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# Editorial: Network-based assessments and interventions in the marine environment

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## Editorial on the Research Topic

### Network-based assessments and interventions in the marine environment

The marine environment is subject to strong pressures related to human activity, such as fishing, tourism, recreational uses, pollution from intensive coastal development, and energy exploitation, among others. Hence, the governance of the marine environment is essential to guarantee its sustainability, both in environmental terms as well as social, economic, and cultural diversity. Some of the management tools that have expanded the most in recent years are based on network analysis of social and/or ecological systems (Bodin & Crona, 2009). The analysis of social networks consists of the systematic study of the patterns of interaction among individuals, groups, or organizations. This allows to identify and describe some emergent structural properties.

In the specific case of the marine environment, network analysis has been applied in (a) the monitoring of participatory governance practices, (b) the evaluation of ecosystem services, and (c) the design and implementation of interventions.

First, network analysis is useful for describing the relationships between a wide variety of actors in collaborative governance processes (Smythe et al., 2014). It can also inform the implementation of participatory strategies with different stakeholders. For example, the Net-Map technique is used to map the relationships among a set of individuals or institutions in local contexts and serves to generate a shared vision that facilitates strategic planning (Fortnam, 2019). Network analysis can also be combined with stakeholder analysis (Maya-Jariego et al., 2016). One of the challenges consists in the selection of leaders with criteria of representativeness and legitimacy in the political processes.

Second, social media data provides valuable information on human-nature interactions (Väisänen et al., 2021). Network analysis techniques have been used successfully in this case to assess ecosystem services (Ruiz-Frau et al., 2020). Automated data extraction can be validated with qualitative observational strategies (Alieva et al., 2022). The ability to handle large volumes of digital data makes it an especially useful tool for describing and monitoring the marine environment on a large scale.

Third, network-based interventions use relational data to design behavior change programs. Structural measures serve as a guide to identify opinion leaders, segment the community into groups or modify the characteristics of the network as a whole (Valente,

2012). Network interventions are effective in the dissemination of responsible ecological behavior (Niemiec et al., 2021) and in the adoption of innovations in the productive system (Isaac et al., 2021). Ecological knowledge and collective memory about the marine environment in coastal communities are resources that can be used effectively in the design and implementation of public policies. Networks provide models and strategies that work especially well in this context.

Two articles in the monograph analyze natural disasters with the incorporation of a network approach in governance or data analysis. Alieva et al. analyzed the impact of the desiccation of the Aral Sea on fishing communities in Uzbekistan. Through direct observation and in-depth interviews with different interest groups, the socioeconomic impact of one of the largest ecological catastrophes of the second half of the twentieth century is described. The decrease in water levels and the increase in salinity caused the disappearance of fish, forcing the population to look for alternatives to fishing activity. In turn, this had a negative impact on local community networks. The study discusses the role of rebuilding ties among former fishermen in local development processes in the area.

Marin et al. conducted a longitudinal analysis of the impact of the 2010 tsunami on fisheries co-governance networks in the Bio-Bio region, Chile. The study revealed that after the tsunami, network fragmentation and decentralization decreased, while the level of perceived trust between the organizations involved increased. That is, in the period immediately following the natural disaster, an increase in the levels of social cohesion of the affected communities was observed. Among the original contributions of this study is the use of a longitudinal design, with a comparison group with communities not affected by the disaster.

The third and the fourth paper make use of networks as a governance tool. Salazar et al. used participatory strategies to involve fishermen in the restoration and conservation of ecosystems in a Marine Protected Area of Cap de Creus, in Catalonia, Spain. Ocean literacy was used to raise awareness among users of the marine environment about interdependent relationships with the habitat, referring to the specific case of gorgonians that inhabit the rocky substrate. The improvement of governance was also promoted by taking advantage of local ecological knowledge. In this case, personal network analysis was integrated with cultural consensus analysis techniques to improve the management of protected areas. Similarly, Dalton et al. show that learning networks contribute to disseminating knowledge about the marine environment, developing institutional capacities, and improving ocean governance.

Finally, there is an example of using networks in the detection of illegal, unreported and unregulated fishing practices. Bichler et al. use the network approach in detecting potentially illegal practices in the supply chain between fishing vessels and refrigerated vessels in FAO Area 81, in the Southwest Pacific. To do this, they used public data from Global Fishing Watch with which they detected cohesive subgroups in the exchange networks in the supply chain. In addition to observing dispersed networks with little connectivity, as is common in illicit trafficking, they identified very active

intermediaries who seem to have a relevant role in illegal activities. The area analyzed is one of those with the highest transshipment rates in the world, given the importance of its tuna fishery. Carrying out transshipment on the high seas makes it difficult to determine the legal or illegal nature of fishing operations. Hence, the Regional Fisheries Management Organizations (RFMOs) are hampered in their task of monitoring and managing fishing activity in their reference areas. The network analysis strategy uncovers illicit interference in the supply chain and can therefore effectively complement port inspection programs.

Applications of network analysis have spread widely in the understanding and governance of natural resources in general and the marine environment in particular. However, along with the growing number of innovations, it is necessary to systematize the network intervention experiences accumulated in recent years. This Research Topic explores the use of network analysis in participatory marine environmental governance strategies and highlights the need for systematization of the practice of network interventions in the marine environment. This Research Topic shows how network analysis can be used for preparatory purposes or as an intervention tool in its own right. As regards the specific area of natural resource governance, networks have been preferably used as a tool for participatory management and co-management. We will probably see a diversification of its uses in the immediate future.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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