



Managing the world's oceans

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Why are the oceans so valuable to humanity, and how does our activity threaten the marine environment? This article looks at the oceans as a resource, the challenges involved and the governance arrangements in place to manage this global commons

We live on a watery planet, most of which is saline. Ninety-eight per cent of the world's water is sea water. The words 'ocean' and 'sea' are often used interchangeably, though strictly a sea is an area of ocean partially enclosed by land. Humans use the oceans and seas in a wide range of ways, because marine environments are chock-full of resources. But these resources are not being well managed at present, and good management is difficult.

Ocean resources

Natural resources are elements of the physical environment that satisfy various human needs and wants. A few of these — such as the need to drink fresh water — are universal. Others vary over time and place. For instance, some Japanese people eat whale meat and blubber, while most Australians value whales as creatures to watch and admire. As geographer Ray Hudson (1999) once said, most 'Natural resources are not *naturally* resources.' They *become so* because of how people view nature and the technologies available to exploit it. The oceans are abundantly resourceful, because of their size and complexity and

because different groups of people value them in a wide range of ways.

Biogeochemical diversity

The world's oceans are a vast and differentiated ecosystem, made up of:

- salt water (containing various elements such as carbon)
- an astonishing number of organisms
- a sea bed of hugely varied morphology, larger than the area of the world's seven continents

The oceans contain huge amounts of solar energy. Its uneven distribution powers major currents that influence climate, while water in the upper ocean is also moved by winds. Marine species are highly adapted to the ocean environment in different parts of the world, and may be part of a large ecosystem such as the Great Barrier Reef or a specialised one such as hydrothermal vents on the sea floor. In coastal environments, they include birds and semi-aquatic species.

Ocean resources valued by people

Broadly speaking, oceans are 'resourceful' for humans in four ways.

- They provide a great deal of food.
 - They are sources of energy and minerals, such as North Sea oil. Wind and tidal energy form an increasing part of this. New areas of exploitation include manganese nodules on the sea bed, which could be mined, and pharmaceutical companies 'bioprospecting' marine species for new chemical or genetic elements. •
 - They provide opportunities for leisure and tourism, such as water sports and cruise-ship holidays.
 - They are important for international transportation and telecommunication. The first telephone cables were laid across the Atlantic more than a century ago, and today large cargo ships criss-cross the globe along lanes that carry 80% of global trade.
- Note that these are not all about resource extraction or exploitation. Often the *protection* and *conservation* of resources is the priority (you can't have a whale-watching industry if most cetaceans are hunted). And not all marine resources are specific 'things' like cod. Often what's valued are whole ecosystems (like coral reefs) or broader 'services', like the winds that power off-shore turbines.



Whales are valued in contrasting ways by different people and cultures

Marine 'resourcefulness' also depends on the cultural preferences of different people and the technologies available to them. In some societies the oceans are not viewed as 'resources' at all, and more as a key element of a whole way of life going back thousands of years. An example would be coastal aboriginal communities in British Columbia, Canada.

Human impacts

In recent decades human use of the oceans has increased significantly and this growth looks set to continue. The oceans can be divided politically into:

- **territorial waters:** the zone extending to 12 nautical miles or approximately 22 km offshore
- **exclusive economic zones (EEZ)** in which a country has exclusive rights to sub-surface water resources up to 200 nautical miles

(370 km) offshore, or further than this if there is a wide continental shelf next to the coastline

- **high seas:** open for use by any country — two thirds of the oceans by area, 95% by volume

The major human impacts are described below.

Resource depletion

The oceans have been heavily fished for decades. Fish and other seafood provides protein for billions of people, and sustains food processing and retailing industries across the globe. Fish are taken from territorial waters and EEZs, but also from the high seas, where countries compete for catch.

Fisheries experts Daniel Pauly and Dirk Zeller (2016) have estimated that actual catches since 1950 are at least 50% higher than those reported to the Food and Agriculture

Organization, because countries tend to under report, and illegal fishing is never reported. They believe catches peaked in the late 1990s at around 130 million tonnes. Since then they have declined because over-fishing has affected species recovery.

A spectacular example of decline was the Grand Banks cod fishery in eastern Canada. A government moratorium on cod fishing was declared here in 1992 after fish stocks collapsed. It remains in force as cod stocks have very slowly recovered.

As well as the target species, fishing has led to huge amounts of 'by-catch' (e.g. dolphins accidentally killed in catching tuna fish).

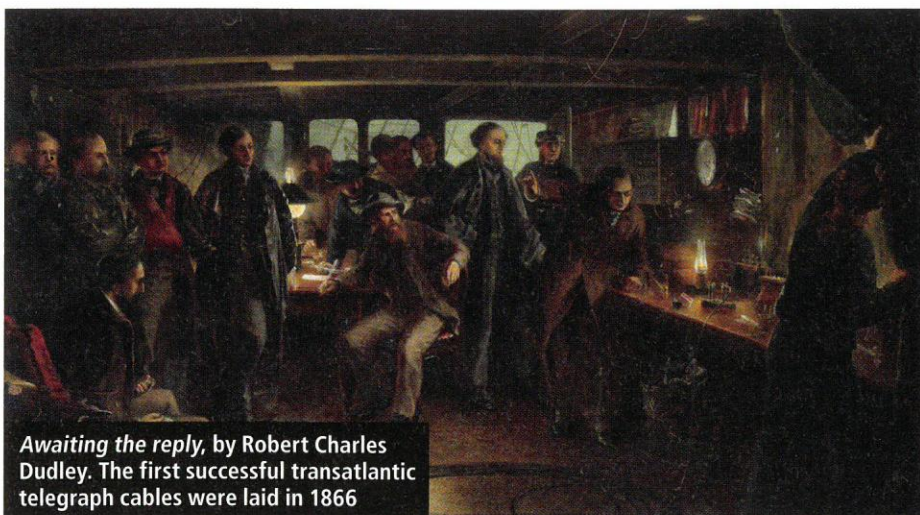
Habitat degradation or loss

Examples of human activity that impacts on ocean habitats are bottom-trawling for fish (which damages sea-floor ecology), oil spills and anthropogenic climate change. During the 2011 *Deep Water Horizon* oil leak from the sea bed in the Gulf of Mexico, oil poured into the ocean for 4 months, affecting marine ecology for thousands of kilometres.

Increased carbon dioxide levels in the atmosphere (due to fossil-fuel combustion) are making the oceans more acidic and warmer, with impacts on marine ecology particularly in the upper layers of water. For example, increased acidity affects the shell strength of molluscs like oysters and clams, while higher ocean temperatures are causing 'bleaching' of corals in many areas, including the Great Barrier Reef.

Marine pollution

Millions of tonnes of plastic bags, bottles and packing float in the water or settle on the sea



Awaiting the reply, by Robert Charles Dudley. The first successful transatlantic telegraph cables were laid in 1866

References



Pauly, D. and Zeller, D. (2016) 'Catch reconstructions reveal that global marine fisheries catches are higher than reported and declining', *Nature Communications* 7, 10244.

Schofield, C. (2017) 'Contested ocean spaces: a case study of the South China Sea', *GEOGRAPHY REVIEW* Vol. 31, No. 2, pp. 22–26.

bed, a notable example being the 'north Pacific trash vortex' between Hawaii and California. Plastic is ingested by marine animals, especially when it breaks down into small particles, and gets wrapped around turtles and other creatures, causing them a slow death.

Somewhat differently, well over 50,000 large ships that make up the world's merchant and naval fleets carry ballast water to stabilise them during a long voyage. If a ship discharges untreated water at its destination this can introduce 'alien' microbes, crustaceans and other organisms into environments on the other side of the world, where they do not belong. Such invaders can have a serious impact on local marine ecology. Noise pollution from ships is also increasingly harmful to whales.

All the above impacts are difficult to quantify. The sheer size of the oceans, and the practical difficulties of systematically observing sub-surface processes and phenomena, mean that we remain ignorant of what is actually happening in the marine environment. This ignorance suggests we should apply the 'precautionary principle'. We may be causing damage far more severe than we know and should scale back harmful activities now.

Current ocean management

Despite their enormous significance for human wellbeing, the oceans are governed by a patchwork of laws, regulations and institutions that don't join up and are not comprehensive. The high seas are particularly poorly governed. They are essentially 'open access', meaning that individual countries can exploit them without paying the direct costs of any harm caused in the short or medium term (e.g. by over-fishing). But problems can exist in territorial waters and EEZs too. For instance, without strong intergovernmental cooperation, mobile species like salmon or seals may not be properly managed as they move between the waters of different countries.

UNCLOS

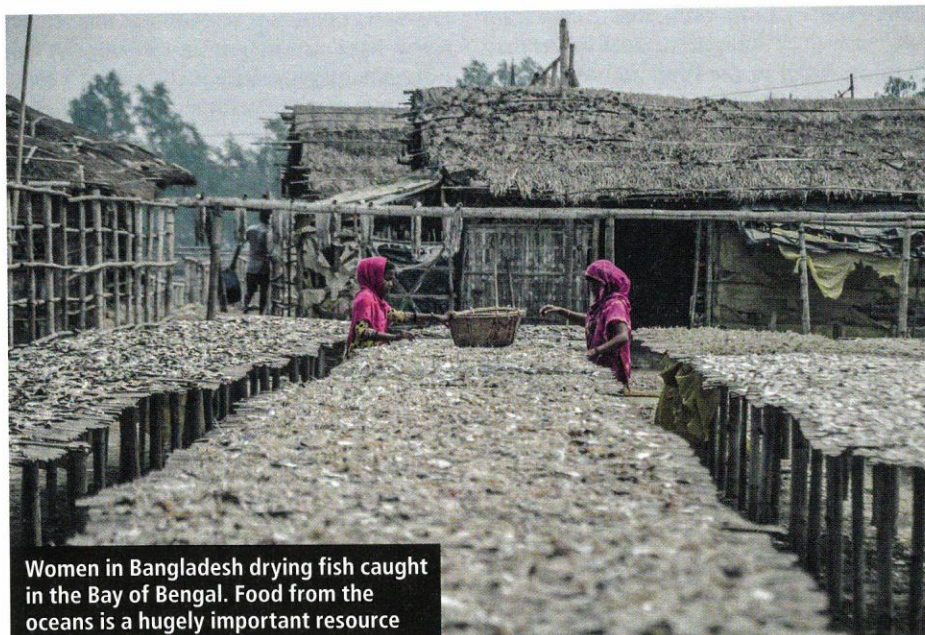
What the oceans do have, which the land lacks, is an overarching inter-governmental agreement, the United Nations Convention on the Law of the Sea (UNCLOS), which entered into force in 1994. It is binding on 167 countries plus the European Union. It helped establish the oceanic divisions mentioned earlier (e.g. EEZs).

Because UNCLOS covers so many things — from high-seas fishing to the mining of sea-bed minerals — it is often not specific on how these are to be managed in practice. This is left to a number of different organisations including the International Whaling Commission, the International Seabed Authority and the International Maritime Organization (which governs ship transportation). There is also a plethora of regional environmental and fisheries management organisations (RFMOs). In the north Atlantic for example there is the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) and the International Commission for the Conservation of Atlantic Tunas (ICCAT).

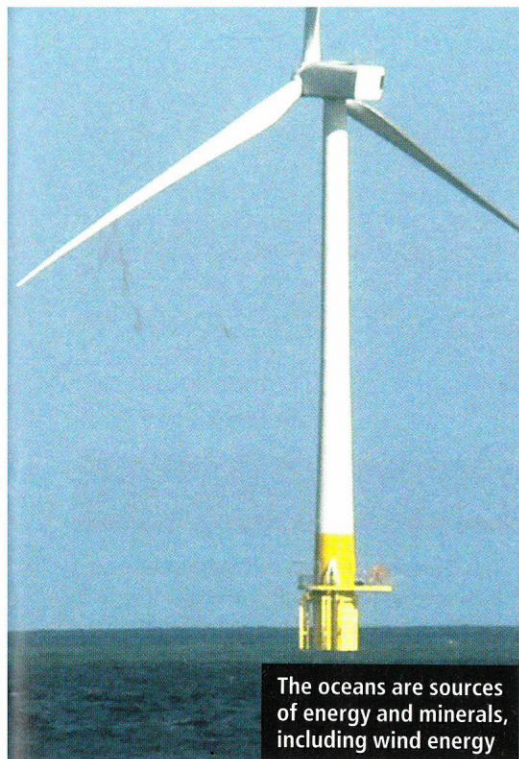
The key challenge in oceans governance are:

- fragmentation: the bodies managing different sectors do not talk to one another enough
- poor implementation of and compliance with the existing agreements
- relying on the goodwill of members, with no power to punish offenders (e.g. Japan still routinely catches whales, despite an IWC moratorium on most commercial whaling for over 30 years)

There are also specific agreements linked to UNCLOS, which require enforcement. For example the United Nations Fish Stocks Agreement became effective in 2001 and is



Women in Bangladesh drying fish caught in the Bay of Bengal. Food from the oceans is a hugely important resource



The oceans are sources of energy and minerals, including wind energy

rely on them, getting governments to act together is almost impossible.

High-seas governance is especially challenging. The high seas belong to all nations. This means that no one nation will sacrifice potential economic gains (e.g. from sea-bed mining) in order to conserve the marine environment for all. Marine Protected Areas on the high seas are an attempt to prevent this 'tragedy of the commons' (see pages 20–21 in this issue).

Countries look for ways to extend their territorial waters and EEZs because they then have access to the marine resources they contain. For instance, China has recently been adding artificial land to the Spratly Islands in the South China Sea, which are closer to Vietnam and the Philippines than China (Schofield 2017).

Not all doom and gloom

Scientists are today doing more than ever to alert politicians to the problems caused by poor use of the oceans. Among them are 'ocean champions' like US biologist Sylvia Earle. In addition, the idea of the 'blue economy' is being pushed in organisations like the UN. This idea emphasises the huge economic potential of well-managed marine environments for the benefit of all people, and challenges the assumption that most economic gain should derive from land-based activities. It suggests that current uses of the oceans only recognise a small fraction of their economic benefit. For some of these benefits, ideas for sharing resources among nations might well work (see Box 1).

Some important anthropogenic changes to the oceans are now irreversible, notably acidification, warming and sea-level rise. These will have profound impacts on marine and human life along the world's coasts over the coming decades and centuries. The stage is set for a far greater emphasis on effective ocean management than we have ever seen before. The question is: how successful will future management be, and how long will it take?

The oceans of the future

The challenge we face is that a huge number and variety of human activities affecting the oceans need to be properly regulated from the global scale down to the scale of individual territorial waters. This requires intergovernmental cooperation, funding and organisations with the legal power to enforce rules. Because the oceans are together so vast and so ecologically complex, and because more than 190 countries

Box 1 How to regulate bioprospecting of the high seas

Bioprospecting is the search for biological substances that might eventually be of commercial value in sectors like pharmaceuticals, cosmetics and agriculture. Large firms are searching the oceans for organisms of potential future use. For instance, many are taking out legal patents on things like genetic sequences of 'extremophiles' living near deep-sea vents in the hope they will be useful in new drugs or crops.

Companies are free to prospect the high seas and to keep the profits made from products based on prospected organisms. These companies are usually in the developed world. One way of regulating this exploitation would be for firms to contribute to an international fund for marine research and innovation that poorer countries could use to bioprospect themselves. This fund could become part of an existing United Nations framework like the Convention on Biodiversity.

UN Sustainable Development Goal 14 calls for the sustainable use and conservation of the oceans. Negotiations are ongoing at the UN on the conservation and sustainable use of biological diversity in the high seas and deep sea-bed areas beyond national claims.

Further reading



There are many good-quality studies of how humans use the oceans and how the oceans are being (mis)managed. Select one topic — such as over-fishing, plastic pollution or acoustic pollution — and do some online research. Only consult credible sources, such as reports by university researchers, by recognised organisations like Greenpeace or established news outlets like the *New York Times*.

Try to answer some key questions as you read and take notes:

- what is the reason for the problem arising?
- who is causing the problem?
- who is trying to solve the problem?
- how effective are the preventative actions so far?
- what explains their success or failure?

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Key points



- The oceans cover over 70% of the Earth's surface and are divided into territorial waters, exclusive economic zones and the high seas.
- What counts as an oceanic 'resource' is determined as much by human appraisals and technologies as by the biochemical and physical character of the oceans.
- The high seas are especially prone to reckless resource use because all nations can use them with few or no restrictions.
- Over-exploitation of resources, marine pollution and habitat loss (or degradation) are major human impacts on the oceans. We may be inflicting more damage than we know.
- Governance of the marine environment involves a patchwork of organisations and regulations, from global to national scales.
- Only by significantly improving governance, based on more and better marine science, can the oceans be responsibly managed for the benefit of all humankind.