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Managing Fisheries and Conserving Fishes: A Difficult Balancing Act

FRANK J. RAHEL

Historically, fisheries management and conservation biology were considered to be different disciplines; the former focused on harvestable species and the latter was concerned with preserving biodiversity, especially nongame taxa (Soulé 1985). In the 1970s, a widely used textbook defined fishery management as “the application of scientific knowledge to the problems of providing the optimum yield of fishery products, whether stated in tons of commercial products or in hours of angling pleasure” (Everhart and Youngs 1975). The differences between these fields have narrowed, however, and fisheries managers have a much broader mission today than in the past. Not only must they consider ways to maximize the sustainable yield of biomass and human enjoyment from fisheries, they also must consider how to maintain the integrity of aquatic ecosystems and preserve the diversity of aquatic biotas. Two recent books illustrate the challenges brought about by the melding of fisheries management and conservation biology.

Conserving biodiversity and restoring fishery resources

In *Fish Conservation: A Guide to Understanding and Restoring Global Biodiversity and Fishery Resources*, Gene S. Helfman aims to fill a gap in the literature by providing a general treatment of topics related to fish conservation, and in my opinion, he has succeeded. The book covers all the major topics relevant to conserving fish biodiversity and restoring exploited fish populations. In part 1, Helfman begins by delving into questions often faced by conservation biologists, such as, Why is biodiversity important? and Why should we care about fishes that cannot be used for food or as pets or bait? According to Helfman, the arguments range from the utilitarian (we like to eat fish, and per-

haps an obscure species might hold the clue to curing cancer), to the ecological (we do not know what losing a species will do to the web of life), to the ethical and religious (each species has a right to exist, and humans have a moral responsibility to care for all of God’s creation). I hope at least one of these arguments will come to a reader’s mind the next time he or she needs to justify conserving a species of darter.

In part 2, Helfman presents an overview of the world’s imperiled species, starting with a taxonomic perspective. Fish biologists will recognize the groups that receive the most attention, such as salmon, sturgeon, and cichlids, but readers will also find interesting accounts of lesser-known groups such as handfishes (yes, their fins do resemble human hands) and seahorses (endangered because some believe they have medicinal value). Next is a geopolitical perspective, from which a species’ status sometimes reveals more about the politics in a country than the ecological conditions in the region. Finally, Helfman analyzes the characteristics of vulnerable species. By identifying general traits associated with species’ vulnerability—limited geographic range, low mobility, and traits specific to particular locales and taxa (such as large body size and communal spawning in marine reef species)—he brings order to the conflicting array of extant studies.

Indirect causes of decline are the focus of part 3. There are chapters on the negative effects of habitat modification, dams, degraded water quality, and alien species on fish populations. At the end of each chapter, Helfman discusses how addressing these factors could help in the recovery of imperiled fishes. The next section, part 4, examines the direct causes of decline, particularly commercial fishing and the trade in live fishes. Again, each chapter ends with consideration of

how modifying the ways in which we exploit fishes could benefit species of conservation concern. This section also contains a discussion of the role of aquaculture and hatcheries in enhancing exploited fish stocks and in the conservation of nonharvested species.

Part 5, the final section, delves into issues seldom considered in fish biology textbooks: the ethics of exploitation. As Helfman notes, unless one is a strict vegetarian, it is easy to justify fisheries that provide human sustenance. Sport fishing, however, especially catch-and-release fishing, can be harder to defend. Helfman also explores ethical issues related to electrofishing, museum collections, and the use of fish in research.

Some of the more thought-provoking aspects of the book involve the intersection of fisheries management and fish conservation. Helfman highlights an important conflict between exploitation and conservation by noting that harvest levels considered sustainable by fisheries managers (e.g., removal of 80 percent of the standing stock for some species) would lead to a species being listed as critically imperiled by IUCN—The World Conservation Union. Many fisheries managers believe that commercial extinction of species will prevent biological extinctions because fishers will switch to more economically profitable species, but this protective mechanism does not work for species in which each individual is exceedingly valuable. A case in point is the bluefin tuna: a single specimen sold for \$173,600 in Tokyo in 2001. Managers and conservationists sometimes disagree on whether hatchery

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fish should be included in estimates of salmon population sizes. Helfman notes that managers charged with meeting the public's demand for commercial and recreational fishing opportunities are likely to view hatchery production of fish differently than do people concerned primarily with the conservation of biodiversity.

Recreational anglers might be astonished to learn that some of their most revered species, such as brown trout and largemouth bass, are listed among the 100 world's worst invasive alien species, along with such notorious troublesome species as fire ants and rats. Introduction of Nile perch into Lake Victoria in East Africa provides a classic, if sad, example of the conflict between fisheries management and fish conservation. Because of their large size and palatability, Nile perch provided a boost to local economies, but also caused the extinction of many smaller, native fish species. Given that the introduction cannot be reversed, fisheries managers and conservationists are working together to develop harvest schemes that will reduce Nile perch populations but maintain the economic viability of the fishery, as well as allow recovery of the remaining native fishes.

The book is very readable and is punctuated with many amusing anecdotes. I enjoyed reading about the 200-liter glass bait bucket that Helfman maintains in his living room, and about why feeding sausages to fish while scuba diving is a bad idea. I smiled when I read his characterization of lampreys as being "as low as one can go on the charisma scale," and I appreciated his analogy that using hatchery fish to supplement wild populations without addressing the underlying causes of decline "is like providing a blood transfusion to a patient without stopping the bleeding."

Helfman is not afraid to state his viewpoints. He takes to task scientists working on genetic engineering for publishing much of their work in non-peer reviewed outlets. He pokes fun at the politician (named in the book) who opposed conservation actions for the imperiled Alabama sturgeon because "We don't want these ugly fish in the state of Alabama."

I have only a few criticisms of the book. The main one concerns the poor quality of some figures and pictures. In a few instances, it was difficult to see the results presented in a figure because I could not discern different shading patterns or make out fuzzy words. The appearance of the book would have been greatly enhanced had the many pictures of interesting fish been in color instead of black and white. Cost factors may have prevented the use of color, but it was disappointing to see a black-and-white picture of a diverse group of cichlids and have the caption inform us that, had the picture been in color, we would have seen a dazzling assortment of blue, yellow, orange, black, and pink fish. In a few cases, as in the chapter on marine fisheries, acronyms were overused—I sometimes felt as though I were reading a text message from my teenage son. It is hard to find a conservation topic that is not covered in the book, but it would nonetheless have been nice to see more pleas for freshwater conservation areas. Overall, these shortcomings are minor in comparison with the depth of coverage, diversity of topics, and wealth of literature and Web references that characterize Helfman's book.

Bycatch reduction in the world's fisheries

One topic that Helfman briefly discussed is bycatch, the incidental capture and mortality of unwanted species. Bycatch has become an increasingly important issue because it has high visibility, causes conflicts among fishers when one person's bycatch is someone else's targeted catch, and gives fishers a bad public image. Also, much of the bycatch consists of small individuals of commercial species, and allowing them to escape and grow would enhance future yields. The world harvest of wild catch is estimated at about 100 million metric tons, with an additional 27 million metric tons of organisms discarded as bycatch. Consequently, great efforts have been made to reduce bycatch, as summarized in a recent book titled *Bycatch Reduction in the World's Fisheries*. The book, edited by Steven J. Kennelly, consists of

eight chapters written by an international group of fisheries biologists.

One way to reduce bycatch is to close a fishery. This approach may be mandated when bycatch taxa have some charisma with the public (think dolphins and the tuna fishery). However, this option is usually not economically or socially acceptable, and sometimes it can lead to unintended consequences; for example, the Hawaiian swordfish fishery was closed for four years because baited hooks also caught sea turtles. This not only caused economic hardship for fishers but also failed to benefit sea turtle populations—the supply of swordfish to US markets was met by imports from other fleets whose sea turtle mortality rates were even higher than those of the Hawaiian fishery.

Faced with the threat of fishery closures, the fishing industry has focused attention on harvesting species more selectively. Three approaches to selective harvest are reducing contact between the fishing gear and nontarget species, separating species by size, and exploiting behavioral differences among species. Efforts to reduce contact between the fishing gear and nontarget species are illustrated by the problem of sea bird mortality in longline fisheries (chapter 8). Flocks of sea birds are attracted to fishing boats—they try to steal bait when the long line of baited hooks is deployed over the stern. Some of the birds become hooked and drown. When endangered bird species die, bad press and the attention of regulatory agencies follow. Consequently, various techniques have been employed in attempts to minimize bird mortality. These include setting hooks at night when the birds are not active, using heavier lines so the hooks sink faster, using streamers to scare the birds away, dyeing the bait blue to make it less visible in the water, and using underwater chutes to set lines below the water surface.

In some cases, gear modifications can be used to separate species by size and thus reduce bycatch. For example, turtle-exclusion devices allow sea turtles to escape from shrimp trawls without reducing the catch of shrimp (chapter 2). In Australia, seines, trawls, and trap nets

are used to harvest prawns (chapter 1). The gears differ in size selectivity, which is important because only large individuals can be legally harvested. Manipulating the size of the net mesh associated with trawls, gill nets, or fish traps is a common approach for reducing bycatch of small fishes (chapters 3 and 4). Bycatch can be reduced for fisheries that target benthic fishes or shellfish by manipulating the size of the mesh of the collection bag or by using filter screens to eliminate organisms that differ in size or swimming ability from the targeted species (chapters 5 and 6).

Differences in the behavioral reactions of species also can be used to reduce bycatch. Electric stimuli cause shrimp to leave the seabed, and they are then harvested by trawls fished just above the bottom (chapter 6). Because benthic fishes are less responsive to the electricity, they remain on the bottom and are not caught by the trawl. The unusual swimming behavior of pink snapper provides a way to reduce the bycatch of this species when it co-occurs with a targeted species, the silver trevally (chapter 4). Both species will enter wire traps, but once inside the traps, pink snapper will turn sidewise and swim through the longest mesh aperture, whereas silver trevally do not exhibit such behavior. Thus, the solution to capturing large numbers of silver trevally while reducing the bycatch of pink snapper is to place the wire meshes so that the long axis of the openings is horizontal rather than vertical.

Although the bycatch problem is well known for commercial fisheries, I was surprised to learn that it is an issue for recreational fisheries as well (chapter 7). Across the world, approximately 30 billion fish are caught and released by recreational anglers. If these fish die after being released, the loss is analogous to that from the bycatch mortality of commercial fisheries. This problem has been ignored because postrelease mortality is usually not highly visible compared with the mortality of bycatch organisms in commercial fisheries. In some recreational fisheries, postrelease mortality can be substantial. For example, more than 11.3 million striped bass are caught and re-

leased annually off the eastern coast of the United States. Postrelease mortality is estimated at 28 percent; thus, about 3.2 million striped bass are killed each year as a by-product of this fishery. There is also concern about mortality associated with competitive fishing tournaments, at which fish are kept in live wells until they are weighed and released at the end of the tournament. The potential for problems is large, given that there are approximately 2260 tournaments each year in North America just for black bass. The mortality rate of released fish can be reduced by using barbless or circle hooks; using artificial lures or flies rather than organic baits; reducing the duration of landing time to minimize physiological stress; and minimizing the time fish are out of water during hook removal, measuring, and picture taking.

A major message throughout *By-catch Reduction in the World's Fisheries* is that it is important to involve fishers in addressing bycatch problems. In part, this is because fishers often know more about fishing than anyone else and may be able to suggest practical solutions to reducing the catch of unwanted organisms. Equally important, though, is that the success of bycatch reduction is determined largely by the willingness of fishers to buy into changes. Heavy-handed mandates by regulatory agencies are likely to be met by resistance in the form of political pressure, litigation, and even civil disobedience, as happened in the battle over use of turtle-exclusion devices in the shrimp fishery off the US Gulf Coast (chapter 2). Also, peer pressure among fishers is a strong force for changing fishing practices. When it was discovered that 20 percent of vessels in a tuna fishery were causing 80 percent of the mortality of dolphins, the boat captains applied pressure to the offenders to clean up their act, since all tuna fishers were suffering in the court of public opinion (chapter 8).

Collectively, the book's eight chapters provide an in-depth coverage of the approaches being used to reduce bycatch in most types of fisheries. However, the book would have benefited from a final synthesis chapter summarizing the major progress in reducing fishery

bycatches, identifying fisheries where bycatch is still a major issue, and outlining the future directions of the field. The book also lacks an index, making it difficult to find particular topics. A casual reader interested in ways that tuna fishers can reduce dolphin deaths would be hard pressed to locate the relevant sections of the book.

What can you do to help fish conservation?

Both books detail myriad ways in which humans can reduce their impacts on aquatic species. At the individual level, people can avoid releasing toxicants into waterways, dispose of unwanted baitfish or pet fish rather than release them into the wild, and use techniques that maximize the survival of caught-and-released sport fish. We can support eco-labeling programs that identify species harvested at sustainable levels or with minimal bycatch (dolphin-safe tuna is one example). There is even a text message service you can use to rank seafood for sustainability while standing at the fish counter of your local store (www.blueocean.org/fishphone/index.html). An important message in these books is that progress in reconciling the sometimes different objectives of fisheries managers and conservation biologists will come only from mutual respect, communication, and compromise. Both books help bridge the communication gap between those interested in managing fisheries and those interested in conserving fishes.

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