MARINE BIOLOGY

Biologists Sort the Lessons of Fisheries Collapse

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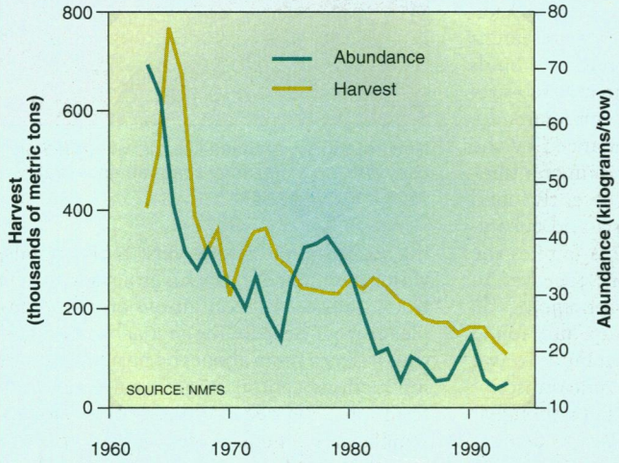
In the doldrums. Cape Cod fishing boats and a species that has been a mainstay of the New England fleet, the winter flounder.

The recent drumbeat of news reports about the collapse of many North American fisheries came as no surprise to fisheries biologist Vaughn Anthony. Anthony, who is the chief scientific advisor for the New England region of the National Marine Fisheries Service (NMFS), has been tracking declining fish stocks off the southern New England coast for years. Now, he says, "any dumb fool knows there's no fish around." Bottom-dwelling fish such as cod, haddock, and flounder are at or near all-time lows, and the venerable fishing industry there is collapsing. And New England is not alone: NMFS estimates that fully 45% of the fish stocks whose status is known are now overfished, and populations of some species have plummeted to less than 10% of the optimum level—the level that yields the largest sustainable catch. Says Anthony, "The status of the stock is so bad now that [nobody argues] about it."

But there's plenty of argument about how this crisis developed. Fishers blame a regulatory bureaucracy that was slow to act, while regulators say they were looking out for the industry's economic interests or that they were blindsided by unpredictable population swings and efficient new fishing technologies. Regulators also complain that biologists' uncertain estimates of fish populations and acceptable fishing levels failed to offer a solid case for tight fishing restrictions.

All of these claims carry varying degrees of truth, depending on the fishery. Still, most observers say that scientists have been giving clear warnings of the decline for years. Says Carl Safina, marine conservation director of the National Audubon Society, "The bottom line is that in fisheries where people have paid attention to the scientific recommendations, there are still fish around. In fisheries where the scientists have routinely been ignored or the most optimistic gloss has been put on the data, we have declines."

That bottom line may now be heeded. One result of the current crisis may be to build support for more cautious catch limits based on population data, even if the data are limited. The National Research Council, in a report issued this month, is calling on Congress to revise the current law governing fisheries management, the Magnuson Act, to build more biology into the regulatory process (see box). And at the same time, scientists are trying to play a savvier political game by stressing the long-term economic benefits of cautious fisheries management. If these efforts succeed in limiting the fishing pressure, biologists say, even New England's sadly depleted fish populations stand a good chance of recovery—given enough time.



Decline and fall of the New England fishery. The total harvest of groundfish (cod, haddock, flounder, and others) and their abundance, as measured by random trawls.

If so, it will be a homegrown solution to what is largely a homegrown problem. The Magnuson Act, passed in 1976, claimed for the United States the exclusive right to manage fisheries within 200 miles of its coastline, where the vast majority of commercial fishing takes place. The act excluded most of the foreign fishing vessels that were fishing these waters intensively, but the ensuing windfall of fish led to a massive buildup of the U.S. fishing fleet.

Overfishing was supposed to be checked by eight regional fishery management councils, with the help of scientific advisers on the council staffs and at NMFS offices. These advisers monitor fish abundance based on the commercial fish harvest itself and on data from research vessels that fish at random. Since most fish are highly mobile and patchily distributed, however, fisheries biologists admit they're often lucky if their population estimates for any given year are within 30% of reality. Nor can scientists always tell whether fishing rather than natural factors such as shortage of prey or climate change is the key factor in a population decline, says marine scientist Brian Rothschild of the University of Maryland at Solomons. Human activities other than fishing can also affect abundances. Most notoriously, salmon populations off California, Oregon, and Washington almost certainly owe much of their steep decline not to fishing but to destruction of their spawning streams by dams and logging.

Signs of trouble. Despite these gaps in their understanding of fish population biology, most fisheries scientists—and many in the fishing industry as well—agree that only rarely do they simply blow the call on how much fishing a population can stand. Scientists can tell that a population is in trouble when its mortality rate, calculated from the age distribution of the fish in the commercial harvest, shows a steady rise, says Andrew Rosenberg, an NMFS scientist. Other factors besides fishing may be contributing, but a cutback in fishing is the only remedy available in most cases. For now, the sorry state of many fish populations often makes the scientists' call an easy one. "No matter how badly you estimate [reproduction] or natural mortality, you still will come to the conclusion that you should reduce the fishing mortality rate," says Rosenberg.

But where the shortcomings in the science do make a difference is in the researchers' ability to influence policy. Many fisheries scientists have seen the current crisis coming for as much as a decade, say Rosenberg and his colleagues, but when they presented their data to the management councils, their penchant for speaking in terms of probabilities and confidence intervals often served them—and the fish—poorly. Joseph Brancaleone, a former fisherman who chairs the New England Fishery Management Council, for example,

argues that uncertainties in the population estimates weakened the case for severe restrictions. Carl Paulsen, program director of the National Coalition for Marine Conservation, an environmental group, agrees that the uncertainty leaves plenty of room for policy disputes. "We've argued that if there's uncertainty, you should err on the side of the resource," says Paulsen. "Industry has argued that you should err on the side of economics and the fishing industry."

And industry's voice tended to carry weight with the councils, say Paulsen and others, in part because of a decision made by Congress when it established the councils in 1976. Because it intended them to draw heavily on the expertise of the fishing industry, Congress went so far as to exempt council members—most of whom are federal appointees—from federal conflict-of-interest rules. As a result, members often hold direct interests in the fisheries they regulate. Such conflicts don't always lead to overfishing, but some councils have consistently overridden scientists' recommendations, many scientists and conservationists charge. "You have people in the industry, with livelihoods at stake, being unable to take the hits necessary to rebuild the stocks," says Paulsen.

Among the worst offenders has been the New England council, says Safina, who calls it "incredibly irresponsible and stupid" for allowing persistent overfishing of cod and flounder stocks. Despite a decade of warnings from fisheries biologists, the council has stubbornly resisted setting direct limits on fish harvests. Only recently did the council agree to restrict harvests by gradually limiting the number of days each boat can fish. And that plan is still not fully implemented. For now, says NMFS's Vaughn Anthony, fishers still catch around 60% of the entire fish population each year—more than twice the sustainable level. "There's no room for rebuilding here," says Anthony.

Brancaleone, the chairman of the New England council, notes that it did respond to scientists' concerns by trying to reduce harvests through other, indirect, means: imposing minimum net-mesh sizes (which let more young fish escape) and staking out no-fishing zones. He defends the council's slow phase-in of more stringent controls as necessary to protect fishers from the economic pain of overregulation. Besides, he says, the science doesn't show a clear need to move any faster. "The data that we have are so slim that we can't put a number on [the effect of the controls]. By the third or fourth year, we'll have the data that will tell us [whether further restrictions are needed]," he says.

But more aggressive management has paid off in other fisheries, say researchers. Even the most outspoken critics of fishery management, such as Safina, agree that the North Pacific management council has done a good job of following scientists' recommendations in setting strict catch limits. As a result, many Alaskan fish populations such as Pacific halibut and salmon are still in good shape. And a moratorium on striped bass fishing in the mid-Atlantic states during the 1980s has allowed that fishery to rebound strongly from historic lows early in that decade.

These successes are encouraging scientists to change their approach in the fight over fishing limits, Rosenberg says. Many are now becoming more outspoken in arguing for conservative catch limits even when the data are uncertain. They've also learned a political lesson, Rosenberg says—the value of involving more members of the fishing industry in the stock-assessment process, "so people don't think we're doing something dark and mysterious." In addition, he notes, NMFS has begun to include economists in its analysis groups to evaluate the economic effects of various management strategies, thereby bolstering its claims that, in the long term, tighter regulation will benefit fishers.

Such regulation, say fisheries experts, might take the form of limits on the overall catch or of quotas assigned to individual fishers, which could be bought or sold. However the fishing pressure is eased, examples such as the striped bass suggest that fish populations can recover from even severe overfishing. Most biologists are reluctant to venture a guess as to how fast, though, because the speed of recovery also depends on the lifespan and reproductive rate of the fish—and the environmental vagaries that affect them.

Yellowtail flounder, for example, only reproduce well in years with cold winters. "Now what can we do about cold winters? If we don't have cold winters for the next 10 years, there won't be any yellowtail," says fishing-boat owner Barbara Stevenson of Portland, Maine. For her and other beleaguered fishers looking for a better future, therefore, the key words appear to be restraint—and patience.

–Bob Holmes

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A Call for Better Science

For scientists whose warnings failed to check the depletion of some of the United States' richest fisheries over the past 15 years (see main story), a panel convened by the National Research Council (NRC) has some advice: Take a broader scientific approach and reduce the uncertainty in your forecasts. More confident forecasts are needed to catch the attention of regulators, the panel says in a new report.*

The report comes as Congress gets ready to re-authorize the Magnuson Fishery Conservation and Management Act, a 1976 law that extended the bounds of U.S. fisheries and created regulatory bodies to conserve fish stocks. The failure of those mechanisms has made it clear that the Act needs reform, and federal scientists turned to the NRC for advice about how to do so.

The report takes fisheries managers to task for failing to uphold a key principle of the Act—that "conservation and management measures shall be based on the best scientific information available." But it also says that available scientific information is often weak, noting in particular that fisheries scientists "have given virtually no consideration" to how fishing a single species can alter the rest of an ecosystem, making yields unsustainable. As a result, says NRC panel chair John Magnuson, a limnologist at the University of Wisconsin at Madison (no relation to the Act's eponym), "you can end up with situations in which one fishery is directed at a predator and another at its prey, yet the two fisheries are managed as though they are independent."

For this reason, the NRC report calls for an "ecosystem approach" to managing fish stocks, along with better models of how both interactions between species and overall ecosystem health affect sustainable yields. Crude models of marine ecosystems have been kicking around for years, but they generally aren't sophisticated enough to apply to commercial fishing, says Michael Sissenwine, senior scientist at the National Marine Fisheries Service (NMFS), which collects and processes data on U.S. fish stocks. The report notes that improving the models will require better data on such human impacts as the extent of "bycatch"—creatures caught accidentally in the nets of trawlers.

Sissenwine agrees that there's a need for more research, but he notes that better models and surer estimates of optimum fishing levels won't help if managers don't use the information. But he does see a bright spot for the ecosystem approach. "People doing research now will increasingly advance to management positions," he says. In time, the managers may not need any persuading.

–Richard Stone

*"Improving the Management of U.S. Marine Fisheries," NRC, May 1994.