The Lead

Apocalypse Forestalled: Why All the World's Fisheries Aren't Collapsing

By Ray Hilborn
Professor, Aquatic and Fishery Sciences, University of Washington
rayh@u.washington.edu

If you have paid any attention to the conservation literature or science journalism over the last five years, you likely have gotten the impression that our oceans are so poorly managed that they soon will be empty of fish — unless governments order drastic curtailment of current fishing practices, including the establishment of huge no-take zones across great swaths of the oceans.

To be fair, there are some places where such severe declines may be true. A more balanced diagnosis, however, tells a different story — one that still requires changes in some fishing practices, but that is far from alarmist. But this balanced diagnosis is being almost wholly ignored in favor of an apocalyptic rhetoric that obscures the true issues fisheries face as well as the correct cures for those problems.

To get the storyline correct, it is important to go back to the sources of the apocalyptic rhetoric. In 2006, a paper was published by Boris Worm in *Science* (Worm et al. 2006) that received enormous press coverage. It argued that, if current trends continued, all fish stocks would collapse by 2048. Worm and his coauthors concluded their paper with the following sentence: "Our analyses suggest that business as usual would foreshadow serious threats to global food security, coastal water quality, and ecosystem stability, affecting current and future generations."

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Others joined in, chief among them Daniel Pauly, who rang and continues to ring the apocalyptic note. "There are basically two alternatives for fisheries science and management: one is obviously continuing with business as usual…," wrote Pauly in 2009 (Pauly 2009a). "This would lead, in addition to further depletion of biodiversity, to intensification of 'fishing down marine food webs,' which ultimately involves the transformation of marine ecosystems into dead zones."

It might surprise you to learn Pauly's views are not universally held among scientists. Indeed, these papers exposed a deep divide in the marine science community over the state of fish stocks and the success of existing fisheries management approaches. Numerous critiques of the apocalyptic stance were published after the 2006 paper, suggesting that Worm et al. had greatly exaggerated the failings of "business as usual." For instance, Steve Murawski, director of scientific programs and chief science advisor, defended the U.S. fisheries management system and pointed out that the proportion of stocks overfished in the U.S. was declining, not increasing (Murawski et al. 2007).

No one disagrees on our goals for the world's fisheries stocks — we need higher fish abundances. The arguments are largely about where we are now and how we will get to higher fish abundance and lower fishing pressure. Are current fisheries management systems working to decimate fish stocks…or rebuild them? Do we need large areas of the oceans closed to fishing to assure sustainable seafood supply? Daniel Pauly says yes to the latter question: "This transformation," he writes, "would also require extensive use of ocean zoning and spatial closures, including no-take marine protected areas (MPAs). Indeed, MPAs must be at the core of any scheme intending to put fisheries on an ecologically sustainable basis" (Pauly 2009a).

In an attempt to resolve this dispute, Boris Worm and I several years ago organized a set of four meetings, sponsored by the National Center for Ecological Analysis and Synthesis (NCEAS), in which we assembled a database on abundance as measured by fisheries agencies and research surveys. Participants included several of the authors of the

2006 paper as well as several people from national fisheries management agencies.

The results were published in *Science* in 2009 (Worm et al. 2009), and showed that, while the majority of stocks were still below target levels, fishing pressure had been reduced in most ecosystems (for which we had data) to below the point that would assure long-term maximum sustainable yield of fish from those ecosystems. About 30 percent of the stocks would currently be classified as overfished — but, generally, fishing pressure has been reduced enough that all but 17 percent of stocks would be expected to recover to above overfished thresholds if current fishing pressure continues. In the United States, there was clear evidence for the rebuilding of marine ecosystems and stock biomass. The idea that 70 percent of the world's fish stocks are overfished or collapsed and that the rate of overfishing is accelerating (Pauly 2007) was shown by Worm et al. (2009) and FAO (2009) to be untrue.

The *Science* paper coming out of the NCEAS group also showed that the success in reducing fishing pressure had been achieved by a broad range of traditional fisheries management tools — including catch-and-effort limitation, gear restrictions and temporary closed areas. Marine protected areas were an insignificant factor in the success achieved.

The database generated by the NCEAS group and subsequent analysis has shown that many of the assumptions fueling the standard apocalyptic scenarios painted by the gloom-and-doom proponents are untrue:

- For instance, the widespread notion that fishermen generally sequentially deplete food webs (Pauly et al. 1998) — starting with the predators and working their way down — is simply not supported by data.
- Declining trophic level of fishery landings is just as often a result of new fisheries developing rather than old ones collapsing (Essington et al. 2006).
- Catch data also show that fishing patterns are driven by economics, with trophic level a poor predictor of exploitation history (Sethi et al. 2010).
- Furthermore, the mean trophic level of marine ecosystems is unrelated to (or even negatively correlated with) the trophic level of fishery landings (Branch et al. 2010).
- And the oft-cited assessment that the large fish of the oceans were collapsed by 1980 (Myers and Worm 2003) is totally inconsistent with the database we have assembled — for instance, world tuna stocks in total are at present well above the level that would produce maximum sustained yield, except bluefin tuna and some other billfish that are depleted (Hutchings 2010).

Nevertheless, many in the marine conservation community appear unwilling to accept these results, continue to insist that all fish may be gone by 2048, and use declining catches in fisheries where regulations have reduced catches as indications of stock collapse.

No one argues that all fisheries are well-managed, and so far we do not have abundance estimates for many parts of the

world, especially Asia and Africa. Using the catch-based methods of Worm et al. (2006) and Pauly, these areas appear to have fewer stock collapses and overfished stocks than in the areas for which we have abundance data. However, we do not know if these areas have been reducing exploitation rates or if they are still increasing.

The evidence is strong that we can and are rebuilding stocks in many places. Let us accept that progress and identify the problem stocks and how to fix them.

Finally, in places without strong central government control of fishing, there is broad agreement that community-based co-management can be effective. For these fisheries, management tools are very different than those used for industrial fishery stocks, and MPAs are here often a key ingredient. The lessons from the Worm et al. (2009) paper about what works to rebuild fish stocks are applicable to industrial fisheries, but probably not to the small-scale fisheries that support many fishing communities.

There is considerable room for policy debate about where we want to be in the tradeoff between yield and environmental impact of fishing. There is no denying that sustainable fishing changes ecosystems, and that different societies will almost certainly make different choices about how much environmental change they will accept in return for sustainable food production. But science cannot provide the answers for this debate; it can only evaluate the tradeoffs.

My perspective is that we need to treat fisheries like medical diagnoses. We must identify which fisheries are in trouble and find the cures for those individual fisheries. The evidence is strong that we can and are rebuilding stocks in many places. Let us accept that progress and identify the problem stocks and how to fix them.

Apocalyptic assertions that fisheries management is failing are counterproductive — not only because these assertions are untrue, but because they fail to recognize the long, hard work of fishery managers, scientists and stakeholders in the many places where management *is* working. While the gloom-and-doom advocates have been attracting public attention and press coverage, thousands of people — decried by Pauly (2009b) as agents of the commercial fishing interests — have worked through years of meetings and painful catch and effort reductions to lower fishing pressure and successfully rebuild fisheries. **SC**

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