Protecting the blue

The ocean is a food source to many and provides ecosystem services for the planet. Scientific understanding is required to help society address numerous threats facing this global common.

Oceans and coasts hold a certain attraction for people, with populations clustered on coasts. But the international nature of the ocean means the high seas can often be overlooked in domestic policies, and governance requires agreement between nations. The 1982 United Nations Law of the Sea Convention extended international law to apply to the global ocean — establishing boundaries for use and sovereignty¹. Another example is the regulation for preventing pollution, including polluting emissions, from ships from the International Maritime Organisation², although more stringent restrictions are being created to minimise sulfur oxide and CO₂ emissions³. It is therefore the responsibility of all stakeholders to commit to combat these threats to the ocean.

A visible threat to the ocean is plastic pollution and the accumulation of rubbish. Reports of massive collections of floating rubbish in oceanic gyres⁴ and washed up debris on remote and uninhabited islands⁵ make it clear that something needs to be done to reduce plastic pollution. Only the larger pieces of plastic are visible; microplastics are ubiquitous^{6,7} and are small enough to be consumed by marine creatures. Plastic pollution is being tackled in a number of ways, such as the UN resolution, signed by 193 nations in December 2017, to eliminate plastic pollution from the sea⁸. This shows a commitment from nations to act, whilst not being a legally binding treaty at this stage. A Comment in *Nature Human Behaviour* suggests working across disciplines and sectors to address this issue⁹.

Although climate change often presents less visible effects, coral reefs are one very visible reminder of the effects climate change is having on the oceans. A healthy future of coral reefs requires urgent intervention with significant impacts from climate change and human influence — such as fishing and pollution — already occurring¹⁰. The number and severity of bleaching events has sharply risen in recent years, and will continue to do so unless action is taken. 2018 has been declared the International Year of the Reef by the International Coral Reef Initiative, with the ambition of increased action to preserve reefs for future generations.

Credit: Seaphotoart/Alamy Stock Photo.

Warmer waters are responsible for coral bleaching but corals are not the only affected species. Increased temperatures can exceed the thermal limits of other marine species, resulting in range shifts to aid survival.

Another climate change impact that threatens marine biota is ocean acidification, caused by higher levels of CO₂ in the water changing the carbonate system. Two papers in this issue, by Landschutzer et al. and Kwiatkowski & Orr, and an accompanying News & Views by Hauck discuss the changes in seasonality of such changes. Changes in the amplitude over the seasonal cycle are already being observed, and future projections highlight how this could lead to earlier exposure to detrimental conditions — an important consideration which emphasizes the need to move away from looking at annual average conditions, as the shorter-term conditions can greatly exceed these.

A topic that has received less coverage but has wide-reaching effects is deoxygenation, which is covered in a recent Review article¹¹. Warmer waters have reduced oxygen solubility, which combined with increased stratification and changes in ocean circulation means areas of low oxygen have already expanded by several million square kilometres in the open ocean, with increases also seen in the number of coastal sites experiencing low oxygen levels. Changes in oxygen levels impact on biology as well as biogeochemical cycling in the impacted areas.

Each of these stressors alone can have significant impacts, but the ocean is experiencing these concurrently and the response to the effects of multiple stressors still needs further investigation. 2021–2030 has been declared the decade for ocean science with the aim of engaging stakeholders from around the world to ensure ocean science can support countries to achieve the sustainable development goal concerning the ocean (<http://go.nature.com/2D6yCJ3>). This requires increased understanding of the threats, both visible and hidden, and scientific direction to comprehend how to combat them. □

Published online: 29 January 2018
<https://doi.org/10.1038/s41558-018-0080-6>

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