Worm et al. "Rebuilding Global Fisheries" - *Science*, July 31 2009
Frequently Asked Questions

How does your work differ from previously published papers on status of world fisheries?

Previous papers have mostly used catch series to judge the status of fisheries, because catch is the only data that is available for much of the world. We concentrated on the areas where more detailed data such as scientific surveys and stock assessments were available so we can assess trends in fish abundance, and the rate of exploitation. This has the advantage of following directly the drivers of fisheries collapse and recovery (i.e. changes in exploitation rate and abundance), but limits us to evaluating a limited number of ecosystems where such data are available.

How different are your conclusions from earlier studies?

The biggest difference is that we have been able to look directly at the rate of exploitation (i.e. the proportion of fish taken out of the sea) and find that it has declined in five out of ten ecosystems and has stabilized in the others. This implies that at least in those regions we should be seeing fewer stocks collapsing and more recovering in the future. Our estimate of current collapsed taxa falls in between the most recent FAO estimates (9% depleted or recovering from depletion), and the Worm et al. 2006 paper (catches of 29% of taxa collapsed in 2003). We found that the abundance of 14% of assessed taxa had collapsed to less than ten percent in 2007. These three studies used different definitions of collapse and different data sources, which may explain some of the differences. Yet they all showed the proportion of stocks defined as collapsed has been increasing over time, and is now higher than ever before. By looking at the drivers of overfishing we have found considerable variation in management success, however, and thus present a more nuanced view of fisheries status.

Is the number of collapsed species a serious concern?

Yes it is a serious concern, and our paper shows that in order to reverse the trend in collapse the exploitation rates need to be decreased further in most ecosystems. However we also show that at the current exploitation rates in most ecosystems we have been able to analyze, we would expect the proportion of stocks collapsed to stabilize at 20-30% and that the sustainable yield from those ecosystems would be near maximum.

Do we have to stop fishing to let species recover?

Our paper shows that a lowering of exploitation rate does result in some stock recovery, particularly in California, New England and Iceland. This does not mean we have to stop fishing altogether, but it does mean that the total fishing pressure on most ecosystems need to be reduced substantially to give most stocks a chance to increase again. Often there are more sensitive species, such as many sharks and marine mammals, that require additional

measures, such as strict bycatch limits and closed areas that can serve as refuges from fishing. Overall, fishing has to become more selective, such that species that are abundant can be fished while others remain relatively unharmed. Improved fishing gear technology may help, as well as the zoning of the oceans in intensively fished, lightly fished and unfished (closed or protected) areas.

Why do some stocks, like cod in New England for example, seem to be so slow to recover even when other species around them are recovering?

Some species like haddock in New England and the North Sea have been able to bounce back quite rapidly on the strength of a single very large reproduction event. Cod take much longer to rebuild and we may simply have not given them enough time. In some places, like Eastern Canada for example, it appears that the ecosystem may have changed so much, that it is not clear that all stocks will rebuild even under very low fishing pressure.

What does this mean for consumers, is it OK to eat fish again?

If the consumer wishes to eat seafood that is from a well managed stock there are a number of organizations that provide advice such as the Marine Stewardship Council's certification program, the Monterey Bay Aquarium's "Seafood Watch Card" and other similar programs. There are a good number fish stocks that are managed well and can be eaten in good conscience. In doing so, the consumer can support sound management and actively discourage unsustainable practices.

Why have some areas been more successful at reducing exploitation rates than others?

We have not fully looked at this question, but it appears that the political and legal environments are the primary determinants of success in reducing exploitation rate. In the U.S. there is a legal requirement to prevent overfishing and this has been enforced through numerous court decisions. In other locations the process is often more political, and the outcomes are more variable.

What are the key tools used to reduce fishing pressure?

In the industrial fisheries we examined we found that absolute catch limits, closed areas, gear restrictions, capacity reduction and catch shares were the most common tools employed. In the small-scale fisheries community based management and gear restrictions were the most common tools. It is important to note that always a combination of tools have been used to reduce exploitation rate – diversity appears important for management success.

Is this the very first time that catch data, assessments, and surveys have been combined in one analysis?

Yes, no one has previously looked at all three sources of data over a range of different ecosystems. Many scientists are familiar with all three sources of data for the ecosystems where they work, but we are the first to bring these data together in a broad synthesis.

If you studied 10 systems with intensively managed fisheries and only 5 show a decline in exploitation rate, how is that hopeful? Is success a matter of chance?

The hopeful part is that the picture has changed from widespread overexploitation to lower exploitation rates on average. This does not mean that all is well, but it may indicate a change in direction. Over the last 30 years, 9 out of the 10 systems that we had detailed data for, were reaching exploitation rates that were exceeding levels predicted to achieve multi-species maximum sustainable yield. Only one, the eastern Bering Sea, has been managed consistently below that threshold. The good news is that by 2007, seven systems were managed below that threshold, which may provide them with a chance to recover. The exceptions are the North Sea, Celtic-Biscay, and Baltic Sea, but even there we see some easing of fishing pressure. Substantial recovery of fish biomass is so far seen in three systems: Icelandic shelf, Northeast U.S. Shelf, California Current.

What does Table 1 really tell us?

Table 1 demonstrates that fisheries need to be regulated by a diversity of management tools, and there is no single "silver bullet" to get exploitation rates into the desired range.

We know of the classic examples of fisheries collapse such as Canadian cod and Atlantic bluefin tuna. Are there comparable examples of rebuilding or successful management?

In New England, haddock and sea scallop stocks are rebuilding due to a large fishing closure and reduced fishing effort. On the west coast, Pacific halibut, Alaskan salmon, and Bering Sea pollock all are certified by the Marine Stewardship Council and have never been overfished. In Australia, Tiger flathead, one of the longest commercially fished species in Australia, has recently been recovering due to an increase in mesh size and a change in fishing gear.