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Lifting baselines to address the consequences of conservation success

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Biologists and policymakers are accustomed to managing species in decline, but for the first time in generations they are also encountering recovering populations of ocean predators. Many citizens perceive these species as invaders and conflicts are increasing. It is time to celebrate these hard-earned successes and lift baselines for recovering species.

Lifting baselines

About a generation ago, Daniel Pauly posited the idea of 'shifting baselines' to describe how cohorts of fisheries biologists perceive the abundance of fish stocks at the beginning of their careers as an ecological baseline. Future changes are then judged against this perceived baseline [1]. Most examples of shifting baselines have come from fisheries, with the all-too-familiar downward trend in biomass and catches: recent estimates suggest that global predatory fish populations have declined by two-thirds in the past century [2].

Yet, other generational shifts have occurred in the last few decades, with species returning to areas where they were once long absent. In many cases, the reduction or elimination of commercial hunting played a critical role. In the 1970s and 1980s, landmark legislation and international agreements were passed, including the Convention on International Trade in Endangered Species (CITES) and the US Endangered Species Act (ESA). Protection from commercial hunting and later bans on dichlorodiphenyltrichloroethane (DDT) led to the recovery of populations of seabirds such as brown pelicans. Protective legislation and supportive public opinion have helped large carnivores recover in Europe [3]. A moratorium on hunting passed by the International Whaling Commission and national legislation such as the US Marine Mammal Protection Act have aided the recovery of whales and seals and prompted their return to areas from which they have long been absent.

In this paper, we propose the concept of lifting baselines, a subset of the shifting baseline syndrome that describes such success stories. We focus on marine mammal recovery because there have been several high-profile recoveries and articles examining their return, although some of these success stories have also been wrought with conflict. An analysis of trends for 92 marine mammal populations showed that 42% are increasing and only 10% are decreasing, with the remainder showing no change (which could be an indication of recovery) or no discernible trend [4] (see also Box 1 and the supplementary material online). Among the successes are many pinnipeds and several cetaceans. All great whale species with published trends in the International Union for Conservation of Nature (IUCN) Red List are increasing or stable (although trends for half of the 14 species are unknown). Consider the humpback whale, star of the thriving whale-watching industry. In 1968 there were fewer than 300 humpbacks off Western Australia; after whales were protected, this population grew to 26 000 individuals, at an annual rate of about 13% [5] (see also the supplementary material online). A similar story can be found with the northern elephant seal. In the nineteenth century, the elephant seal was hunted so intensively in the North Pacific that it was presumed extinct by the 1880s – perhaps as few as 20 individuals survived. Mexico and the USA protected the species in the 1920s and it has since recovered to more than 200 000 seals [6] (see also the supplementary material online). With a population size approaching carrying capacity, there might be more elephant seals now than at any time since humans first encountered them (Figure 1) and sighting elephant seals is a customary part of life for residents of the US Pacific coast. Yet in the early careers of many older biologists, raised at a time of marine mammal deficit, such an encounter would have been a surprising, memorable event – the reestablishment of species sets new reference points for each generation, the consequence of conservation efforts and shifting resource needs.

The recovery of marine predators has not been welcomed uniformly. Many coastal communities and maritime industries have developed while marine mammals were sparse and dispersed, with the implicit assumption that they would remain so. In these cases the perception of a surplus model of marine predators emerges, where they seem overabundant regardless of pre-exploitation numbers. In eastern Canada, for example, gray seal populations have increased by 1410% since 1977 [7]. Consequently, a Canadian Senate Committee proposed to cull 70 000 seals to increase yields of groundfish, although it produced no evidence linking them to the stocks' collapse. Gray seals are also recovering rapidly in US waters and conflicting with human activities (Box 2).

There is a need to counter the shifting baseline syndrome through a process of lifting baselines, where the

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Keywords: conservation success; endangered species; historical abundance; marine mammals; recovery; shifting baselines.
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0169-5347/
 http://dx.doi.org/10.1016/j.tree.2015.04.003

Box 1. How common is recovery?

Of course, the phenomenon we highlight here is by no means universal. The sixth mass extinction on our planet is real and by most measures the state of biodiversity is deteriorating [13]. Areas such as Southeast Asia are experiencing marked increases in overall extinction risk as a result of agricultural conversion, timber harvest, and unsustainable hunting [14]. Perhaps of equal concern, we simply do not have the data for many species to assess whether they are threatened or whether their current populations are in decline.

In the oceans, many species of large vertebrates show little or no sign of recovery and remain in a precarious conservation status. For example, of the 87 cetacean species assessed as part of the IUCN Red List, 15 are considered to be of conservation concern (critically endangered, endangered, or vulnerable) and only 22 are of least concern. Most (45) cetacean species remain to be evaluated because of data limitations. Of the 14 species of great whale – many of which had been under intense commercial pressure in past centuries – 36% are increasing, 14% stable, and 50% unknown. The impacts of the whaling moratorium and other management efforts are clear. Pinnipeds, with their faster life histories, fare slightly better than cetaceans, with only 13 species or subspecies of conservation concern compared with 26 taxa of least concern, including the northern elephant seal and gray seal highlighted here. Some baselines will never change: three species – the Japanese sea lion (*Zalophus japonicus*), Caribbean monk seal (*Monachus tropicalis*), and baiji (*Lipotes vexillifer*) – are now extinct.

successful recovery of depleted species is verified, celebrated, and understood in an ecological and historical context. Salient events, such as reports of first encounters with abundant animals and later actions to avoid extinction, could help incorporate an understanding of historical ecology into the collective memory.

Strategic recommendations

There is little guidance for communities seeking to coexist with formerly depleted species as they recover or return to areas from which they have been extirpated and where adaptations for coexistence have been lost. Here we propose four strategic recommendations to lift baselines, develop supportive public opinion, and create an accepting sociopolitical climate around conservation successes.

First, when protection works, conservation scientists and nongovernmental organizations should celebrate these success stories, actively engaging the public in recording a species' return to former ranges and framing the recovery trajectory in light of the historical abundance, ecosystem health, and natural capital. The state of Nebraska, for example, encourages observers to report whooping crane sightings as the birds migrate through the state. Although still endangered, crane populations have increased 15-fold since the 1960s (see the supplementary material online). Such public engagement can help foster a sense of responsibility for recovery. The use of historical ecology to identify meaningful baselines and increase awareness of the potential abundance of recovering species is essential. Without such understanding, recovered populations could be perceived as invasive species, nuisances, or pests – and calls for culls will grow.

By estimating the benefits of abundant wildlife populations, particularly at local scales, support for their return will rise. Marine mammals were once valued exclusively as a source of commercial goods to be removed from the ocean; they are now valued for the services they provide. Whale watching is a global industry worth approximately

Figure 1. Northern elephant seal rookery on Año Nuevo Island, CA. There are probably more individual seals in this photograph than there were in the North Pacific Ocean before conservation efforts were enacted by the USA and Mexico. Overlay: Rise in number of births of elephant seals since 1960 [6]. Photo courtesy of Ari Friedlaender, taken under permit by NOAA.

Box 2. Gray seal recovery in the USA

Gray seals are recovering from depletion in coastal areas across the temperate and sub-Arctic North Atlantic. Historical evidence from Native American middens and the logs of early European explorers reveals that they previously formed large colonies along the east coast of North America from Labrador south to Cape Hatteras. During the 19th and 20th centuries, gray seals in this region were depleted through a combination of subsistence hunting and government-sponsored bounty programs. The passing of the US Marine Mammal Protection Act in 1972 provided protection in US waters, and in the following decades gray seals grew in abundance and reoccupied substantial portions of their original range (Figure I). In the Cape Cod, MA region, gray seals were rarely sighted in the 1980s but are now a common occupant on ocean-facing beaches. While the current abundance of gray seals in US waters is unknown, the most recent beach counts revealed that at least 15 756 gray seals inhabit the Cape Cod region and the number of pups born at one colony has grown exponentially from six in 1990 to 2095 in 2008 [15]. Some have embraced the recovery of gray seals in southern New England through seal-watching ventures, but acceptance is far from universal. Indeed, some people who have grown up in coastal communities of Cape Cod view the gray seal as an invasive species and the seals are increasingly blamed for declining fishery yields, changing water quality, and attracting greater numbers of white sharks into coastal waters. One resident, quoted in a news story about the increasing gray seal population, provided an extreme perspective on their recovery: 'Their benefit to humanity is just about on the level with mosquitoes and houseflies.' Some have gone further than expressing concern about the return of gray seals to southern New England: in 2011, six gray seals were illegally shot and killed.

There is an urgent need to confront conflicts between people and gray seals. The lack of data on the demography of these seals and the roles they play in the coastal ecosystem has generated a seascape of fear, where seals are seen as unnatural threats to coastal livelihoods. A greater scientific understanding of the abundance of these seals and their ecology – past and present – is needed. This new knowledge, integrated into a thoughtful communications campaign that actively educates the public about their recovery and the opportunities it creates, is required to move past fear into understanding and coexistence.

Figure I. Gray seals hauled out near Chatham Harbor, MA in the summer of 2014. Superimposed on this image is a graph of single-day pup counts at Muskeget Shoals from 1990 to 2008, illustrating the exponential increase of gray seal pups born at that location. Data from the National Marine Fisheries Service (NMFS) [15]. Photo by D.W. Johnston, taken under permit by NOAA.

US$2 billion per year; cetaceans also provide ecological benefits, such as enhancing primary productivity in areas where they feed, supporting deep-sea biodiversity, and sequestering carbon [8]. An ecosystem perspective is helpful: whereas the return of individual species can be flashpoints, healthy and resilient ecosystems rarely attract such resentment. A kelp forest is seen as an asset to fishers and conservationists alike, even if the sea otter that helps maintain it is not.

Second, we should down list and delist species that no longer require special protective measures, rewarding efforts that reverse a species' decline. Gray whales were removed from the US list of endangered species in 1994 and continue to remain stable. And most (10 of 14) humpback whale populations could soon join gray whales on this list of conservation success stories. For humpbacks, as with other recovering species, quantitative guidance is required to determine what level of risk should result in delisting. Celebrating success and freeing time and resources for other animals and plants is essential in fighting the moral wrong of extinction. Recoveries should not be reasons for complacency, but rather should be seen as calls to action: ongoing declines elsewhere can also be reversed.

Third, conflicts resulting from the range expansion and trophic interactions of recovering species must be anticipated and proactively managed. Habitat suitability models can predict areas of expansion and identify conflicts before they occur. As ranges expand, we should monitor ecological changes that result from a species' return and engage stakeholders as part of the recovery strategy. Such activities help to anticipate arguments that blame animals for the failures of resource management. As a recovered species assumes its ecological role, it will influence other species – rare and common alike – and affect food webs and trophic cascades. Investigations into the functional relations between interacting species of concern, such as sea otters and their rare northern abalone prey, will help develop realistic recovery targets and avoid setting unachievable management goals [9]. To lift baselines, trained science communicators, facilitators, conflict managers, and negotiators must help resolve conflicts.

Finally, the true costs and benefits of removing so-called nuisance animals, whether through translocation, aversive conditioning, or lethal means, must be established. Predators have long been persecuted for killing livestock. Conflicts with seals attending ocean net-pen aquaculture sites are likely to remain a problem, especially given depleted wild fish stocks. In Irish waters, the permitted or illegal killing or scaring of seals and other predators continues in many areas where conflicts occur, yet there is little follow-up after the removal of such nuisance individuals and cost–benefit analyses are rarely performed for lethal controls [10]. The level of depredation and associated cost to fishing sectors must be quantified and should include both ecological and social measures. If controls are not cost-effective, a less destructive approach is needed.

These recommendations should be adopted while initial conservation measures are being put in place. Clear recovery goals can help species, from wolves to whales, move off

the endangered list, and true estimates of costs and benefits can provide transformative views of wildlife: from scapegoat to valued neighbor. Adopting these measures is no trivial task. It will require interdisciplinary work involving social scientists and economists to help estimate and address the benefits and costs of recovery. Artists, journalists, and writers are essential: stories capture public attention – and what better storyline than the recovery of an endangered species? Examples of restoration in other systems that have led to general acceptance provide hope. By the 1960s American alligators were hunted to near extinction and rarely seen in the wild. Today they number in the millions and are a common sight on golf courses and in urban canals. Public opinion in Florida is generally favorable toward this large carnivore [11]. Approximately 700 grizzly bears inhabit the Greater Yellowstone area, an increase of more than 500% since they were listed under the ESA in 1975, and the US Fish and Wildlife Service is expected to propose removing the bear from the endangered species list. A survey in Wyoming indicated that 61% of residents support grizzly bear recovery in the area if the efforts are coupled with education and management to reduce human–bear conflicts [12].

Although we have focused here on conservation successes, there is no doubt that many wild species and ecosystems remain threatened (Box 1). We live in an age of extinction [13], with more species moving toward higher levels of threat than are moving toward recovery [see the IUCN Red List Summary Statistics (http://www.iucnredlist.org/about/summary-statistics)]. Yet we have reversed this trend with some species and should celebrate our conservation efforts and lift public baselines for native fauna and flora. Clearly there will be difficult decisions to be made along with the celebrations, but these are choices of abundance rather than scarcity – rare and welcome opportunities for conservation biologists, resource managers, and society.

Acknowledgments

J.R. was supported by the Mary Derrickson McCurdy Visiting Scholar Program at Duke University Marine Lab and a Sarah and Daniel Hrdy Visiting Fellowship in Conservation Biology at Harvard University. M.M.D-D. was supported by a National Marine Fisheries Service (NMFS)–Sea Grant Population Dynamics Fellowship.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.tree.2015.04.003.

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