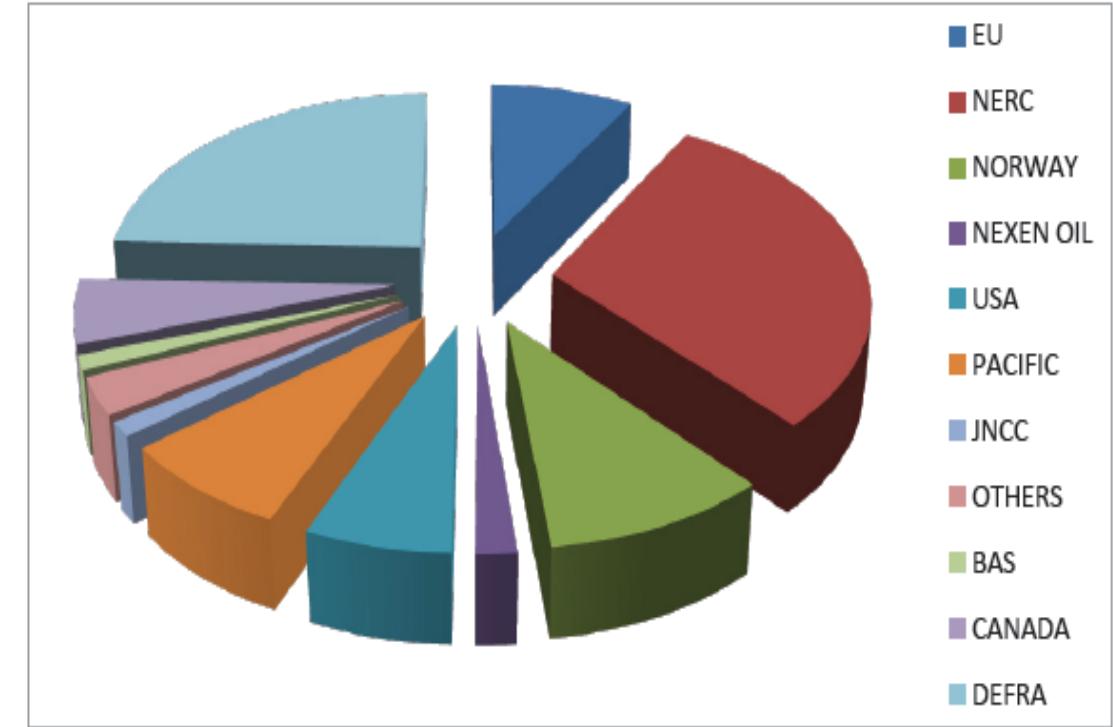
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Alternative funding

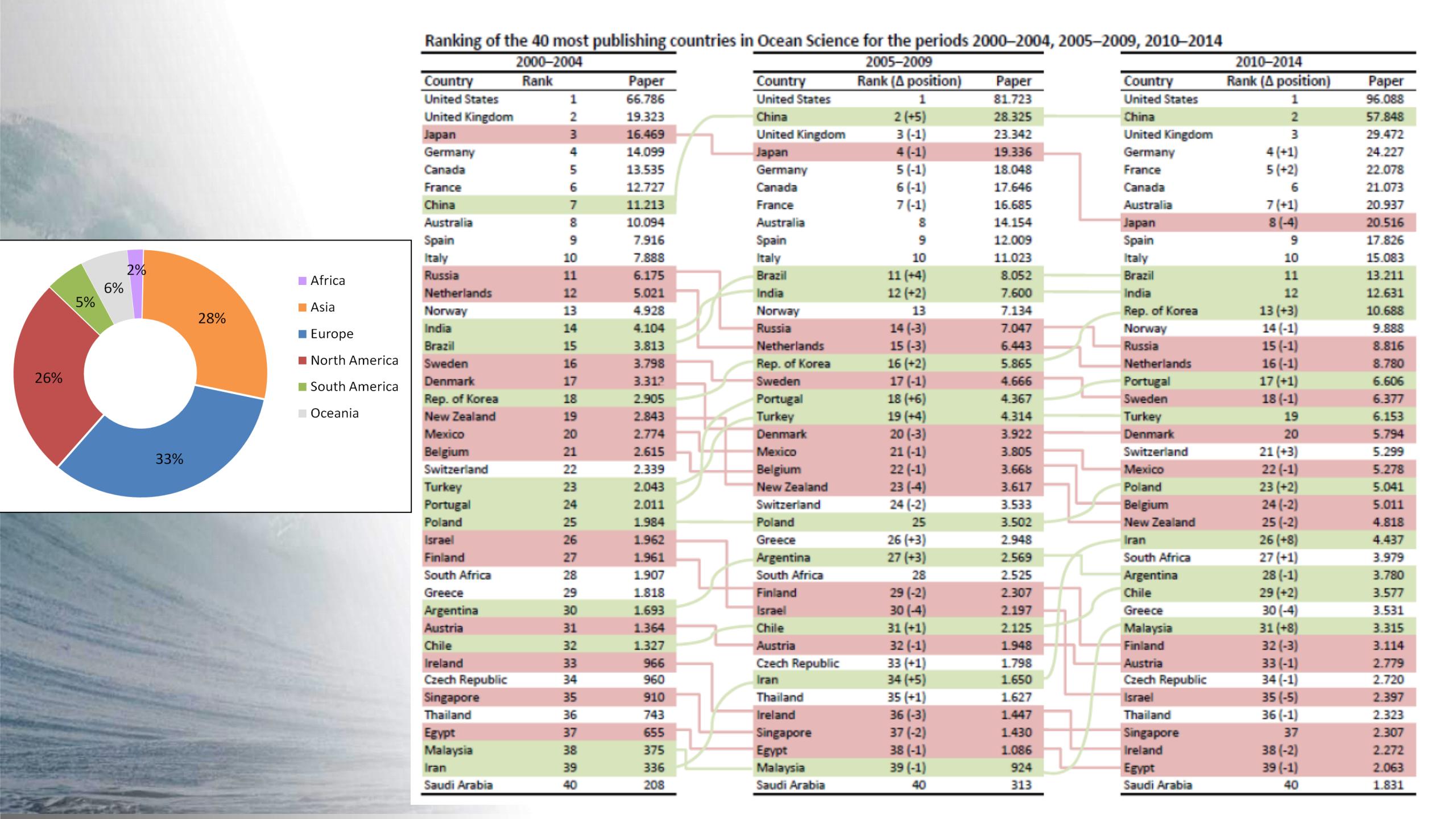
Ocean science benefits from funding from various national, regional and international funding sources (public and private)



Proportion of national, international and regional funding resources for ocean science (2009-2013) for selected countries (source: GOSR questionnaire, 2015).

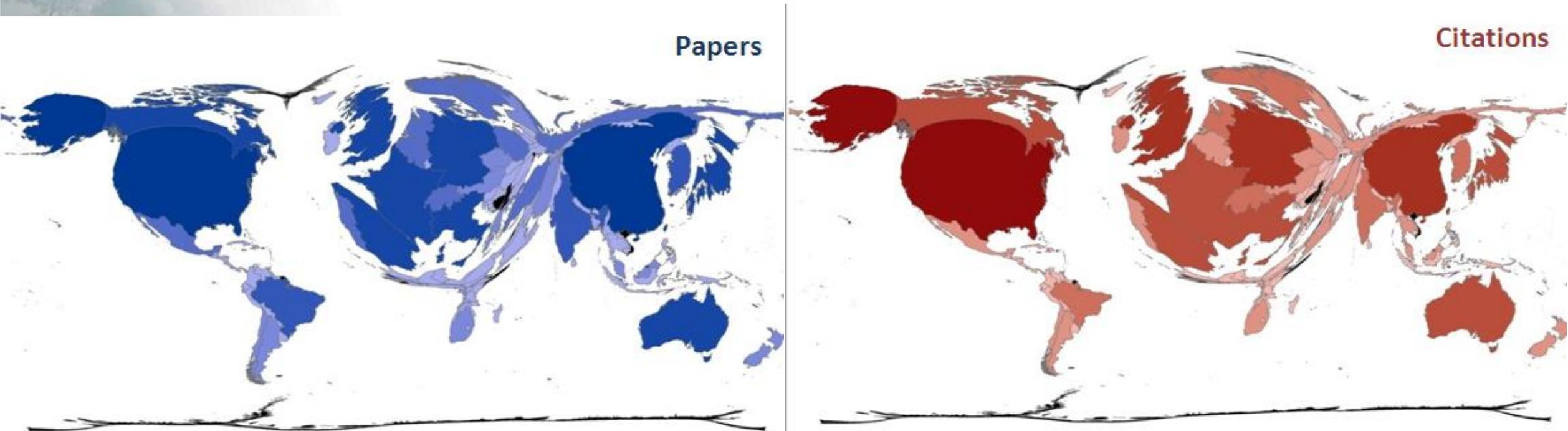


Principal sources of funding for Sir Alister Hardy Foundation for Ocean Science (continuous plankton recorder) in 2014 (source: Johns and Brice (eds.), 2015).



Ocean science production is increasing

More than 370,000 manuscripts in ocean sciences were published
and more than 2 million articles were cited (2010-2014)



Cartogram showing publications and citations of the world. The area of each country is scaled and deformed according to the number of ocean science publications (top) or citations received (bottom). Darker colours indicate a higher number of publications (top) or citations (bottom)..

Specialization in ocean science fields

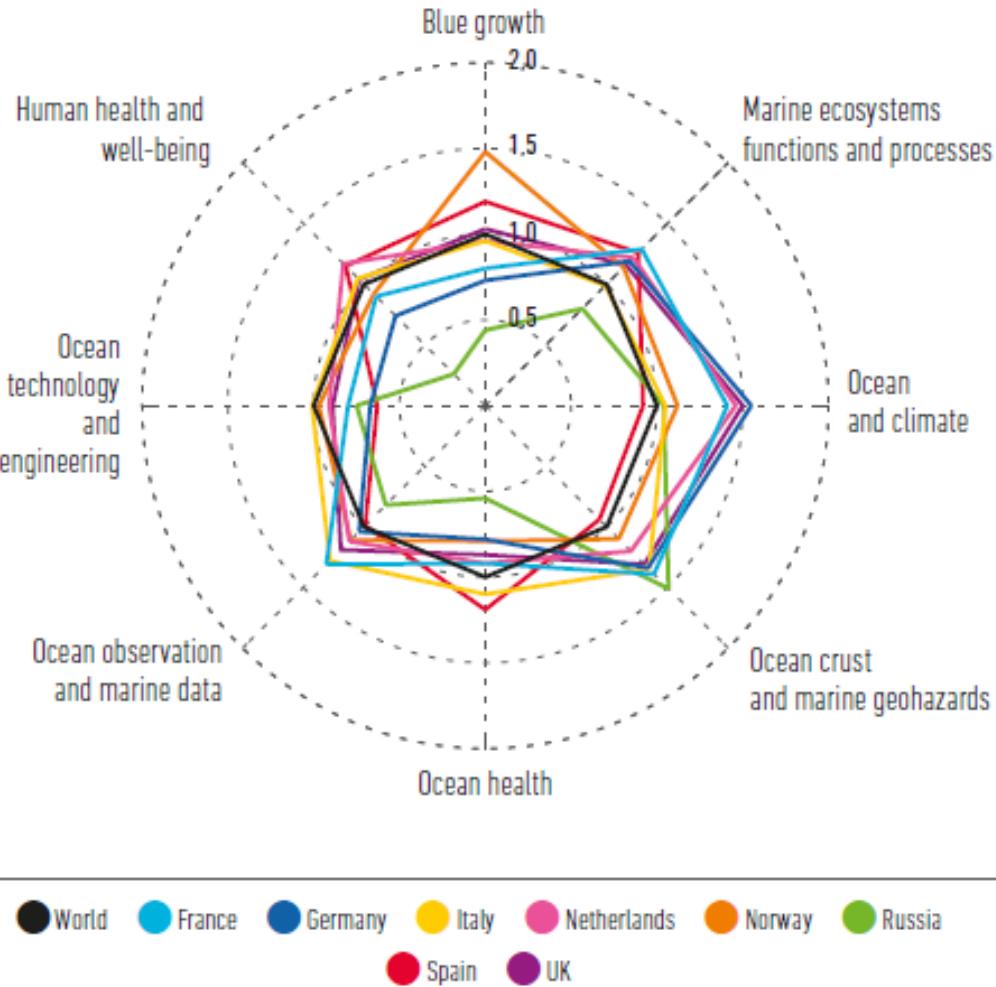


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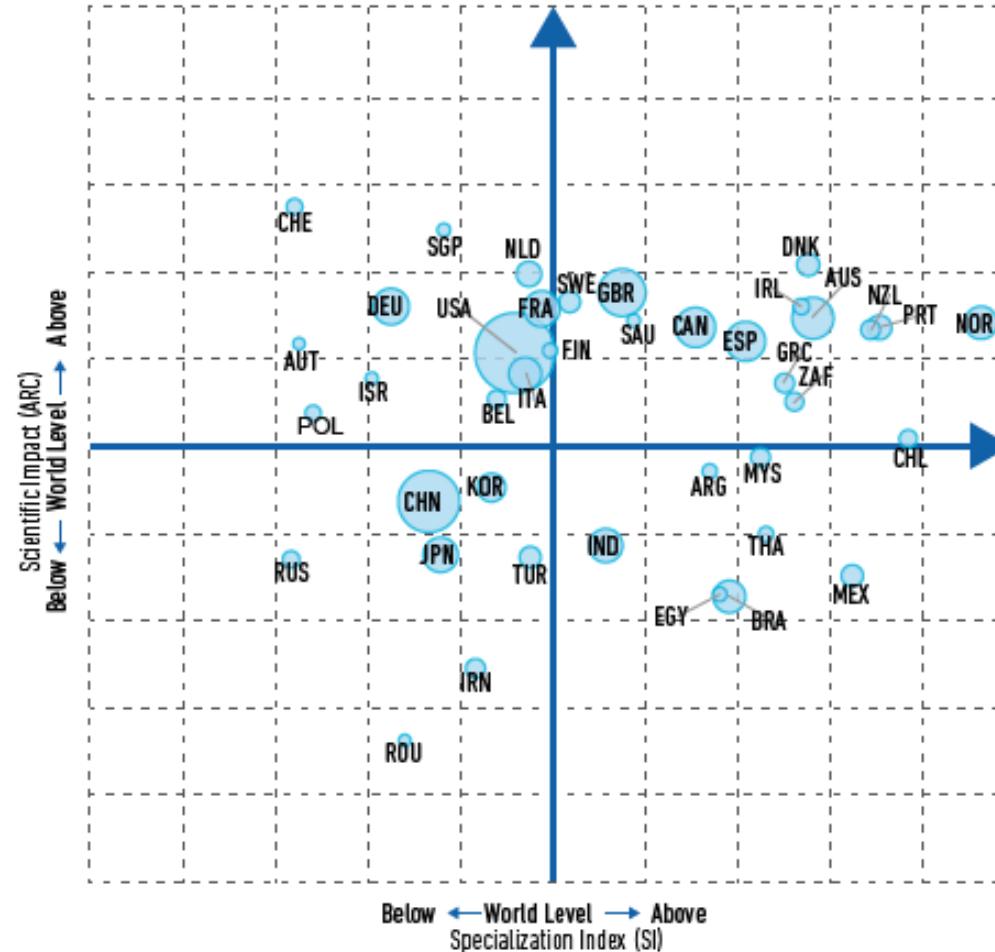


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Europe



Blue growth





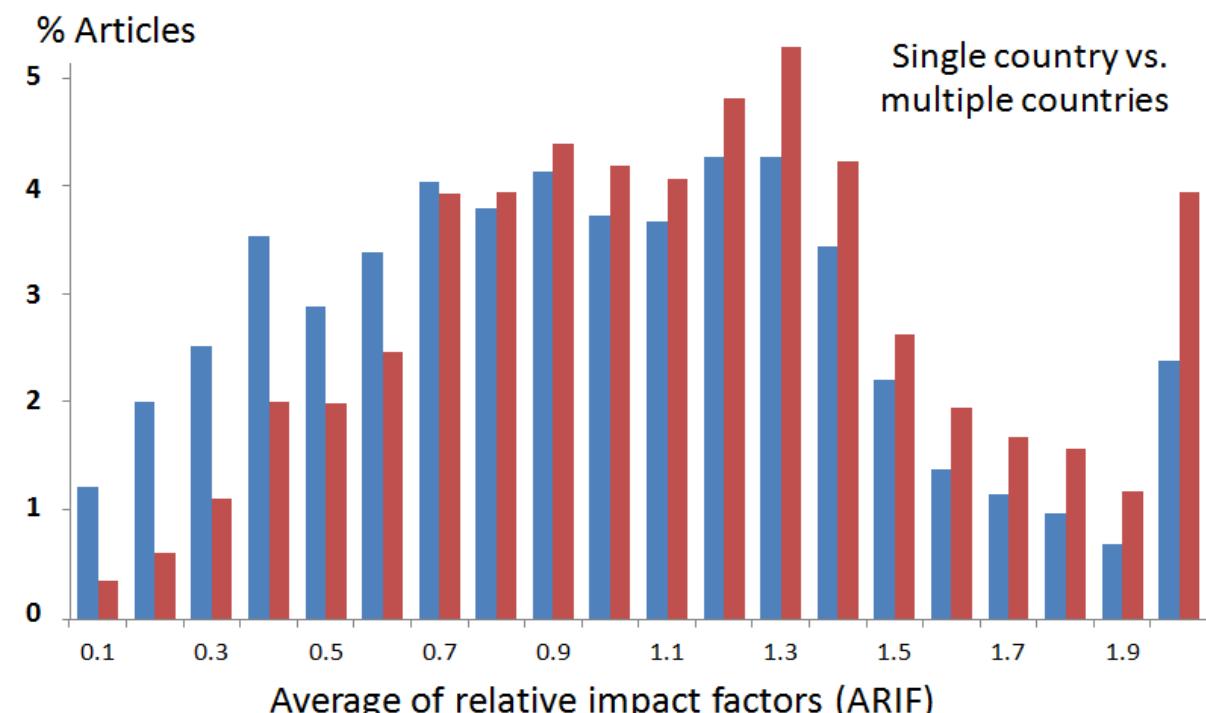
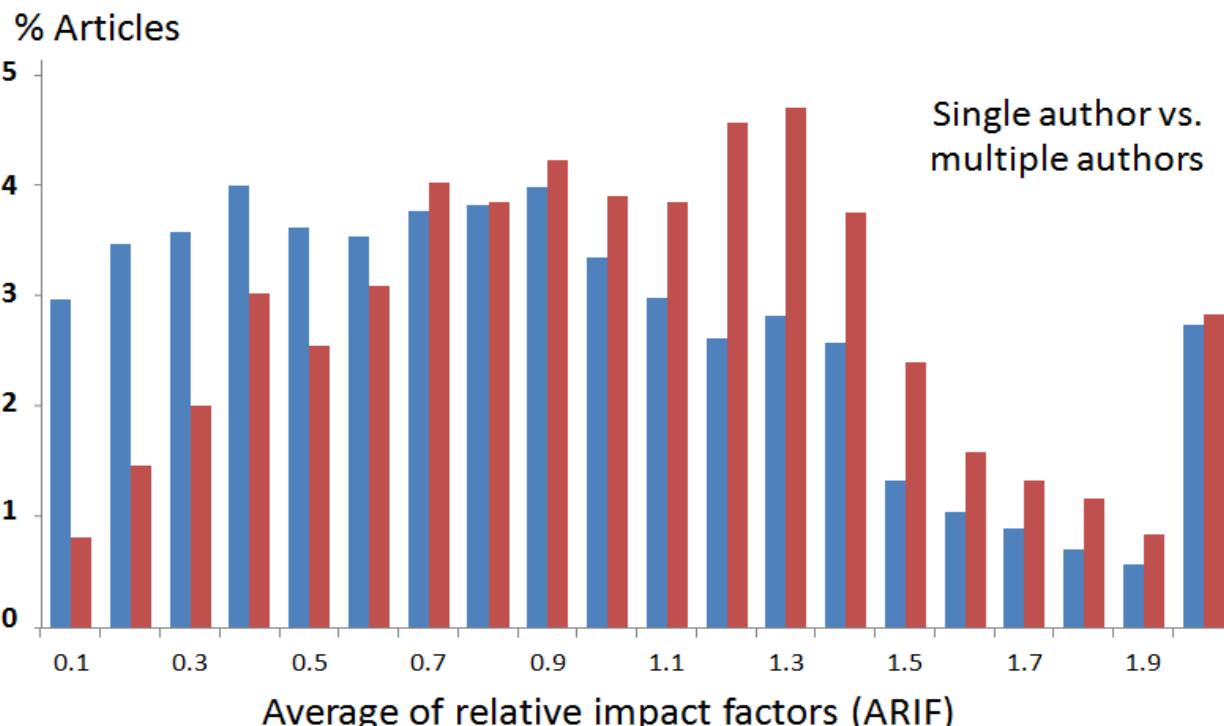
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International collaboration increases science impact

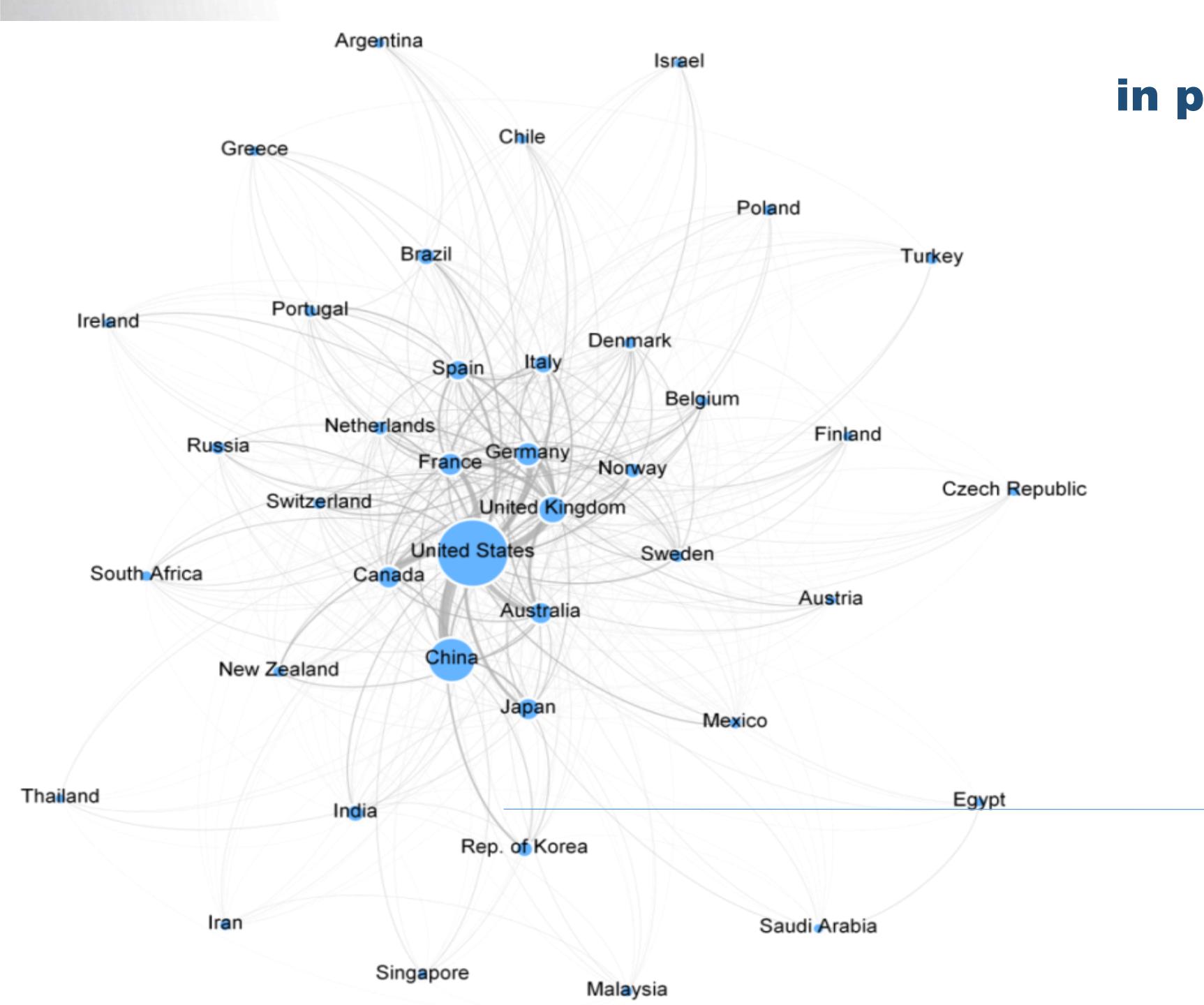
Publications with multiple authors from multiple countries have higher citation rates



in publications



International collaboration networks are changing the global landscape of research publication



International collaboration network of selected top publishing nations and organizations in ocean science, 2010-2014. The size of the nodes is proportional to the number of publications in ocean science and the thickness of the lines is proportional to the number of collaborations (co-authored papers).

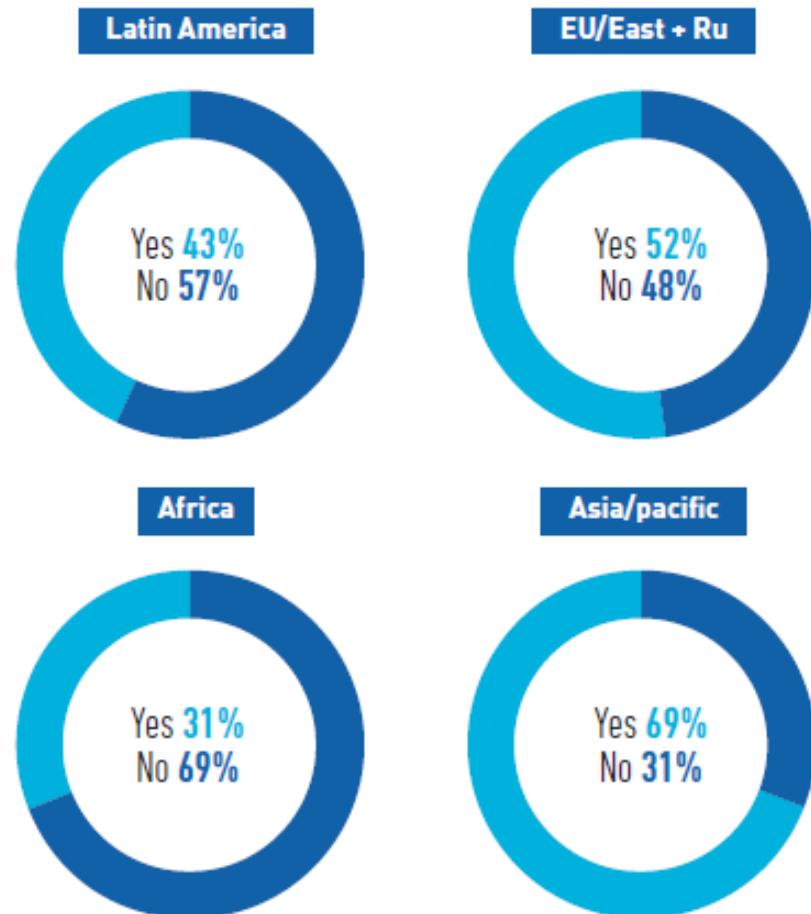


Figure 6.12. Illustration of how many of the data centres surveyed have a national data policy on the management and sharing of data. Source: IODE survey, 2016 (answered by 56 focal points).

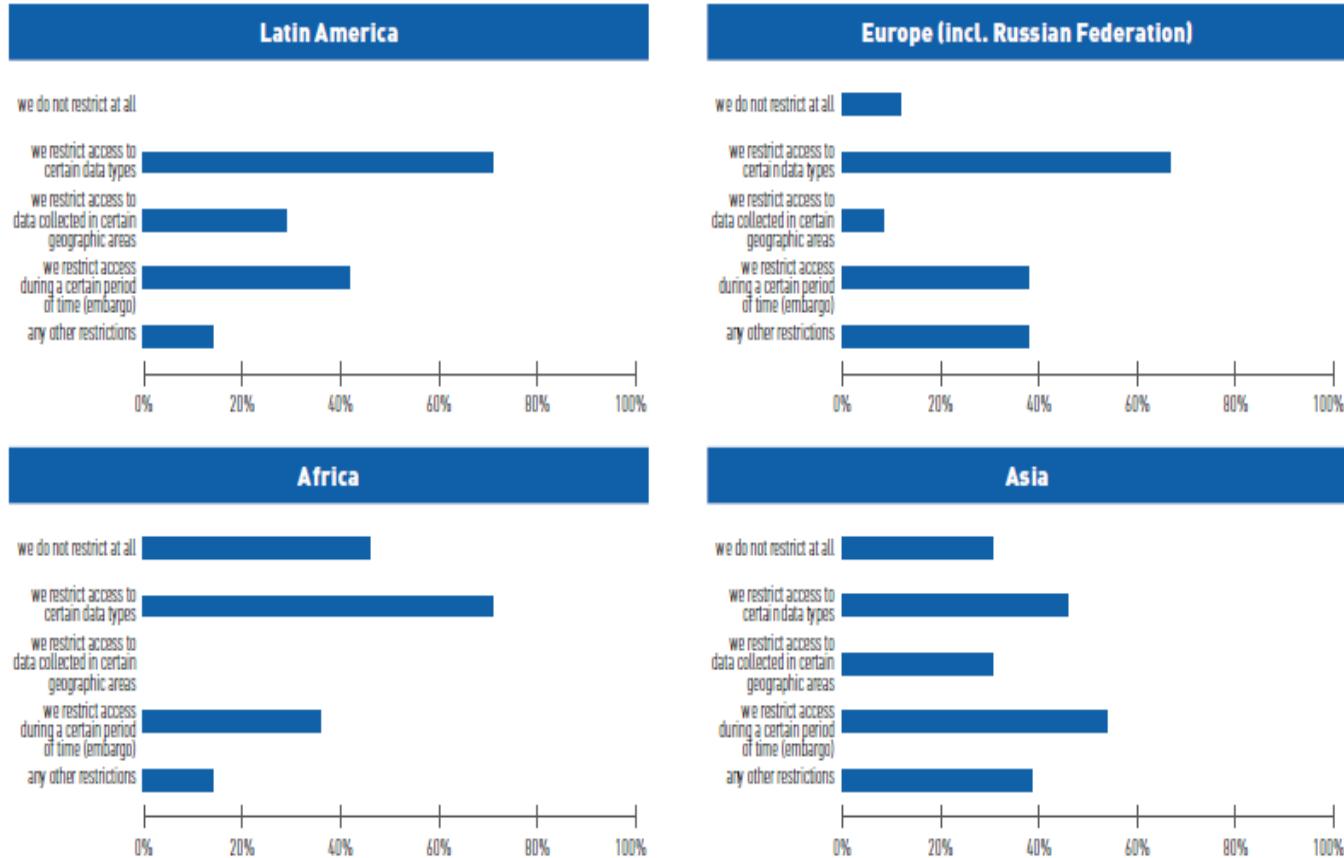
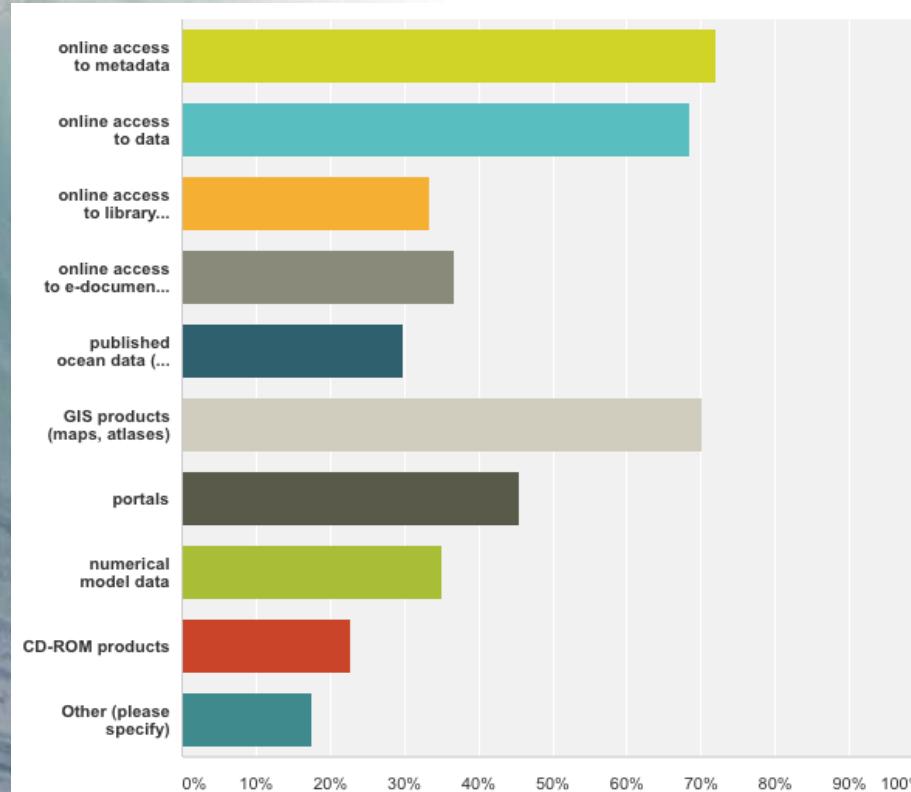


Figure 6.14. The percentage of data centres which do/do not restrict access to data by region. Source: IODE survey, 2016 (answered by 57 focal points).

Ocean data centres

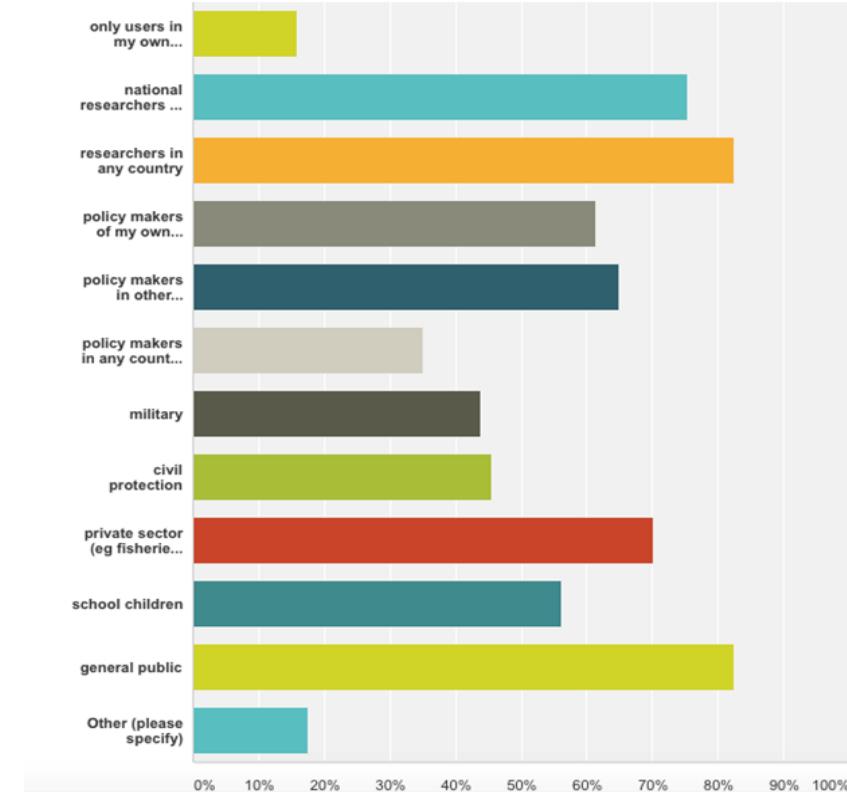
Data centres offer different types of ocean data physical, biological, chemical, pollutants, fisheries. Trend towards open access – but some restrictions.

Multiple products and services



Data and information products provided to clients by data centres, (% respondents). Source: IODE survey, 2016.

Multiple users



Clients and end users of data, products or services provided by data centres (% respondents). Source: IODE survey, 2016.





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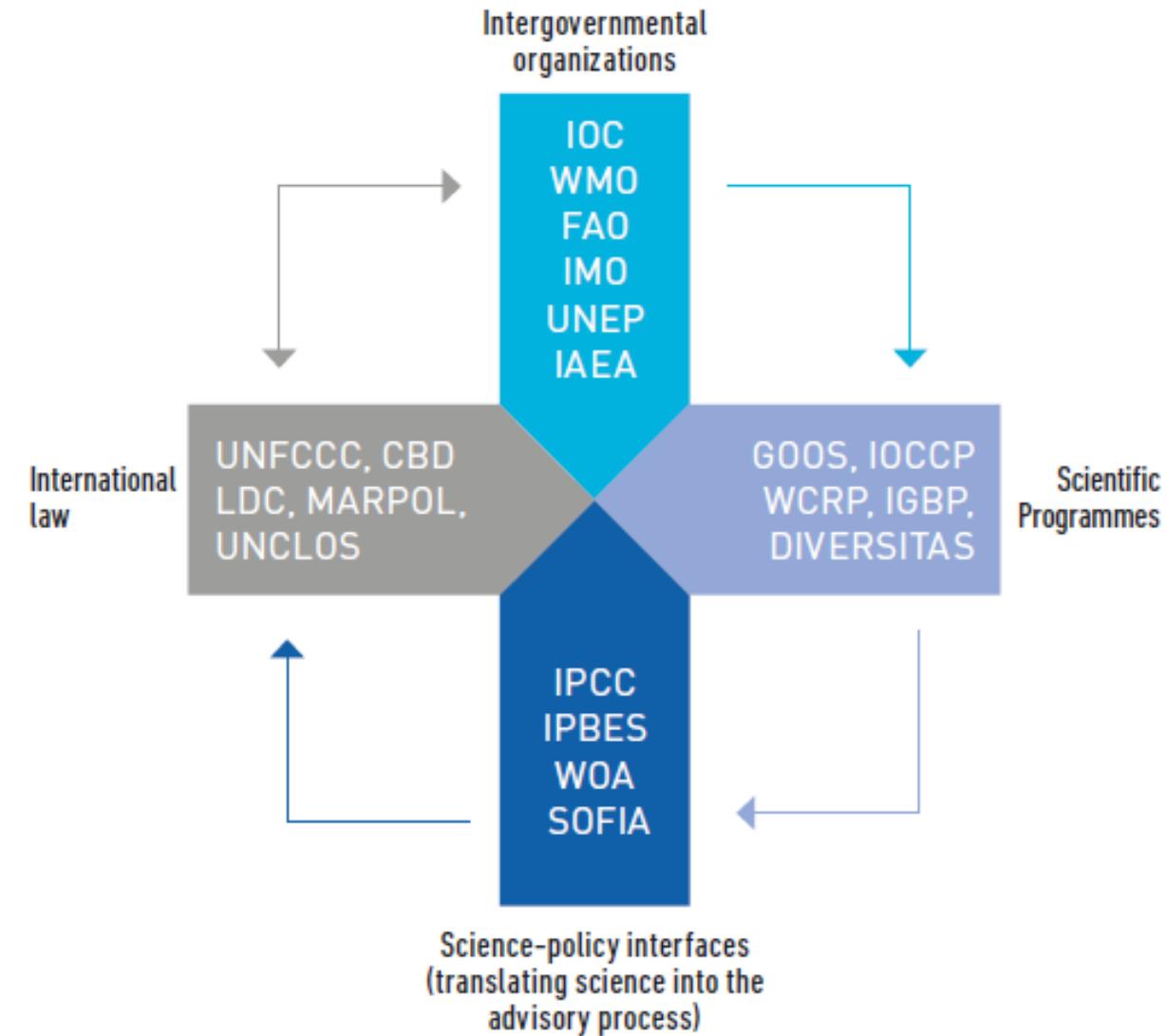
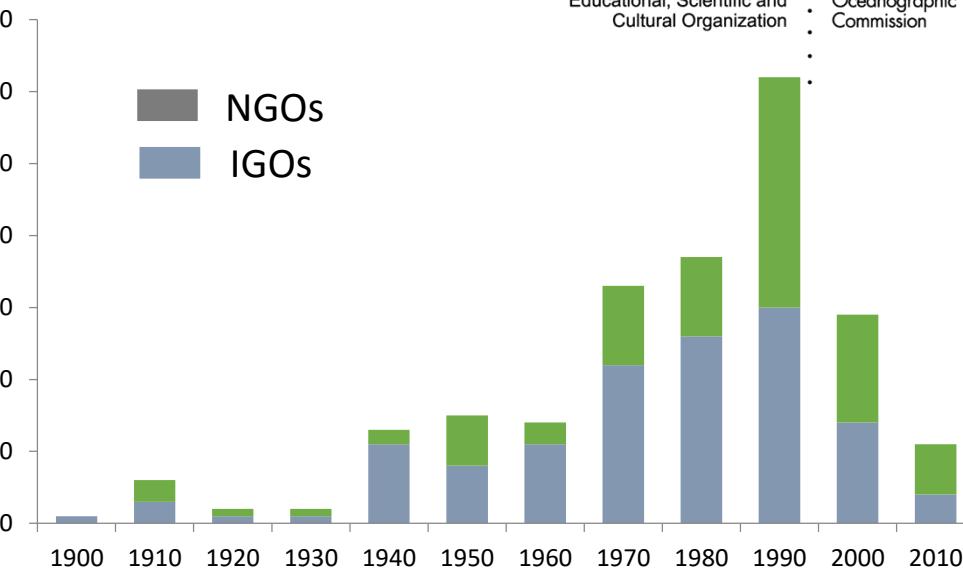
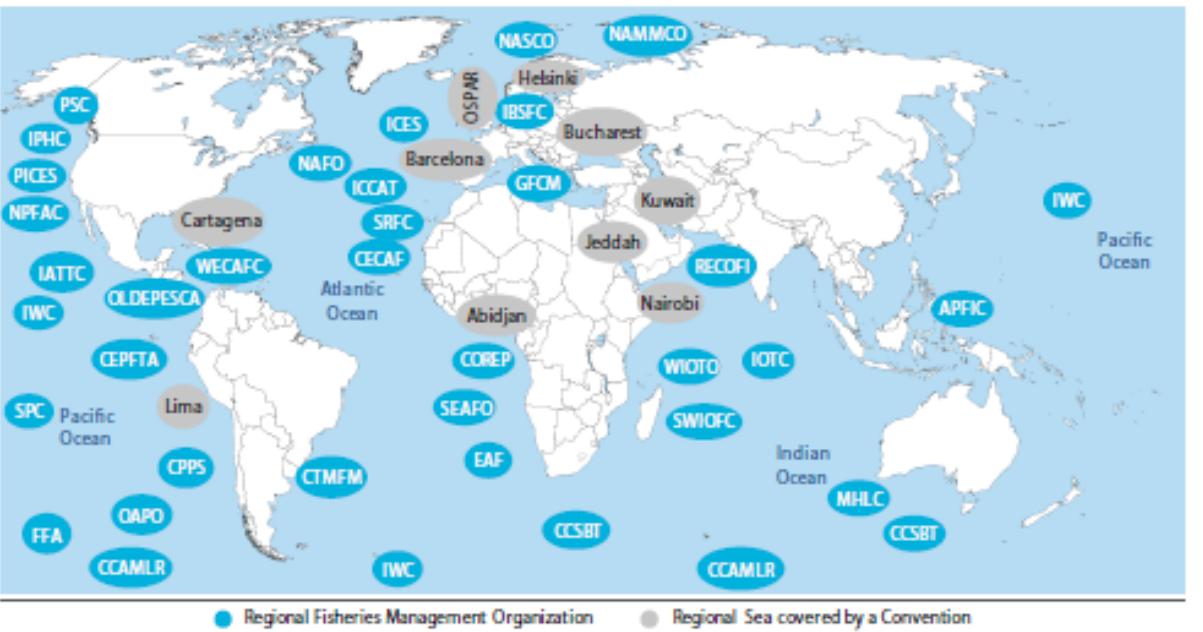
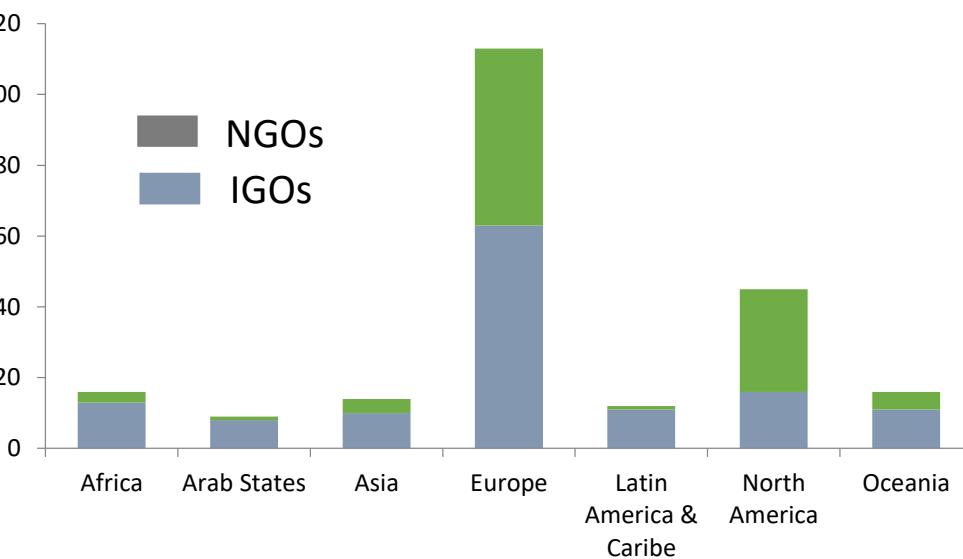
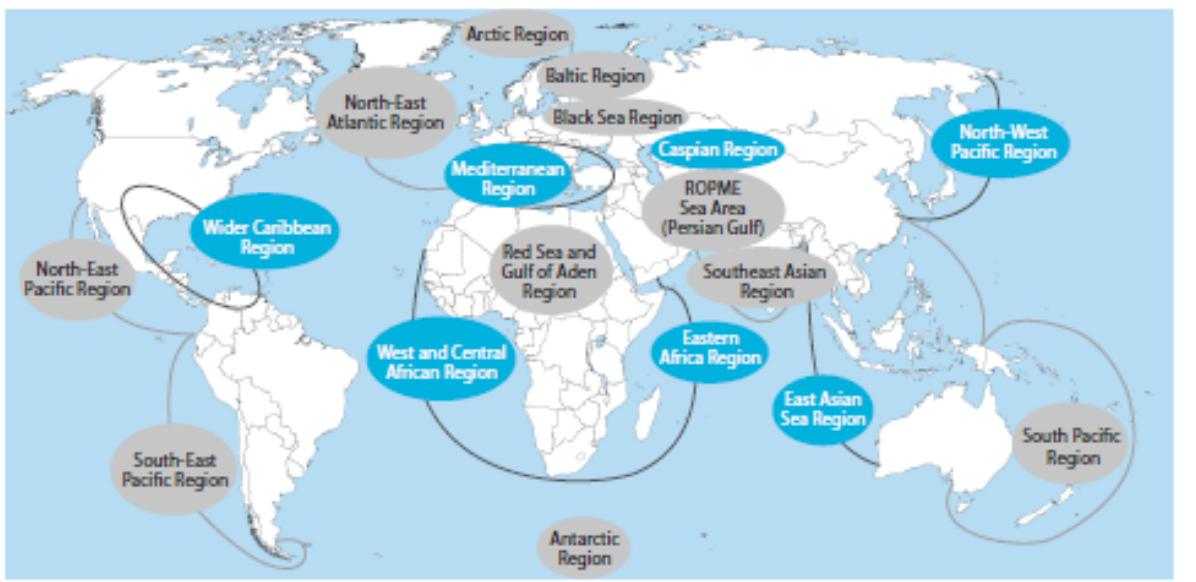


Figure 7.1. Quadruple helix model showing the UN architecture for ocean science knowledge and environmental governance (the list of organizations and entities shown here is not exhaustive). Source: redrawn from Valdés (2017).

a) Main FAO regional fisheries management organizations and regional seas covered by conventions



b) Main UNEP regional seas programmes and initiatives



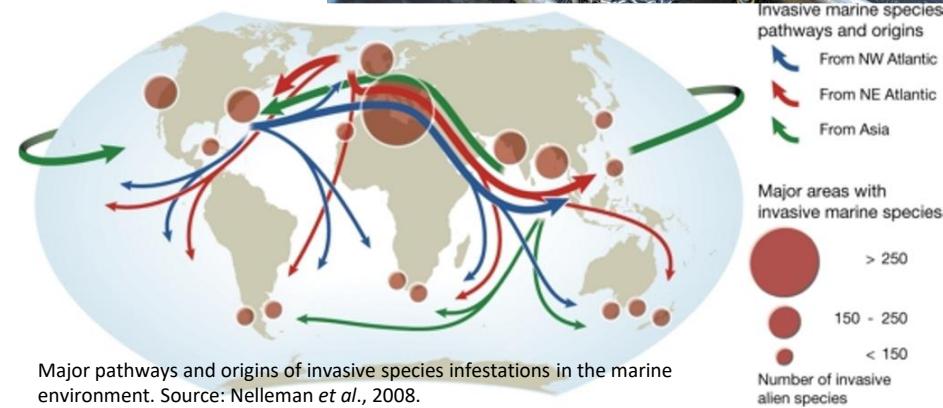
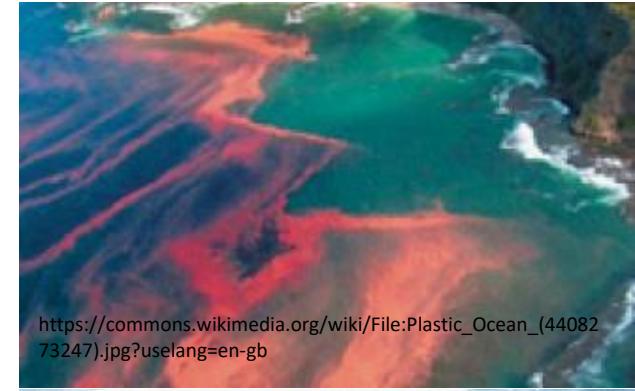
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Science-policy interactions

- International cooperation in ocean science is supported by many intergovernmental and non-governmental organisations
- Science-policy interactions can occur through many avenues
- Examples
 - Fisheries
 - Harmful algal blooms
 - Invasive species
 - Anti-fouling
 - Large marine ecosystem
 - Ocean fertilisation/geoengineering
- Future ocean sciences priorities for SDG 14
 - Physical characteristics (e.g. sea-bed mapping)
 - State of ocean waters
 - Biodiversity
 - Human impacts





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Key findings

1. Global ocean science is '**big science**'
2. Ocean science is **multidisciplinary**
3. There is more equal **gender balance** in ocean science than in science overall
4. Ocean science **expenditure** is highly variable worldwide
5. Ocean science benefits from **alternative funding**
6. Ocean science **productivity** is increasing
7. International collaboration increases **citation** rates
8. Ocean **data centres** serve multiple user communities with a wide array of products
9. **Science-policy** interactions can occur through many avenues.
10. National **inventories** on ocean science capacity exist only in few countries

Call for action

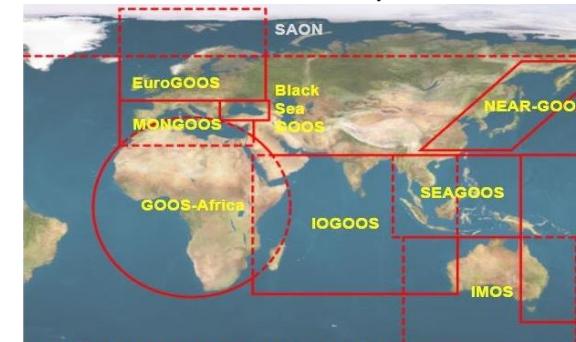
1. Facilitate international ocean **science cooperation**
2. Support global, regional and national **data centres** for effective and efficient management and exchange of ocean data and promote open access
3. Explore and encourage alternative **funding models**
4. Enable ocean **science-policy** interactions through diverse avenues
5. Align national **reporting mechanisms** on ocean science capacity, productivity and performance



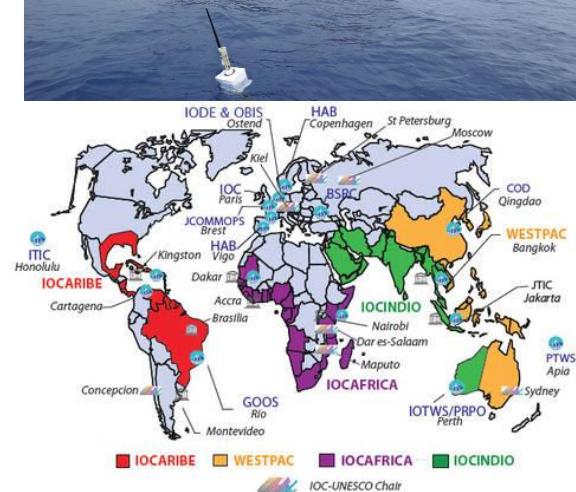
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GOOS regional alliances (GOOS 2015)





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The Global Ocean Science Report is a tool for international cooperation and collaboration to increase ocean science, boost global research capacity and transfer technology

<http://unesdoc.unesco.org/images/0025/002504/250428e.pdf>

**Thank you very much
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