EMB POLICY BRIEF

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Next Generation

European Research Vessels

European MARINE BOARD
Advancing Seas & Ocean Science

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European Marine Board

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The European Marine Board is an independent science policy interface membership organisation established in 1995 to facilitate enhanced cooperation between European marine science organizations towards the development of a common vision on the strategic research priorities for marine science in Europe. Our members include major national marine or oceanographic institutes, research funding agencies, and national consortia of universities with a strong marine research focus. In 2020, the European Marine Board represents 34 Member Organizations from 18 countries. The Board provides the essential components for transferring knowledge for leadership in marine research in Europe. Adopting a strategic role, the European Marine Board serves its member organizations by providing a forum within which marine research policy advice to national agencies and to the European Commission is developed, with the objective of promoting the European Research Area.

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NMU Norsk Marint Universitetskonsortium Norwegian Marine University Consortium · Institute of Marine Research Havforskningsinstituttet · The Research Council of Norway · CETMAR

CIMAR Laboratório Associado · FCT Fundação para a Ciência e a Tecnologia · Romanian Black Sea Research Consortium · University of Gothenburg

TÜBİTAK · MASTS · UKRI Natural Environment Research Council · National Oceanography Centre Natural Environment Research Council

This policy brief is based on Position Paper 25[1] of the European Marine Board, drafted by an interdisciplinary working group (WG Research Vessels, April 2018 – November 2019) consisting of 17 experts, nominated by the European Marine Board. The working group aimed to provide a comprehensive overview of the current European research vessel fleet and capabilities, and identify future needs. This work was conducted in collaboration with the European Research Vessel Operators (ERVO) Group (http://www.ervo-group.eu).

[1] Nieuwejaar, P., Mazauric, V., Betzler, C., Carapuço, M., Cattrijsse, A., Coren, F., Dañobeitia, J., Day, C., Fitzgerald, A., Florescu, S., Ignacio Diaz, J., Klages, M., Koning, E., Lefort, O., Magnifico, G., Mikelborg, Ø., Naudts, L. (2019) Next Generation European Research Vessels: Current Status and Foreseeable Evolution. Heymans, JJ., Kellett, P., Viegas, C., Alexander, B., Coopman, J., Muñiz Piniella, Á. [Eds.] Position Paper 25 of the European Marine Board, Ostend, Belgium. 140pp. ISBN: 978-94-92043-79-5 DOI: 10.5281/zenodo.3477893

Why do we need research vessels?

Research vessels play a key role in supporting marine scientific research and development. They are dedicated ocean observation and data collection platforms, allowing direct access to otherwise inaccessible locations.

Addressing global challenges

The ocean is inextricably linked to many global societal challenges, such as climate change and food security. Research vessels are required to deliver marine data and support the research needed to answer fundamental scientific and policy-driven questions that arise in addressing those challenges. They also enable mandatory monitoring activities. Without research vessels, much of this research would not be possible.

Supporting ocean observations

Integrated networks of ocean observations are needed to understand the systems of the ocean and its functioning, to forecast weather, to enable maritime safety, and to address the impact of climate change on ecosystem health and biodiversity, among many other uses.

Research vessels play several crucial roles in supporting these ocean observation system activities. Firstly, they are platforms for the collection of a wide variety of data and samples, from the atmosphere, the ocean surface, across the water column, the deep seafloor, and the sub-seafloor. Secondly, they install, recover, service and maintain stationary ocean observation equipment on the sea surface, in the water column and on the seabed. Thirdly, they provide ground-truthing for data collected autonomously, namely by satellites, autonomous underwater vehicles (AUV's) and gliders.

Given the importance of ocean observations, the roles that research vessels play should not be underestimated, as these services cannot currently be efficiently provided in any other way. They are a critical and complimentary component of the wider global observing system.

Extreme environments

Understanding the functioning of life systems in extreme environmental conditions, such as the deep sea and the Polar regions, is particularly vital given the significance of these areas in understanding global climate and other changes. With growing commercial interest for exploring these regions for precious metals, oil, gas etc., it is also important to understand current and potential future anthropogenic impacts on these ocean areas.

Operating and conducting research in extreme environments requires purpose-built vessels and specialized equipment, and in the case of Polar operations, compliance with dedicated regulations. However once operational, these research vessels and their equipment, in particular autonomous and remotely operated systems that can be deployed from the vessels, offer unprecedented access to these areas.

An example of this is the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) Expedition[1] where the RV Polarstern will spend an entire year frozen in the ice, starting in the autumn of 2019. Exploration of these relatively unknown and unseen areas can also generate fascination for the ocean amongst the public. Therefore, research vessels and their equipment can serve as gateways to wider conversations about the ocean, and serve as tools for furthering Ocean Literacy.

Credit: Kosta Purnika / ICOScapes

RV *Simon Stevin* participating in the Integrated Carbon Observation System (ICOS) initiative

[1] https://www.mosaic-expedition.org/

What does the current European research vessel fleet look like?

The current European research vessel fleet is highly capable and provides excellent support to European and wider marine science. However, the fleet is ageing. Further investment is urgently needed to ensure that the fleet can continue to provide the same level of support into the future.

An overview of the fleet

At present, there are 99 research vessels within Europe that are:

- Openly available for research at least part of the time;
- Able to operate at least on a regional scale;
- Not owned by a private company; and
- Able to deploy a minimum set of basic equipment.

Of these vessels, 9 have ice-breaking capability and 24 have some capacity to operate in Polar waters. In terms of working in deep-sea regions, 8 vessels are capable of deploying a full set of equipment in water depths of 4000-6000m, and a further 8 can conduct some research at these depths. They are owned almost exclusively by countries in Northern and Western Europe.

In terms of size distribution, one third of the fleet is Local and Coastal Class (average length 27m), one third is Regional Class (average length 46m), and the final third is a combination of Ocean Class (average length 70m) and Global Class (average length 97m).

The fleet is highly capable but is also ageing, with a current average age of 25 years. Given that the expected functional lifetime of a research vessel is 30 years, this indicates a pressing need to renew and modernise the fleet.

Data and information on the fleet and its capabilities should be made publically available and should be kept up to date. Such data is already presented in the EurOcean Research Infrastructure Database (RID)[2], but support should be provided to enable the continuation of this valuable resource.

Equipped to support

The European research vessel fleet is well equipped with Large EXchangable Instruments (LEXI) such as AUV's, remotely operated vehicles (ROV's) and gliders. This pool has grown significantly in recent years to around 90 large instruments. With the increasing use of autonomous systems in marine research, this increase is set to continue, and new vessels will need to be able to adapt to ongoing technological development by being able to accommodate, support, connect with, and deploy new equipment. The development of equipment pools at regional, national or even international level is recommended as it can make the acquisition and running of large equipment more cost-effective and reduce redundancy.

Innovation in technology towards greater automation and smaller, more powerful sensors will alter the number of crew required on board, creating a new balance in vessel sizes, categories and capabilities. However, it will remain important to have a mix of capabilities and capacity spread across Europe.

Managing the fleet

The European fleet is owned, managed and operated differently by different countries, but all vessels provide crucial support to marine science in Europe and beyond.

The 99 vessels are run by 62 different research vessel operators in 23 countries, but the distribution of vessels in Europe is not uniform. Three countries each operate 11 vessels (France, Germany and Norway), three countries operate between 7 and 9 vessels (UK, Spain and Portugal), and the remaining 17 countries operate five vessels or fewer.

THE FLEET IN FIGURES

99
VESSELS

Operated by 62 operators in 23 different European countries. 6 countries own more than 5 vessels

25
YEARS

Average age of the fleet is 25 years. The fleet is split equally into 1/3 Local and Coastal Class, Regional Class, and Ocean and Global Class

Credit: SOCIB

Deploying a Conductivity, Temperature and Depth (CTD) profile and water sampling bottles (-rosette), one of the basic equipment capabilities, from RV *SOCIB*.

There is no single "correct" approach to vessel and resource management. A number of factors will dictate the most appropriate approach in a given country. However, collaboration between vessel operators in some aspects such as scientific equipment, crew and sharing of samples and data will improve efficiency.

Widening access to ship-time

Several projects such as EUROFLEETS / EUROFLEETS 2 / EUROFLEETS+[3] and ARICE[4] have embedded a culture of transnational access into their projects, allowing researchers from across Europe to have access to ship-time, based on scientific excellence. However, apart from these projects it can be almost impossible to gain access to ship-time on an appropriately capable vessel, especially for researchers from countries that lack the required capabilities within their own fleet.

The transnational access approach should be implemented in Europe beyond the scope of these projects, to ensure that all researchers have access to these infrastructures, while also ensuring appropriate funding schemes to support this. This would help to enlarge the community of users and foster scientific exchange, collaboration and excellence in European scientific capacity, with global relevance and impact.

8

DEEP-SEA VESSELS

that can deploy a full set of deep-sea equipment and a total of 16 vessels that can conduct some research in the deep sea

9

POLAR VESSELS

with ice-breaking capability and a total of 24 vessels that have some ice-going capability

[3] https://www.eurofleets.eu/

[4] https://arice.eu/

How to ensure a well-trained crew?

Vessel crew, marine technicians, vessel operators and other shore-based staff are vital to research vessel activities. However, at present there is a lack of dedicated training opportunities for these roles.

Providing training opportunities

Most current research vessel-related training opportunities focus on students and early career researchers. However, there are few examples of training dedicated to on-board and shore-based staff. Training is instead typically offered in-house and on the job, resulting in heavy reliance on the knowledge and experience currently available within the organization.

This clearly indicates a need for dedicated training that is specific to these roles in relation to research vessels, as more general maritime and sea-going training will not be sufficient. A set of training programs for such staff functions should be developed and offered at European level.

Availability of crew

The provision of vessel crew and marine technicians varies by country, depending on the management system that has been implemented. In some cases, they will be part of the vessel operators' organization, while in other cases they will be employed by a professional crewing agency or external body. For smaller institutes with limited fleets, operating only one crew per vessel limits the number of days they can operate. Problems can arise in the case of staff shortages, and in finding appropriately trained and experienced replacements.

A viable approach could be to develop pools of crew at regional, national or even international level, developing a built-in reserve capacity and simplifying the delivery of appropriate training and transfer of knowledge.

An attractive career?

It can be challenging to find sufficient and appropriately qualified and experienced vessel crew, marine technicians and vessel operators to ensure sufficient support by research vessels to the marine science community. The demand for greater research vessel activity is anticipated and therefore this could become a challenge in the future.

The future needs, in terms of human resource capacity, should therefore be assessed and approaches for attracting people to these career paths should be investigated. Research vessels and their innovative equipment may serve as a first point of interest for the younger generation in raising awareness about the ocean and ocean related careers.

Credit: Louise Allcock, NUI Galway

Training of research vessel crew and technicians, as seen above participating in Ocean Sampling Day 2019 on RV *Celtic Voyager* is vital to support the needs of science.

Recommendations

The overarching recommendations are:

- Publicly available information about European research vessels and scientific equiment should be collected and updated periodically, to keep funding agencies and decision-makers informed about status and trends;
- Continued modernization and renewal of the aging European research vessels, to support the science needs of today and in the foreseeable future in terms of both quantity and capabilities;
- Use foresight and horizon-scanning approaches in collaboration with industry and the marine research community to identify future requirements, especially in relation to technological and digital capabilities, and in terms of future fleet size and capability requirements, and ensure these requirements are integrated into strategic plans for vessel development;
- Increase collaboration between the research vessel community at regional, national and international level in order to exploit opportunities for greater efficiency such as sharing of resources and equipment;
- The research vessel community should take an active role in promoting activities for training of marine technicians, crew and shore-based staff, and should seek partnerships to develop courses on all aspects of vessel operations;
- Transnational access mechanisms based on excellent science should be further developed to give access to European research vessels and enlarge the community of users, in in particular for the limited number of deep-sea and Polar research vessels.

Research vessels will continue to play a critical role in marine science research, ocean observing and monitoring for the foreseeable future. However, the pace of development of new technologies for data collection and sampling, as well as automation and artificial intelligence, is very high and will introduce new and exciting innovations into the field in the coming years. This may fundamentally change the way marine research is conducted, and the move towards carbon neutrality will also change the design of research vessels. The key challenge will be for the research vessel operators, marine science community, industry and funders to work together to adapt to these changes and ensure that the European research vessel fleet remains capable and fit-for-purpose to address the scientific and societal challenges to come.

Further reading

Binot, J., Danobeita, J., Muller, T., Nieuwejaar, P. W., Rietveld, M. J., Stone, P.,....Veenstra, F. (2007). European Ocean Research Fleets. In N. Connolley, A. Carbonniere, J. Binot, T. Muller, P. W. Nieuwejaar, M. J. Rietveld, & P. Stone (Eds.), *EMB Position Paper 1*0.

Binot, J., Danobeita, J., Muller, T., Nieuwejaar, P. W., Rietveld, M. J., Stone, P., di Bitteto, M., Breslin, J., von Broeckel, K., Coimbra, J., Georgopoulous, D., Gillooly, M., Gronvall, H., Piechura, J., Veenstra, F. (2007). European Ocean Research Fleets. In N. Connolley, A. Carbonniere, J. Binot, T. Muller, P. W. Nieuwejaar, M. J. Rietveld, & P. Stone (Eds.), EMB Position Paper 10. Retrieved from http://marineboard.eu/publication/europeanocean-research-fleets-towards-common-strategy-andenhanceduse

National Research Council of the National Academies. (2009). Science at Sea: Meeting Future Oceanographic Goals with a Robust Academic Research Fleet. In Endeavour (Vol. 29). https://doi.org/10.17226/12775 GET

Nieuwejaar, P., Mazauric, V., Betzler, C., Carapuço, M., Cattrijsse, A., Coren, F., Danobeitia, J., Day, C., Fitzgerald, A., Florescu, S., Ignacio Diaz, J., Klages, M., Koning, E., Lefort, O., Magnifico, G., Mikelborg, Ø., Naudts, L. (2019) Next Generation European Research Vessels: Current Status and Foreseeable Evolution. Heymans, JJ., Kellett, P., Viegas, C., Alexander, B., Coopman, J., Muñiz Piniella, Á. [Eds.] *Position Paper 25* of the European Marine Board, Ostend, Belgium. 140pp. ISBN: 978-94-92043-79-5 DOI: 10.5281/zenodo.3477893

Smith, S. R., Alory, G., Andersson, A., Asher, W., Baker, A., Berry, D. I., Drushka, K., Figurskey, D., Freeman, E., Holthus, P., Jickells, T., Kleta, H., Kent, E. C., Kolodziejczyk, N., Kramp, M., Loh, Z., Poli, P., Schuster, U., Steventon, E., Swart, S., Tarasova, O., de la Villéon, L. P. and Vinogradova-Shiffer, N. (2019) Ship-Based Contributions to Global Ocean, Weather, and Climate Observing Systems. *Frontiers in Marine Science* 6:434. https://doi.org/10.3389/fmars.2019.00434

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EMB policy briefs provide a high-level summary of the key research needs and priorities on topics of strategic and emerging importance in seas and ocean science from a European perspective. Policy briefs are normally (but not always) summary versions of full EMB position papers, produced by EMB expert working groups.

Cover Photo: View from the RV *L'Atalante* afterdeck while the ship is maneuvering. The *L'Atalante* is a research vessel of the French oceanographic fleet operated by Ifremer. This operation named Cassiopée, took place in the Pacific Ocean in 2015.

Credit: © Ifremer/Ird - N. Lamande

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