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Editorial: Ocean Sciences and Ethics

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Editorial on the Reseach Topic

Ocean Sciences and Ethics

"The Anthropocene is changing our relationship with the planet, and we must determine how to assume this responsibility" (Nobel Laureate Elinor Ostrom, 1933-2012). Humanity must be the steward of the planet's natural resources and all stakeholders must participate to reduce anthropogenic damage to the environment. In this context, ethical behavior is necessary to ensure the sustainable use of our planet and our oceans. Consequently, it is our responsibility to apply core ethical values, identify and promote sustainable ocean principles, especially in line with the United Nations (UN) Sustainable Development Goals (SDGs) (United Nations, 2016). For the marine environment, this is particularly evident in the UN Decade of Ocean Science for Sustainable Development (Ryabinin, 2020).

Responsibility is one of the core values that humans accept as universally representative of individual and social good in terms of honesty, justice and respect for life and the environment (Chan et al., 2016). The responsibility of scientists and industry is to take necessary actions to secure a healthy and productive ocean. Industries and researchers must ensure that the effects of their actions do not destroy the autonomy, dignity, integrity of future humanity, especially under human induced climate change challenges, or increasing blue economy (Bennett et al., 2021).

The term "Ocean Ethics" emphasizes reflection and reasoned actions based on scientific advances to develop the exploration and exploitation of the oceans. It involves social, scientific, environmental, legal, political, industrial and associative actors to adopt commendable and responsible behavior that will support the sustainability and stability of the ocean and support the resilience of the Earth system (Auster et al., 2009).

A bibliometric search in Scopus, in the title, abstract and key words, using the terms "marine" OR "ocean" AND "ethic*" AND NOT "health*", was made on 4th February 2022. "Health" was removed, because in a first search medicine studies in small islands were very abundant, biasing the topic studied here. A total of 840 references was found, for the period 1977-2022, and exported to EndNote. A keyword co-occurrence analysis was undertaken, using VOSviewer software, version

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1.6.16 (Van Eck and Waltman, 2010; Van Eck and Waltman, 2020), in order to determine the main research topics under these terms. For details on this kind of analyses, Borja and Elliott (2021) can be consulted.

For those keywords with more than 10 co-occurrences, 5 clusters with 118 items have been identified (**Figure 1**). Cluster 1 (in red) includes 46 items, and is built around ethics in conservation, sustainability, environmental impact and protection, governance and management of the marine and coastal systems, especially in Europe, North America and Asia. Cluster 2 (in green) includes 26 items and relates ethics with the research in Oceania about the aborigine culture and their multiple relationships with the ocean, including the use of traditional knowledge. Cluster 3 (in blue) includes 24 items, with links between ethics and the use of animals in controlled experiments, bioassays and toxicity studies. Cluster 4 (in yellow) includes 12 items and is an emerging field of research on the ethics and climate change effects, sustainable development, education and awareness (Allison and Bassett, 2015). Finally, Cluster 5 (in magenta) includes 10 items, is closely related to Clusters 1-3, and relates research on ethics and some economic uses of the sea, such as fishery and aquaculture, but also the conservation of natural resources and the animal welfare (Hobday et al., 2019).

This means that the ocean ethics topic covers currently diverse approaches and fields of research, which maintain some interaction among them and the number of papers around this topic is growing progressively: before 2002, less than 10 papers were published by year; between 2003 and 2009, the papers published ranged from 15 to 40 per year; between 2010 and 2017, they ranged from 40 to 50; and after 2018, >50 papers are published per year.

In this context, this Research Topic (RT) on Ocean Sciences and Ethics intends to provide a platform to publish research, recommendations and guiding principles on the many ethical challenges and issues that scientists and industries may face when conducting research activities or develop innovation at sea. This includes protecting and respecting natural processes and phenomena when planning and implementing environmental interventions; sustainability of economic and social activities linked to energy and other natural resources; advance ocean education and awareness to promote sustainable economic development, prevent and mitigate environmental risks, environmental protection, and improve the resilience and well-being of societies; respect different cultural interest in the oceans; prevent unfair advantages or benefits for one or more parties over others; developing clear, transparent and traceable procedures regarding the exploitation of natural resources; ensure the effectiveness of decision making to prevent duplication of effort, minimizes investments and environmental impact, and ultimately reduces service and maintenance costs.

Within this Research Topic, eight manuscripts have been published, covering an ample selection of topics. Hence, Miller et al. focus on a current increasing debate about the effects on the extraction of minerals from the seabed of the deep ocean (Levin et al., 2016). Miller et al. provide a perspective on: (1) arguments that deep seabed mining is needed to supply minerals for the green energy revolution, using the electric vehicle battery industry as an illustration; (2) risks to biodiversity, ecosystem function and related ecosystem services; and (3) the lack of equitable benefit sharing to the global community now and for future generations. These authors explore the justification for a global moratorium on deep seabed mining to ensure protection of marine ecosystems, the need to focus on baseline research, and how improved governance of targeted marine regions could be key to the preservation and conservation of the ocean biome.

The second paper focuses on the current most growing Research Topic, which is the plastic pollution in the ocean (Borja and Elliott, 2021). Here, Owens and Conlon consider that plastic waste is currently understood by industry as an externality that demands a technological solution. However, when the problem of plastic waste is ignored, the costs are pushed to marginalized communities around the world, to future

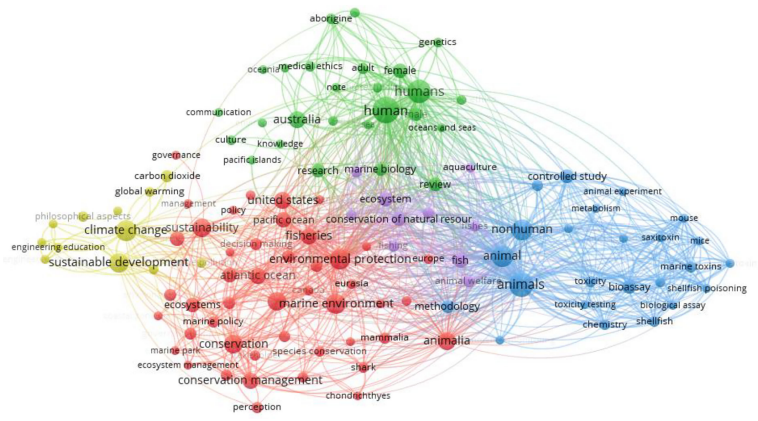

FIGURE 1 | Clusters (bubbles in same color) of keywords co-occurring at least 10 times in the 840 references identified for the topic ocean ethics, together with the links among them (lines in same color).

generations, citizens, governments, and taxpayers, producing multiple ethical problems. These authors consider that, rather than leave the problem-solving to the problem-creators, scientists, policymakers, and governments are advised to frame plastic waste narratives like that of Common Seas: with an emphasis on reduction, redesign, re-use, and collaborative decision-making for plastic reduction rather than downstream management.

Sánchez-Arcilla et al. say that met-ocean factors (waves, currents, etc.) are normally selected from a probability distribution, where only the central trend is considered, and then the analysis of hydro-morphodynamic processes is carried out within a deterministic framework. This analysis is often based on a non-updated topo-bathymetry, with implicit error intervals for many variables, which results in uncertainties that, unless presented from an ethical perspective, tend to hinder proactive decision making and thus result in growing coastal degradation. To address this challenge, the article develops an approach for field and lab data, to estimate key variables in coastal sustainability and engineering decisions. The article addresses the implications that the uncertainties associated to those variables may have for coastal risk assessments and proactive decision making, discussing how large error levels without a suitable ethical assessment may result in socio-economic mistrust, which will limit the necessary optimism to address future coastal sustainability.

Cappelletto et al. focus on "ambassadorship" programmes in marine science. These programs are conceived to address the future generations of scientists, entrepreneurs, policymakers, and citizens, and to promote the awareness and shared responsibility on the sustainable use of marine resources in an authentic and credible way, through the empowerment of young researchers and professionals, communicators, or activists. Such ambassadors are well-positioned to act as agents of change, improving the dimension of Ocean Ethics related to inclusive governance, especially necessary for an equal, just, and sustainable management of multi-actor and transboundary socio-environmental contexts. Pivoting on the Young Ambassadors' Program developed in the framework of the BlueMed Research and Innovation (R&I) Initiative for "blue jobs" and growth in the Mediterranean area as case practice, the article aims to propose some reflections about the long-term perspective of such experiences. Outlining an emerging physiognomy of the "One Ocean Ambassadors," it discusses their potential to build the next generation of responsible scientists, citizens, and decision-makers and to embed ethical principles in research-based marine governance.

Giuffredi et al. quantify the effects of the unprecedented experimental conditions induced by the reduction of many anthropogenic pressures during COVID-19 lockdown. This was undertaken in a project conceived with a holistic, interdisciplinary approach, geared to combine scientific, economic and cultural observations to promote collective actions suitable to the governance of socio-ecological systems, reconciling respect for the environment with human activities and wellbeing, and thus grounding an ethical approach to marine resources. The authors comment the process- and community-related features, explore limits and opportunities, and propose a set of recommendations, based on a preliminary review of their experience and oriented to promote the development of a shared Ocean ethics.

Nauen and Arraes Treffner work on the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) (FAO, 2015). The authors investigated with self-selected men and women in small-scale fisheries in Senegal, a country with a large and dynamic SSF, which suffers, however, from diminishing profitability as a result of multiple pressures. The authors report ongoing work on the principles and approaches of the Small-Scale Fisheries Academy as a way to support the implementation of these Guidelines. The first phase of developing the SSF Academy focuses on testing learning methods aimed at developing critical thinking, planning and action. Respectful dialogue in the secure space of the Academy made academy learners, particularly women and younger participants, gradually more confident, articulate, and active. They started harvesting the results of enacted planning. The authors argue that it would be useful to expand these tests combining dialogue, the art of hosting communication and visual thinking to different places in Senegal and elsewhere. They provide an opportunity to address sensitive social issues like gender equity and intra-household violence and open perspectives on other societal challenges that hamper the implementation of the SSF Guidelines.

Whoriskey et al. commented that globally huge investments are made annually in establishing infrastructure for shorter-term ocean observing systems, with punctual studies that address targeted as opposed to broad science needs. Given punctual infrastructure's small and frequently transient nature, these authors consider that connections to enable sharing will probably be done locally, and both potential additional users and owners of the infrastructure will need to be energetic, receptive and flexible. The accommodation of new uses will have to be balanced against any costs of these additional activities, which could pose an ethical dilemma in themselves if they compromise the infrastructure's ability to meet its original intent. However, such adaptive infrastructures may be the most efficient way to provide the resources needed to identify and monitor emerging or new ocean stressors.

Xiao et al. studied the transformation of the reclaimed land in Quanzhou Bay (China), dividing it into four stages, which are closely linked to the economic development in the region. In the early industrialization period, reclaimed land in the region was used for agricultural production, whereas in the mid-industrialization period, it was gradually transformed into a combination of industrial and agricultural lands. In the later period of industrialization, the reclaimed land was gradually converted into urban industrial and port lands. Finally, with further refinement and upgrading of economic and industrial structures, the socio-economic and environmental benefits from coastal reclamation projects have been increasing, whereas the proportion of economic benefits (in the total benefits) has been decreasing, posing ethical questions.

The variety of topics submitted to this Research Topic shows that this field of knowledge is growing progressively, incorporating new areas linking ethics and the use of marine resources (e.g. deep-sea mining, use of space, fisheries), the legacy of pollutants (including plastics), the observation of the ocean and the use of such data in an equitable way, or the awareness of young people and young scientists about the ocean problems. We hope that this Research Topic can contribute to increase our responsibility to apply ethical fundamental core values, identifying and promoting sustainable ocean principles.

AUTHOR CONTRIBUTIONS

MB developed the idea of the RT. AB wrote the first draft of the article and all authors contributed equally to the discussion-conclusions and in writing the final manuscript.

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