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Beyond food: fish in the twenty-first century

The earliest interactions between human beings and the marine environment are through the human appetite. Modern humans, i.e., *Homo sapiens*, began consuming seafood at least 164 000 years ago on the shores of what is now South Africa, as evidenced by shell middens containing the remains of brown mussels, giant periwinkles, and whelks (Marean *et al.*, 2007). Similar remains were found in 125 000-year-old middens along the Red Sea coast of East Africa, in what is now Eritrea, where humans enjoyed meals of oysters, crustaceans, and other shellfish (Walter *et al.*, 2000). They also briefly consumed the flesh of the giant clam *Tridacna costata*, which they collected from the reefs. But their clambakes did not last. Shortly after human arrival, *T. costata* nearly disappears from the fossil record – the first documented case of eradication through overfishing (Richter *et al.*, 2008).

Today, our hunger for seafood continues, and so do its consequences. Seafood consumption is on the rise globally. The US now consumes almost five times more fish than it did 100 years ago (~2.2 million tonnes in 2004 compared to ~500 000 tonnes in 1910, NMFS, 2006), and Chinese consumers are now eating almost five times more seafood per capita than they did in the early 1960s (25.4 kg/person in 2005 compared to 4.8 kg/person in 1961, Halweil and Mastny, 2006). Worldwide, per capita consumption of marine fishes has nearly doubled since the 1960s (9 kg in 1960s compared to 16 kg in 1997, WHO, 2003), while the human population also doubled over this same time period. In addition to humans, pigs, poultry, and carnivorous farmed fish, we are eating more and more seafood because it is currently an inexpensive protein source for industrial farmers. But turning 36% of fisheries catches into fishmeal – as we do currently – comes at the expense of malnourished humans.

Ecosystem Approaches to Fisheries: A Global Perspective, ed. V. Christensen and J. Maclean. Published by Cambridge University Press.

Projections show that seafood supply from capture fisheries is decreasing and that, overall, today's marine fisheries are unsustainable (Pauly *et al.*, 2002; Worm *et al.*, 2006). Further exacerbating overfishing is that seafood has become increasingly profitable, markets have been globalized, and technology has facilitated fishing in every dimension of the sea. The impacts of the recent "global" fishing industry are considerable. One trawler today can remove 60 tonnes of fish from the ocean in a single haul, and as a result we have witnessed widespread declines in the biomass of fish in the oceans (Christensen *et al.*, 2003; Myers and Worm, 2003).

As seafood becomes more profitable and local waters become more depleted, fishing fleets travel further, toward the high seas and waters off tropical developing countries, where fish stocks are less exploited. When they take place in distant waters, these industrial fisheries can outcompete many coastal small-scale fisheries. Sometimes, this competition between luxury and subsistence seafood is obvious. In African waters, for instance, shrimp trawlers from distant shores compete with local fishers for the same fishing grounds. Rather than feeding local people who rely on fish for survival, the shrimp is shipped to food-secure markets in Europe, Japan, and the United States.

If the actual boats do not travel to the developing world, the demand still might. In this case, the "invisible hand" of the market shrouds the redirection of fish from those who need it to survive to those who do not. Many developed countries have become net importers of seafood because their fisheries fail to meet national demand due to the historical overexploitation of their fishing grounds. Between 1996 and 2006, world exports of fish and fishery products for human consumption grew 57% (FAO, 2009). In 2006, the top five seafood importing nations were Japan, United States, Spain, France, and Italy, while China, Thailand, Chile, and Vietnam were among the top 10 exporters (FAO, 2009). This redirection is facilitated by non-transparent access agreements (Kaczynski and Fluharty, 2002) and subtle and not so subtle unequal trade patterns. This is an age-old North–South story and it is likely only to worsen as climate change pushes fish out of the tropics and closer to the poles (Cheung *et al.*, 2009).

We currently have a limited understanding of the role fish plays in food security. This is partially because those who rely on fish for food have been marginalized, in part due to the fact that they are (1) often located in the developing world; and (2) catch seafood predominantly to feed their families rather than the market. In Mozambique, women and children glean reefs and intertidal areas for mollusks, crustaceans,

and other small fish, primarily for home consumption, but their catches have not been considered in official fisheries catch statistics (Jacquet and Zeller, 2007). Thus, part of understanding food security is in the improvement of fisheries catch data.

Fisheries landings data are compiled by the Food and Agriculture Organization of the United Nations (FAO) and are fed by national statistics. These data have served as the primary tool for many global and regional fisheries studies, and are used to determine fish consumption, the value of fisheries to national economies, and the amount of "surplus" fisheries production. Developing countries eager for foreign exchange will sell what they perceive to be "surplus" fisheries (often driven by reliance on incomplete statistics) in the form of fishing rights.

It is possible that many developing world countries do not indeed have a "surplus" of fish, because those fish are caught by small-scale, subsistence fishers but have gone unrecorded. To obtain a better understanding of fisheries catches around the world, catches can be reconstructed by using historical gray literature to establish proxies (Pauly, 1998) or by biological models (e.g., Watson and Pauly, 2001).

Members of the Sea Around Us project are busy reconstructing catches for small-scale fisheries worldwide and re-examining policy decisions based on the improved catch estimates (see contributions in Zeller and Pauly, 2007). In Mozambique, for instance, access agreements have allowed distant-water fleets to access Mozambican waters – often under the premise that local, small-scale fishers produce little to no fish. Since the 1950s, Mozambique has reported to the FAO primarily industrial catches and has vastly underreported the country's small-scale fishing sector due to lack of resources and civil war. However, based on reconstructed data for the small-scale sector, the Mozambique fishing sector as a whole has caught between 150 000 and 172 000 tonnes per year since 2000. Overall, reconstructed marine fisheries catches for Mozambique during 1950–2005 were 6.2 times greater than data reported to and by the FAO (Jacquet and Zeller, 2007).

Underreporting of catches does not only undermine issues related to food security but also management of marine ecosystems and protection of wildlife. In today's globalized market, regional demand can result in global pressure on a species or group of species. Asian demand for shark fin soup combined with overfishing in Asian waters has led to an increase in shark finning in distant waters, including those off the coast of South America. Perhaps due to the highly contentious nature of shark finning, shark catches in Ecuador

have been underreported. Reconstruction of Ecuador's mainland shark landings for 1979–2004 shows that they reached an estimated 7000 tonnes per year, or nearly half a million sharks, and were 3.6 times greater than those reported by the FAO for 1991 to 2004 (Jacquet *et al.*, 2008).

Overfishing imperils one of the globe's last hunter-gatherer food systems and those humans who still largely rely on seafood for survival. One could argue on moral grounds that we should prioritize fish for those people who rely on them most, and point out the immorality of the fishmeal industry or the discarding of perfectly edible fish as do many industrial fisheries, such as shrimp trawlers. But these ethical arguments have been relegated as secondary to the science.

When it comes to the science, research, like globalization itself, has been largely dismissive of issues pertaining to equity such as food security, cash flows, and the wasteful fishmeal industry. Instead, in the same way that climate research has focused on the natural and physical sciences, the bulk of fisheries research has, to date, focused on the technically rigorous (and therefore often intellectually stimulating) biological and supply-side of the fisheries crisis. Often overlooked is the real culprit: demand led by that small but greedy organ, the human stomach. The conservation movement, however, has considered things differently.

Because it is the appetite that lies at the root of the fisheries crisis, it is unsurprising that many conservation groups believe it is through addressing this insatiable demand that overfishing will be solved. A substantial effort has developed over the last two decades that attempts to affect consumer demand in the Western world through various awareness campaigns (Figure 8.1). These campaigns aim to decrease consumption of overfished species by encouraging demand for sustainably caught ones.

There are major impediments that undermine consumer campaigns, such as the renaming and mislabeling of seafood (Jacquet and Pauly, 2008b) – a type of cheating that is likely to become more prevalent as seafood demand and trade continue to grow. Even the most sophisticated consumers would have difficulty navigating the confusing messages and underhandedness that occur in Western seafood markets.

But changing consumption in the household cannot compete with over-efficient fishing techniques with lax and unsustainable policies. These small changes at the household level would require widespread adoption and, therefore, a lot of time – time we do not

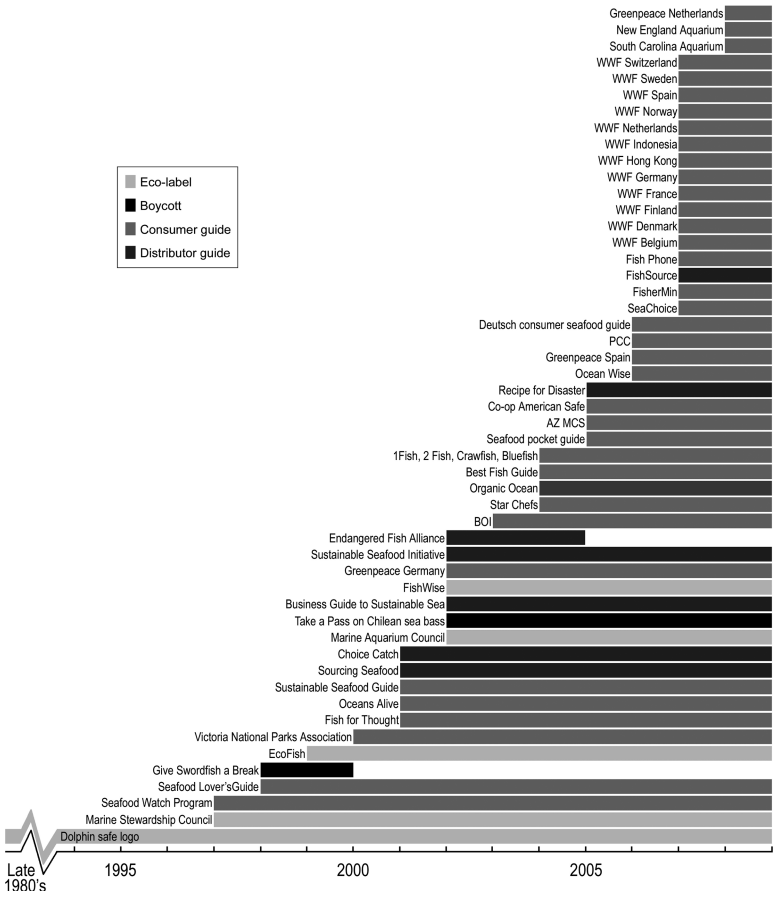

Figure 8.1 Growth in number of awareness campaigns related to seafood consumption.

have – to yield positive effects. This is why consumer efforts, which aim to reform consumer preferences in luxury markets, are largely futile. So far, the consumer campaigns that address "sustainable seafood" have not proved themselves capable of much more than catering to niche desires to "do the right thing" (Jacquet and Pauly, 2007; Jacquet *et al.*, 2010). Furthermore, localized successes in reducing demand for certain species are easily masked by a globalized and increasing demand for seafood.

This certainly does not mean such efforts should not be undertaken. Indeed, one could argue the benefits of marine protected areas are also eclipsed in an ocean where more than 99% of the ocean is open to fishing (Spalding *et al.*, 2008; Wood *et al.*, 2008). However, it does provide

an argument that the conservation community must be more strategic in its efforts and its funding strategy (Jacquet and Pauly, 2008a).

Today's conservation movement, like the fishing industry it seeks to revolutionize, must make big changes over small time. It can do this best by working higher in the demand chain, in what can be described as vertical (consumer to mega-consumer or government), rather than horizontal (consumer to consumer), agitation. In a market-based approach, efforts should be directed at eliminating harmful fisheries subsidies (Jacquet and Pauly, 2008a), working with large seafood buyers, and eliminating the use of fishmeal in agricultural feed (Jacquet *et al.*, 2010). Fish that is caught should go to humans, not animals.

In North America and Europe, there has been a call to eat lower on the food web (Pimentel and Pimentel, 2003; Pollan, 2008) and this has been echoed for marine food webs (Hall, 2007; Grescoe, 2008). However, humans currently must compete with factory-farmed animals for this meal of small pelagic fish. Currently, about 30 million tonnes of fish (36 % of world fisheries catch) are ground up each year into fishmeal and oil, mostly to feed farmed fish, chicken, and pigs (Alder *et al.*, 2008). Decreasing the amount of fish used for the production of animal feed should be a top priority of the sustainable seafood movement, particularly because pigs and chickens alone consume six times the amount of seafood as US consumers and twice that of consumers in Japan. One premise of sustainable seafood should be that no fishery that catches fish for the production of animal or feed fish oil should be eco-certified.

Finally, the biggest change the conservation community could hope to achieve would be to create an ethical shift that seeks to create mythologies for fish and invertebrates, i.e., to de-commodify them. We were able to achieve this with whales because they are mammals that nurse their young, communicate with one another, and apparently exhibit high levels of intelligence. However, fish are, for the most part, cold-blooded, expressionless creatures. But, in some ways, fish are not that different from birds and, as anyone who has ever been to England knows, there is no shortage of sentiment for avian species. Like the albatross, tunas cover remarkable migratory distances. Like an eagle, an octopus can also build an impressive home. And, like many macaws, the Moorish idol chooses a mate for life. Fish are not only food. When discussing their future, we should engage as citizens concerned about Earth's fellow inhabitants as much as consumers worried only about our appetite.

REFERENCES

Alder, J., Campbell, B., Karpouzi, V., Kaschner, K., and Pauly, D. (2008) Forage fish: from ecosystems to markets. *Annual Review of Environment and Resources*, 33, 153–166.

Cheung, W. W. L., Lam, V. W. Y., Sarmiento, J. L., Kearney, K., Watson, R., Zeller, D. and Pauly, D. (2009) Large-scale redistribution of maximum fisheries catch potential in the global ocean under climate change. *Global Change Biology*, 16, 24–35.

Christensen, V., Guënette, S., Heymans, J. J., Walters, C. J., Watson, R., Zeller, D. and Pauly, D. (2003) Hundred-year decline of North Atlantic predatory fishes. *Fish and Fisheries*, 4, 1–24.

FAO (2009) The state of the world fisheries and aquaculture. Rome: FAO.

Grescoe, T. (2008) *Bottomfeeder: how to eat ethically in a world of vanishing seafood*. New York: Bloomsbury.

Hall, M. (2007) Eat more anchovies. *Conservation*, 8, 24.

Halweil, B. and Mastny, L. (2006) *Catch of the Day: Choosing Seafood for Healthier Oceans*. Washington DC: Worldwatch Institute.

Jacquet, J., Alava, J. J., Ganapathiraju, P., Henderson, S., and Zeller, D. (2008) In hot soup: sharks captured in Ecuador's waters. *Environmental Sciences*, 5, 269–283.

Jacquet, J., Hocevar, J., Lai, S., Majluf, P., Pelletier, N., Pitcher, T., Sala, E., Sumaila, R. and Pauly, D. (2010) Conserving wild fish in a sea of market based efforts. *Oryx*, 44, 45–56.

Jacquet, J. and Pauly, D. (2008a) Funding priorities: big barriers to small-scale fisheries. *Conservation Biology*, 22, 832.

Jacquet, J. and Zeller, D. (2007) National conflict and fisheries: Reconstructing marine fisheries catches for Mozambique. Reconstruction of marine fisheries catches by countries and regions (1950–2005). Fisheries Centre Research Report. Vancouver, Canada: Fisheries Centre, University of British Columbia.

Jacquet, J. L. and Pauly, D. (2007) The rise of seafood awareness campaigns in an era of collapsing fisheries. *Marine Policy*, 31, 308–313.

Jacquet, J. L. and Pauly, D. (2008b) Trade secrets: renaming and mislabeling of seafood. *Marine Policy*, 32, 309–318.

Kaczynski, V. M. and Fluharty, D. L. (2002) European policies in West Africa: who benefits from fisheries agreements? *Marine Policy*, 26, 75–93.

Marean, C. W., Bar-Matthews, M., Bernatchez, J., Fisher, E., Goldberg, P., Herries, A. I. R., Jacobs, Z., Jerardino, A., Karkanas, P., and Minichillo, T. (2007) Early human use of marine resources and pigment in South Africa during the Middle Pleistocene. *Nature*, 449, 905–908.

Myers, R. A. and Worm, B. (2003) Rapid worldwide depletion of predatory fish communities. *Nature*, 423, 280–283.

NMFS (2006) Fisheries of the USA, 2005. Silver Springs, MD: National Marine Fisheries Service.

Pauly, D. (1998) Rationale for reconstructing catch time series. *EC Fisheries Cooperation Bulletin*, 11, 4–7.

Pauly, D., Christensen, V., Guénette, S., Pitcher, T. J., Sumaila, U. R., Walters, C. J., Watson, R. and Zeller, D. (2002) Towards sustainability in world fisheries. *Nature*, 418, 689–695.

Pimentel, D. and Pimentel, M. (2003) Sustainability of meat-based and plant-based diets and the environment. *American Journal of Clinical Nutrition*, 78, 660S.

Pollan, M. (2008) *In Defense of Food: An Eater's Manifesto*. New York, NY: Penguin Press.

Richter, C., Roa-Quiaoit, H., Jantzen, C., Al-Zibdah, M., and Kochzius, M. (2008) Collapse of a new living species of giant clam in the Red Sea. *Current Biology*, 18, 1349–1354.

Spalding, M. D., Fish, L., and Wood, L. J. (2008) Toward representative protection of the world's coasts and oceans-progress, gaps, and opportunities. *Conservation Letters*, 1, 217–226.

Walter, R. C., Buffler, R. T., Bruggemann, J. H., Guillaume, M. M. M., Berhe, S. M., Negassi, B., Libsekal, Y., Cheng, H., Edwards, R. L. and Von Cosel, R. (2000) Early human occupation of the Red Sea coast of Eritrea during the last interglacial. *Nature*, 405, 65–69.

Watson, R. and Pauly, D. (2001) Systematic distortions in world fisheries catch trends. *Nature*, 414, 534–536.

WHO (2003) Global and regional food consumption patterns and trends: availability and consumption of fish. report of a joint WHO/FAO expert consultation, Geneva, January 28–February 1, 2002, available at http://www.fao.org/docrep/005/ac911e/ac911e05.htm.

Wood, L. J., Fish, L., Laughren, J., and Pauly, D. (2008) Assessing progress towards global marine protection targets: shortfalls in information and action. *Oryx*, 42, 340–351.

Worm, B., Barbier, E. B., Beaumont, N., Duffy, J. E., Folke, C., Halpern, B. S., Jackson, J. B. C., Lotze, H. K., Micheli, F. and Palumbi, S. R. (2006) Impacts of biodiversity loss on ocean ecosystem services. *Science*, 314, 787–790.

Zeller, D. and Pauly, D. (2007) Reconstruction of marine fisheries catches for key countries and regions (1950–2005). Fisheries Centre Research Report. Vancouver, Canada: Fisheries Centre, University of British Columbia.