

SHIFTING BASELINES: THE PAST AND THE FUTURE OF OCEAN FISHERIES

Jackson, J., Alexander, K. & Sala, E. (Eds.). 2011. Washington, DC: Island Press, 312 pp., figures. Hardcover: ISBN-10: 978-1-61-91-000-1. US\$70. Paperback: ISBN-13: 978-1-61091-000-9. US\$35.

In 1995 the eminent fisheries scientist Daniel Pauly observed that “each generation of fisheries scientists accepts as a baseline the stock size and species composition that occurred at the beginning of their careers, and uses this to evaluate changes” (Pauly 1995). Because fishing has depleted stock after stock, there has been a ratcheting down of that baseline from generation to generation – “a gradual accommodation of the creeping disappearance of resource species, and inappropriate reference for evaluating economic losses resulting from overfishing.”

Daniel Pauly’s now-famous shifting baseline syndrome is an interesting psychological and sociological phenomenon, but it wouldn’t exist without the serial depletion of resources, loss of biodiversity and wholesale transformation of ecosystems around the world. *Shifting Baselines: The Past and the Future of Ocean Fisheries*, edited by marine ecologists Jeremy B.C. Jackson and Enric Sala, and historian Karen E. Alexander, does not explore the syndrome but rather its drivers and is excellent background for anyone studying seabirds and their prey. The book addresses four aspects of the underlying problem: 1) the magnitude of human-caused depletion of fisheries, 2) the trajectories and tempo of the depletion, 3) documentation of the cause and effects and 4) use of this knowledge to “ameliorate the degradation.”

In the Introduction, Jackson and Alexander point out that the depletion of resources is not strictly a recent phenomenon. Historical documents have shown that the global depletion of fish began in the 15th century with the growth of the great maritime empires, and anthropological data have demonstrated the depletion of coastal resources as early as 10 000 years ago. They argue that, much as the expansion of humans out of Africa, which led to the colonization of every continent (except Antarctica) by the end of the last ice age, resulted in the extinction of the majority of large animals on those continents, the last few centuries have seen a similar trend in the oceans. They suggest that our baseline has been shifting for centuries and millennia, from which an inescapable conclusion is that we have only a fuzzy idea of what natural systems should look like. They caution that we need to understand the long-term pattern of degradation and not get distracted by short-term change.

Seabird ecologist-turned-ocean writer Carl Safina makes the case in the first chapter for extending our baselines back in time – “in nature conservation the past is the only rational guide to a better future” and suggests that we have so thoroughly transformed “every realm of nature” that, as we seek to understand the impact of our actions, the past is often the only control left.

Fisheries economist Rashid Sumaila and Daniel Pauly then systematically and concisely describe the depletion of fisheries and failures of governance and management around the world – what they call the “March of Folly”: the deliberate, institutionalized pursuit of overfishing for financial gain with full knowledge that it would lead to depletion and unsustainable resource extraction. They conclude by offering approaches that hold promise of an alternative, sustainable pathway.

Alex MacCall (Chapter 4), world expert on forage-fish population dynamics, reminds us that “sardine (*Sardinops* spp) and anchovy (*Engraulis* spp) populations around the world have exhibited extreme fluctuations, often varying a thousand-fold in abundance from one decade to the next.” Those fluctuations are likely inherent in the biology of these species in a highly variable environment subject to large shifts in oceanographic conditions on a decadal timescale. And, of course, those fluctuations have had devastating consequences for their predators – fish, squid, seabirds, marine mammals and humans. MacCall and David Field and colleagues (Chapter 5) use the extreme fluctuations in forage-fish populations – sardines and anchovies in the California Current and anchoveta in the Humboldt Current – to illustrate the difficulty of distinguishing the effects of fishing and other human activities from large-scale oceanographic shifts, or, more accurately, their relative contribution to the population dynamics of these species. While it may have been tempting at one point to ascribe the collapse of sardines in California or anchoveta in Peru to overfishing, we now know that such collapses in modern times are mostly likely the result of declines in ocean productivity coupled with excessive exploitation rates. The picture they describe suggests that, in this case, the shifting baseline syndrome effect is likely swamped by these large-scale dynamics operating on a similar scale. Field and colleagues note that changes associated with the warming of the planet complicate the problem and that much of our scientific knowledge of marine ecosystem dynamics has been acquired during a period of intense exploitation and depletion as well as disruption due to ocean climate change, further complicating the already-difficult problem of characterizing the original baseline.

Thomas Huxley famously claimed in 1883 that “probably all the great sea fisheries, are inexhaustible; that is to say, that nothing we do seriously affects the number of fish.” While the history of fishing has shown that Huxley seriously underestimated our capacity to exploit natural resources, present-day scientists have not been immune to similar miscalculations. Maritime historian W. Jeffrey Bolster and colleagues (Chapter 6) remind us that “only a generation ago marine scientists, fishery managers, and maritime historians shared the popular assumption that diminished fish stocks and damaged marine ecosystems were lamentable artifacts of the late twentieth century, of synthetic filaments, fish finding sonar, and electronic navigational systems.” In other words, although they knew that Atlantic cod had been subject to industrial fishing for hundreds of years, they felt it “unlikely that historic sailing fleets could have depleted naturally abundant fish populations with simple hooks, hemp line, and handmade nets,” and yet they did. Bolster and colleagues point out that “by 1675, there were reportedly 440 boats and about 1,300 men fishing the coast between Boston and eastern Maine, producing over 6 million pounds of dried salt cod annually.” A careful extraction of catch data from mid-19th century logbooks showed that the abundance (biomass) of cod on the Scotian Shelf then was likely three orders of magnitude greater than it has been in the last 40 years. Further, they noted that human exploitation was already driving right whales and the great auk toward extinction. Their historical analysis suggests that the shifting baseline syndrome is so potent that modern-day ecologists

and fishermen, largely unaware of this massive depletion of cod and other groundfish, apparently believed that pre-World War II conditions represented the pristine state or that the appropriate recovery target should be the abundance of the 1980s.

Bolster and colleagues convincingly demonstrate, in the case of cod, the necessity of historical analysis if we are to have any hope of understanding how far we have slid. In Chapter 7, Daniel Vickers, an early America and maritime historian, educates the reader on the difference between the past and history, on what happens when man is added to the ecological equation, and takes the reader through the maze of factors that can distort our view of the past and that must be taken into account by historical ecologists or ecological historians. Bolster and colleagues challenge ecologists to rethink their view of the past: "Integrating the *past* into ecology is one thing; integrating *history* into it is another."

Historical marine ecologist Heike K. Lotze and colleagues (Chapter 8) describe a wide range of disciplines and methods for extracting ecologically meaningful information and data from our history of the past. They conclude with a compilation of data gathered from prehistoric eras to the present that unambiguously show dramatic declines in marine birds, mammals, fish, invertebrates and habitats. Prominent marine population geneticist Stephen R. Palumbi (Chapter 9) uses new methods to address a vexing problem: What was the size of exploited whale populations before whaling? Traditionally, scientists have used whaling records to estimate the number of whales removed from the population. Palumbi offers an alternative method – an analysis of genetic diversity in the gene pool – which suggests pre-whaling population sizes of gray whales three to four times larger than previously estimated from analyses of whaling records. The same comparison for humpback whales yields roughly an order-of-magnitude difference. Palumbi concludes that needed improvements to the methods for reconstructing the past will enhance the diversity of perspectives we have, which is essential to understanding our ecological past.

Renowned fisheries scientist/manager and policy expert Andrew A. Rosenberg and colleagues (Chapter 10) bring the element of management into the picture, pointing out that management and its response to the evolution of fishing practices affects the course of population change, and that managers need to learn from history to avoid the mistakes of others: "The pattern of overfishing has been repeated again and again, as if learning by example were anathema." The fishing practices and management

systems form part of a fisherman's, manager's or scientist's baseline. Rosenberg and colleagues suggest that common sense makes it clear that slight reductions in fishing mortality are not going to return a biomass that is at 5% of what it was 150 years previously in a reasonable timeframe, if at all. They argue that "the shifting baseline paradigm challenges traditional perspectives on governance and scales of observation, refocusing management from single species to ecosystems, and acknowledging the role of humans as key species."

Marine ecologists Enric Sala and Jeremy B.C. Jackson (Chapter 11) illustrate the similarities in the processes that have led to the collapse of fisheries and ecosystems, foremost of which are the economic and social pressures to continue exploitation even in the face of obvious depletion to the point of extinction, and then relate the shifting baseline syndrome to changes on coral reefs around the world. Sala and Jackson propose five fundamental questions that need to be answered: 1) how variable were pristine ecosystems, 2) what are temporal patterns of degradation, 3) what causes collapse, 4) can collapse be anticipated, and 5) will degraded ecosystems recovery to their pristine state?

The well-supported message in *Shifting Baselines* appears to be that, because the restoration of resources and ecosystems requires a target, we cannot identify that target if we do not understand the dynamics of these ecosystems and resources, the history of human impacts and the resulting depletion and degradation. Missing from the book was much consideration of how the syndrome itself distorts our understanding of these processes and how that knowledge could be used to improve our understanding ecological history.

The editors conclude that "recognizing shifting baselines is the first step toward creating new ways of thinking that reintegrate the past, present, and future. Not to dwell on our past failures or to imagine returning to some idyllic pristine state, but to better envision ways of living that can heal the wounds of the natural world while improving people's lives."

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REFERENCE

Pauly, D. 1995. Anecdotes and the shifting baseline syndrome of fisheries. *Trends in Ecology and Evolution* 10: 430.