GLOBAL FISHERIES

Détente in the Fisheries War

After a controversial projection that wild-caught fish will disappear, top researchers buried the Dhatchet to examine the status of fisheries—and what to do about it

All gone? A controversial projection of exhausted fisheries led to a new look at the oceans.

Doomsday will come to fishes across the world's oceans by 2048. That was the startling implication of findings published in 2006 by marine ecologist Boris Worm of Dalhousie University in Halifax, Canada, and several colleagues. The projection was merely a side note in a paper in *Science* about the relationship between biodiversity and ecosystem services in the oceans, which concluded that the world's oceans were in bad shape, in part because of overfishing. Then, in the next-to-last paragraph, the authors extrapolated from the percentage of fisheries that have already collapsed and predicted that in 32 years no more fish would be caught in the ocean. That point, not their larger conclusions on the role of biodiversity in ecosystem functions, was highlighted in press releases and then garnered headlines around the world.

Many fisheries scientists were appalled. Trained in quantitative techniques for determining the abundance of fish stocks, they questioned the methods used in Worm's global assessment, such as a reliance on the mass of fish reported caught. They also blasted the paper for ignoring fisheries that are doing well, like those in the northeastern Pacific and New Zealand, and those that are now recovering from decades of overfishing.

One particularly prominent critic was Ray Hilborn of the University of Washington, Seattle. In media interviews, he called the analysis "incredibly sloppy" and the projection "mind-boggling[ly] stupid." Worm and his colleagues defended their analyses in responses in *Science* and elsewhere. The conflict continued a charged and long-simmering debate between marine ecologists and fisheries scientists about the status of the world's ocean ecosystems.

Yet less than a year later, Hilborn and Worm began meeting on neutral ground to hammer out their differences—to the amazement of some observers. "There were such extreme attacks on the [Worm *et al*. paper] that it was a little hard to imagine that they would have a constructive dialog," says ecologist Larry Crowder of Duke University in Durham, North Carolina. Working under the auspices of the National Center for Ecological Analysis and Synthesis (NCEAS) in Santa Barbara, California, a grant-funded center run by the University of California to facilitate collaboration among ecologists, Hilborn and Worm have brought together some 20 scientists from their respective disciplines as well as dozens of graduate students who they hope will also learn to think more broadly. "This is the most interesting thing I've been involved in in a long time," Hilborn says.

The goal was to figure out why their different data or methods yield such divergent impressions of ocean ecosystems—and in the process create better databases that both camps deem reliable and informative. Perhaps more importantly, they have used the new databases to develop a common vision of how to balance fishing and conservation most effectively. Joint publications are expected to start appearing later this year. "I have high expectations that they'll come back with useful outcomes," says Steven Murawski, chief scientist of the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service in Silver Spring, Maryland, who participated in the first meeting.

> *"There are a lot of problems, but things may not be as bad as ecologists have thought."*
>
> —RAY HILBORN, UNIVERSITY OF WASHINGTON, SEATTLE

Head to head

In large part, the Worm-Hilborn clash reflects the different worldviews of the two disciplines. Fisheries scientists see marine ecosystems as a resource to be used, whereas marine ecologists usually envision pristine, unfished habitats as the ideal.

The two fields also tend to rely on different types of data. In their 2006 *Science* paper, Worm and his co-authors were trying to look at the global impacts of marine biodiversity loss. For that, they had to rely on the most comprehensive kind of data available: the tonnages that countries report are caught. Fisheries scientists, by contrast, tend to look at individual stocks of fish and typically use sparser data gathered

CREDIT: ARNULF HUSMO/GETTY IMAGES

Published by AAAS

by scientific means; they consider catch reports unreliable.

High-profile journals have been publishing dire warnings about the impact of fishing on ocean ecosystems for years. One of the first was a 1998 *Science* paper by Daniel Pauly of the University of British Columbia in Vancouver, Canada, one of the few fisheries biologists who takes a global perspective (*Science*, 6 February 1998, p. 860). He and his colleagues speculated provocatively that with continued overfishing, only jellyfish and plankton would remain to be harvested.

In 2003, a paper in *Nature* continued that tradition. Written by Worm and the late Ransom Myers of Dalhousie, the paper concluded that industrial fishing had reduced global populations of sharks, tuna, and other large open-water predators by 90%. Again, the conclusion attracted international media attention. It was also the first big paper for Worm, then a postdoc. Now 39, he is a rising star among marine ecologists; soft-spoken and media-savvy, Worm is a passionate conservationist.

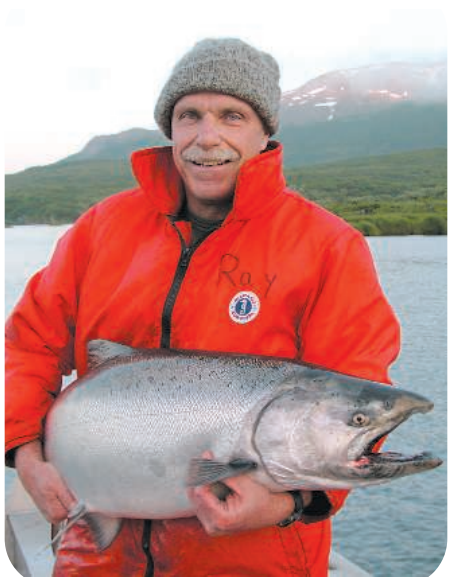
Fisheries scientists fought back. Leading the charge was Hilborn, who received the Volvo Environment Prize in 2006 in part for his work on mathematical models and fisheries management. In a scathing opinion piece titled "Faith-based Fisheries," which was published in *Fisheries* in November 2006, Hilborn accused Worm, Myers, and others of cherry-picking data to support "sensational but unsubstantiated headlines" and asserted a "lack of the basic skepticism needed in science." Swinging widely, he also took *Science* and *Nature* to task for seeking publicity at the expense of rigorous peer review.

A crack in the ice emerged when the two scientists were invited to talk on a National Public Radio call-in show about the future of fish not long after publication of the 2006 paper. When they started to discuss the issue on air, Worm recalls, they didn't seem to be that far apart. The two continued to converse by phone and agreed to collaborate at NCEAS. "Ray and I realized independently this [public disagreement] was not going to make the science any better, because you have the danger of being blind in one eye," Worm recalls.

Splitting the difference

In large part, it was the prospect of looking at new data sets that brought Worm and Hilborn to the table. The two decided to assemble a resource they both could agree on. "It's being data-driven that's led us to common ground," says Hilborn, who is now a member of *Science*'s Board of Reviewing Editors. The results are much more comprehensive and rigorous databases to examine the status of the world's fisheries, NOAA's Murawski says.

The first target was an updated collection of stock assessments, the gold standard of analysis in fisheries science. These consist of surveys and statistical models of fish populations. Second, they compiled a similar database of trawl surveys, a broader sampling of fish populations usually conducted by research vessels. They also collected about two dozen ecosystem models, which show the interactions of various species in a particular fishery. Finally, they also examined the catch data that Worm and his colleagues had relied on in their 2006 paper.



Hooked. Boris Worm (*top*) and Ray Hilborn set aside past disagreements to launch a joint study on the state of the world's fisheries.

The databases had to be a joint effort, they say, because that showed that the group was not trying to attack fisheries management—and that helped persuade fisheries scientists elsewhere to contribute data. "There's trust because there are checks and balances in the group, there are people from each field," Worm says.

With these new tools, the group is now taking a fresh stab at assessing the status and trends in world fisheries and ecosystems. They plan to publish an overview this summer. Although Worm and Hilborn don't agree on everything—such as the projection that first triggered the project, the disappearance of wild-caught fish by 2048—they have found middle ground about the present. "There are a lot of problems, but things may not be as bad as ecologists have thought," Hilborn says. For his part, Worm says he's surprised by the number of places where managers have gradually reduced fishing over the past 10 years.

Both agree that more needs to be done. They are outlining a balance between extraction and conservation, a way to most effectively manage the world's oceans for human use while maintaining biodiversity and the structure of natural ecosystems. The key conclusion—coming from comparisons of management in both successful and failing sites—is that a little change in fishing practices could go a long way. The current practice is for fisheries scientists to set a target called maximum sustainable yield (although in practice, many stocks are overfished). Hilborn and others had already noted that it is more economical to fish less than this (*Science*, 7 December 2007, p. 1601). The new findings show that somewhat reducing fishing offers biological benefits as well, including more preservation of biodiversity. "There is this new area of consensus, that fishing below maximum sustainable yield would be beneficial in all these realms," Worm says.

In their final meeting next month, the researchers and graduate students will summarize what they've learned and finalize results of the main papers. "You can already see how things will trickle down and be taken up and processed by the next generation of scientists, who hopefully will not be part of that polarized debate anymore," Worm says. Although it can sometimes be useful to have contrasting views, he says, "there is only one world, and we need to work on it together."

–ERIK STOKSTAD

CREDITS (TOP TO BOTTOM): D. ABRIEL/DALHOUSIE UNIVERSITY; PETER WESTLEY