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Small-scale fishers on the east coast of Sri Lanka sort the morning's catch.

## Fisheries

The most important fishing grounds in the world are found on and along continental shelves within fewer than 200 nautical miles (370 kilometres) of the shore. The distribution of these fishing grounds is patchy and localized. More than half of the marine landings are caught within 100 kilometres of

the coast in depths generally less than 200 metres covering an area of less than 7.5 per cent of the world's oceans, and 92 per cent of marine landings are caught in less than half of the

## International Guest Statement

### The Rise and Fall of Industrial Fisheries

*Daniel Pauly*

Industrial fishing started in 1880, when the first steam trawlers were deployed along the English coast. This form of fishing spread rapidly in the North Atlantic, as it did in the North Pacific when Japan developed similar fishing methods. However, only after World War II did industrial fisheries begin their conquest of the world ocean. The growth of these fisheries was particularly rapid in the 1950s and 1980s, in terms of both input into the fisheries (invested capital, vessel tonnage, etc.) and output (tonnage or ex-vessel values of the landings). This period was also a time when fisheries appeared to behave like any other sector of the economy, with increased inputs leading to increasing outputs.

The 1950s and 1980s also saw the first massive fisheries collapses, as stocks that sustained entire fishing fleets, processing plants, and thousands of workers and their families, such as the California sardine fishery, disappeared practically overnight. Other fisheries were rebuilt after a few years; such as the Peruvian anchoveta fishery, which first experienced a massive collapse in 1972. The Peruvian example illustrates an approach already prevalent in the heyday of the California sardine fishery: blame the environment. Thus, in Peru it was El Niño that did it, never mind the fact that the catch in the year prior to the collapse was about 16 million tonnes, rather than the 12 million tonnes that were officially reported, which

itself hugely exceeded what the best experts of the time had recommended as sustainable.

Various concepts have been deployed to apprehend these events. One of these is Garrett Hardin's 'Tragedy of the Commons', which can be used to explain why the pathologies mentioned above were likely to occur in the largely unregulated fisheries then prevalent. These pathologies—which are still with us—have other aspects, notably: (1) not monitoring the fisheries, which results, among other things, in catches that are generally under-reported; (2) ignoring scientific advice aimed at restricting the catch and buildup of fishing effort; and (3) blaming 'the environment' for the fisheries collapse that inevitably follows. These and related pathologies existed long before the overfishing became widespread. However, when generalized overfishing became undeniable, a battery of new terms had to be coined to deal, at least conceptually, with the new developments. Hence the words 'bycatch' (fish caught but not targeted by fishing operations) and 'discards' (bycatch that is thrown overboard, mostly dead), and the emergence of concept of 'IUU' (illegal, unregulated, and unreported) fisheries.

In 1975, catches peaked in the North Atlantic, before going into a slow decline continuing to the present. This was accentuated when the giant stock of northern cod off Newfoundland and Labrador collapsed, plummeting thousands of families

and an entire Canadian province into dislocation and economic hardship, and setting off a frantic search for something to blame (hungry seals, cold water, etc.) other than the out-of-control fishing industry.

The relatively well-documented freshwater and coastal fisheries of ancient times had the capacity to induce severe decline in and even extirpation of vulnerable species of marine mammals, fish, and invertebrates, as documented by a variety of sources. However, only since the onset of industrial fishing has the successive depletion of inshore stocks, followed by that of more offshore stocks, become routine. Thus, in the North Sea, it took only a few years for the accumulated coastal stocks of flatfish and other groups to be depleted and for the newly deployed English steam trawlers to be forced to move on to the central North Sea, then further, all the way to Iceland. A southward expansion soon followed, towards the tropics and through the development of industrial fishing in the nascent Third World, often through joint ventures with European (e.g., Spanish) or Japanese firms. Obviously, this expansion created new resource access conflicts and/or intensified earlier ones, and hence the protracted 'cod war' between Iceland and Britain, or the brief 'turbot war' of March 1995 between Canada and Spain. At the close of the twentieth century, the bottom fish resources of all large shelves of the world, all the way south to Patagonia and Antarctica, had been depleted, mainly by trawling, along with those of seamounts and oceanic plateaus. Indeed, from 1950 to 1980, industrial fisheries expanded their reach by about one million km<sup>2</sup> per year; the increase was to 3–4 million km<sup>2</sup> per year in the 1980s, then declined. By 2000, the geographic expansion was essentially over, and the emphasis turned to two other forms of expansion.

The second dimension of the expansion of fishing was bathymetric (i.e., offshore), which affected both the open (pelagic) waters and the sea floor. In the pelagic realm, the exploitation of tuna, billfishes, and sharks by longlines and similar gear has strongly modified oceanic ecosystems, which now have much reduced biomass of large predators. This is intensified by the use of fish aggregating devices (FADs), which, starting around

the Philippines, have spread throughout the inter-tropical belt and have made accessible to fisheries small tuna and other fish that could not be captured before, thus representing an additional expansion of sorts. In the demersal or sea-floor realm, trawlers were deployed that can reach down to depths of several kilometres. They yield a catch increasingly dominated by slow-growing, deep-water species with low productivity, which cannot be exploited sustainably. Therefore, given that the High Seas (the waters outside 200-mile exclusive economic zones) are legally unprotected against such depletions, their oceanic plateaus and seamounts are subjected to intense localized fishing pressure, with subsequent collapse of the resources; the same is then repeated on the adjacent plateau or seamount. This fishing mode is no more sustainable than tropical deforestation.

Finally, the two expansions described above, which deplete traditional species, also cause previously spurned fish species to be caught and processed, thus generating a 'taxonomic' expansion. This is the reason why North American and European fish markets increasingly display unfamiliar seafood.

Overall, these three expansions—geographic, bathymetric, and demersal—and the massive import of seafood products by the global North from the global South are the reasons why global fisheries appear sustainable. They are also the reason why they are not.



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total ocean area. These areas of the ocean play a major role in sustaining global populations.

Global annual per capita fish consumption has risen from 9.9 kg in the 1960s to over 17 kg by 2009, supplying 3 billion people with over 15 per cent of their protein requirements. Fisheries supply some 20 per cent of the world's annual animal protein supply, but in some areas of Asia and Oceania, fish provide virtually all the protein supply. More than one billion people rely on fish as their primary source of protein. This supply is tapped by fishers ranging from villagers using homemade canoes trying to feed their families through to multi-million dollar offshore factory ships owned by multinational corporations. Given this great scale and variation, it is only recently that fisheries scientists have begun to understand more about what is happening in global fisheries

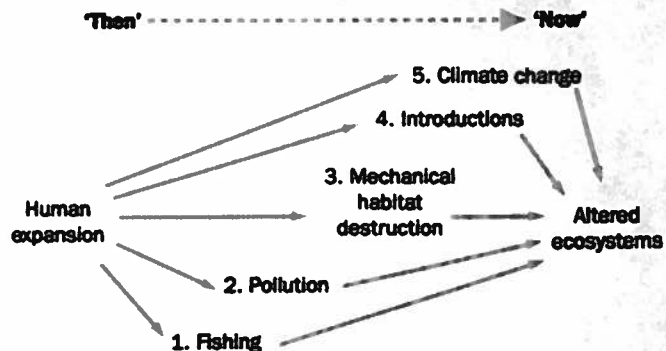


Figure 8.4 | Historical sequence of human impacts on marine ecosystems. Source: Roberts (2003: 170), from Jackson et al. (2001). Reprinted with permission from AAAS: [www.sciencemag.org/cgi/content/abstract/293/5530/629](http://www.sciencemag.org/cgi/content/abstract/293/5530/629).