Marine Conservation

McQuatters-Gollop, A

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Topic 4: Marine Conservation Topic

Dr Abigail McQuatters-Gollop, University of Plymouth

The marine environment is biodiverse

Oceans and seas have a high number of species and a wide range of habitats, with some studies suggesting only 10% of marine species have been identified and described (Mora et al., 2011). Collectively, these species and habitats can be referred to as 'marine biodiversity'. Marine biodiversity encompasses all life in the marine environment, from viruses to single-celled phytoplankton to whales, and includes habitats such as kelp forests, abyssal plains, coral reefs, and the open oceans. The diversity of life in the oceans supports complex processes and functions occurring in marine waters, including carbon and nutrient cycling, trophic interactions, and climate regulation. For example, phytoplankton produce 50% of global oxygen. Without marine biodiversity our planet would look and function very differently.

What is marine conservation?

Human activities can negatively impact marine biodiversity, harming wildlife and diminishing the oceans' ability to support ecological functions and processes. For example, overfishing can both damage benthic habitats and alter food webs, changing predator-prey relationships and the transfer of energy between trophic levels. Coastal development can destroy coastal habitats such as mangroves and seagrass meadows, decreasing the biodiversity of these systems and diminishing the coastline's natural protection against storm events. Plastic is polluting beaches and waterways across the globe, and is increasingly found in the guts of fish, seabirds, whales, and even plankton. In addition to these direct human pressures, anthropogenic climate change and ocean acidification, caused by carbon emissions, are additional stressors on marine ecosystems. Climate change is increasing sea temperatures, and altering biogeochemical cycling and biological distributions, while ocean acidification is changing the pH of the ocean, impacting biological and physiological processes. Managing these human pressures on the marine environment is complex, particularly for climate change and ocean acidification, which can only be managed through a global reduction in carbon emissions.

Marine conservation helps safeguard the ocean's biodiversity. Conservation efforts can focus on the marine environment at the single species, species groups, habitat, or ecosystem level. Marine conservation seeks to protect or restore species and habitats by managing the human pressures directly impacting them. In this way conservation works to maintain or increase the health of marine biodiversity, resulting in species and ecosystems which may be more resilient to the effects of climate change and ocean acidification. Marine conservation is an interdisciplinary field, requiring expertise from marine biology, oceanography, fisheries, marine policy, law, and social science.

How do we conserve the marine environment?

Marine and coastal environments vary in their biodiversity and human uses. Management of these environments therefore requires a variety of conservation techniques across multiple political scales, from international agreements to community plans. Using the marine ecosystem sustainably, in a way that ensures its species, habitats, processes, and functions are preserved for future generations, is key to effective marine conservation and management.

Environmental conventions are a fundamental conservation technique. Environmental conventions are international agreements formed to address particular challenges. An important milestone in marine conservation occurred in 1946 with the establishment of the International Whaling

Commission (IWC) in response to the systematic global depletion of whales due to hunting. The IWC adopted a moratorium on commercial whaling in 1982, which is implemented by 89 countries worldwide. The moratorium has achieved successful results, with some species, such as humpback whales (*Megaptera novaeangliae*), substantially increasing in abundance from near extinction, although other species, like the North Atlantic Right Whale (*Eubalaena glacialis*), remain critically endangered. Japan had been a member of the IWC but withdrew in 2019. This issue is controversial among Japanese people, including scientists, nature conservation groups, politicians and general citizens.

In 1992, the United Nations Convention on Biological Diversity (CBD) provided a legal basis for biodiversity conservation (United Nations, 1992). The objectives of the CBD are to conserve and sustainably use biodiversity and to share genetic resources. Globally, 196 countries (including Japan) have signed the convention, and have therefore committed to creating and implementing biodiversity conservation, both on land and in the marine environment. The CBD's Aichi Biodiversity Targets were established in 2010 to provide a pathway for member countries to halt biodiversity loss, promote sustainable use of biodiversity, improve the health of species and habitats, enhance the benefits from biodiversity, and improve participation in biodiversity management (United Nations General Assembly, 2015).

Humans are not separate from the marine environment, but depend on seas and oceans for food, recreation, transportation, and cultural activities. The 'ecosystem approach' to marine management considers humans as part of the ecosystem, and is a balance of conservation and sustainable use (United Nations, 2000). Implementation requires scientific understanding of the marine system as well as knowledge of the services provided to humans from the marine environment. An ecosystem approach to fisheries management, for example, is used to manage not only fish stocks, but to limit the impact that fishing has on the wider ecosystem. Some examples of such management measures include reducing the accidental catch of unwanted non-target species (known as 'by catch') and protecting areas of the sea bed from the damaging effects caused by trawling, which drags heavy fishing gear along the sea's bottom, destroying benthic habitats.

Figure x: Small scale fishing in Bako National Park, Malaysia.

Marine Protected Areas (MPAs) are a common marine conservation tool that are often implemented as part of an ecosystem approach to marine management. MPAs protect areas of the marine environment from damaging human activities such as certain types of fishing or oil exploration. MPAs can have different levels of protection, from strictly controlled reserves which may prohibit all human activities, to protected areas where recreational fishing may be allowed but commercial

fishing is forbidden. Globally, MPAs which prohibit fishing are on average 670% richer in fish biomass than in adjacent unprotected areas (Sala and Giakoumi, 2017). MPAs can even increase fishery catches in nearby unprotected areas, as fish 'spillover' from the MPA into adjacent waters (Halpern et al., 2010). The conservation benefits of MPAs are recognised internationally, with Aichi Target 11 requiring the protection of 10% of global marine and coastal areas (United Nations General Assembly, 2015). MPAs alone will not protect marine biodiversity, however, as some key ecosystem components, such as ecological processes and mobile species like cetaceans, cannot be protected through area-based management (Mora and Sale, 2011).

The role of data in marine conservation

Data and scientific research about the marine environment form a critical scientific evidence-base which supports marine conservation. Due to the difficulty and expense of surveying the marine environment, marine biodiversity data are generally limited in spatial and temporal extent, making it challenging to detect and interpret changes in the marine environment. Time-series datasets are a powerful tool which can increase understanding of change in marine biodiversity. Most marine ecological datasets, however, are coastal and short in length, and not adequate to detect the influence of long-term changes, such as climate change and ocean acidification, on marine biodiversity. Where long time-series biodiversity datasets do exist, particularly when they cover a large spatial region, they can be used to explore a wide range of complex issues such as: marine biodiversity change in a warming ocean, the impacts of fishing on marine ecosystems, and links between marine biodiversity and climate oscillations. Understanding such changes in marine biodiversity is necessary to ensure that conservation decisions, such as where to place an MPA or how to manage sensitive species, are based on good science.

In addition to biodiversity data, social data are important for effective marine conservation. Social data can reveal information about the impacts of biodiversity change or conservation measures on local communities, employment, or human welfare. This information is critical for understanding how conservation issues affect people and their livelihoods. People who have an interest in a specific marine conservation issue are called 'stakeholders'. Depending on the issue in question, stakeholders may include, for example, fishermen, the general public, policy makers, or beach goers. To minimise negative impacts and ensure support for conservation measures, it is good practice to include stakeholders in the development and implementation of conservation measures.

Figure x: A SCUBA diver collects biodiversity data at Shikine-jima, Japan

***Satoumi*: traditional application of the ecosystem approach in Japan**

Japan has a history of applying an ecosystem approach to biodiversity management through *satoumi*. *Satoumi* are coastal seas where human influence has increased the productivity and biodiversity of ecosystems (Yanagi, 2007). In *Satoumi* areas human interactions with marine systems, such as fishing, resource management, and even MPA creation, are based on environmental considerations and sustainable use. The *satoumi* system uses local scientific and community knowledge to make decisions about marine management, based on a philosophy of community responsibility. Stakeholders are an important component of *Satoumi*, as local people are the key instigators of ecosystem enhancement, demonstrating their investment in their coastal environment (Hill et al., 2016). Japanese policymakers support this approach because it integrates conservation and sustainability to manage the coastal environment (Ota et al., 2011). The sustainability focus of *satoumi* means that *satoumi* can also help fulfil the Japan's Aichi target commitments (Berque and Matsuda, 2013).

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