Ocean study predicts the collapse of all seafood fisheries by 2050

All species of wild seafood will collapse within 50 years, according to a new study by an international team of ecologists and economists. Writing in the Nov. 3 issue of the journal *Science*, the researchers conclude that the loss of marine biodiversity worldwide is profoundly reducing the ocean's ability to produce seafood, resist diseases, filter pollutants and rebound from stresses, such as climate change and overfishing.

"Unless we fundamentally change the way we manage all the ocean species together as working ecosystems, then this century is the last century of wild seafood," said study co-author Stephen Palumbi, professor of biological sciences at Stanford's Hopkins Marine Station.

Palumbi and Stanford colleague Fiorenza Micheli, assistant professor of biological sciences at Hopkins, are two of 14 co-authors of the Science study, the first major analysis of all existing datasets—historical, experimental, fisheries and observational—on ocean species and ecosystems.

Based on current global trends, the authors predicted that every species of wild-caught seafood—from tuna to sardines—will collapse by the year 2050. "Collapse" was defined as a 90 percent depletion of the species' baseline abundance.

"Whether we looked at tidepools or studies over the entire world's ocean, we saw the same picture emerging," said lead author Boris Worm of Dalhousie University. "In losing species we lose the productivity and stability of entire ecosystems. I was shocked and disturbed by how consistent these trends are—beyond anything we suspected."

The impacts of species loss go beyond declines in seafood, the authors said, noting that human health risks also emerge as depleted coastal ecosystems become vulnerable to invasive species, disease outbreaks and noxious algal blooms.

"The ocean is a great recycler," Palumbi said. "It takes sewage and recycles it into nutrients, it scrubs toxins out of the water and it produces food and turns carbon dioxide into food and oxygen." But to provide these services, he added, the ocean needs all of its working parts—the millions of plant and animal species that inhabit the sea.

Accelerating declines

The research team analyzed 32 controlled experiments, observational studies from 48 marine protected areas and global catch data from the United Nations Food and Agriculture Organization's database of all fish and invertebrates worldwide from 1950 to 2003. The scientists also looked at a 1,000-year time series

for 12 coastal regions, drawing on data from archives, fishery records, sediment cores and archeological sources.

"We see an accelerating decline in coastal species over the last 1,000 years, resulting in the loss of biological filter capacity, nursery habitats and healthy fisheries," said Dalhousie University co-author Heike Lotze, who led the historical analyses of Chesapeake Bay, San Francisco Bay, the Bay of Fundy and the North Sea, among other sites.

The results revealed that every species lost causes a faster unraveling of the overall ecosystem. This progressive biodiversity loss not only impairs the ability of the ocean to feed a growing human population but also sabotages the stability of marine environments, the authors said. Conversely, the study found that every species recovered adds significantly to the ecosystem's overall productivity and ability to withstand stresses.

According to the research team, species collapses are hastened by the decline in overall health of the ecosystem—fish rely on the clean water, prey populations and diverse habitats that are linked to higher diversity systems. This finding points to the need for marine resource managers to consider all species together rather than continuing with single-species management, the authors said.

Restoring populations

One pressing question for managers is whether losses can be reversed, the authors said. If species have not been pushed too far down, recovery can be fast, they found, adding that there is also a point of no return where recovery is unlikely, as in the case of the northern Atlantic cod.

Examination of protected areas worldwide showed that restoration of biodiversity greatly increased productivity and made ecosystems 21 percent less susceptible to environmental and human-caused fluctuations on average—an indication that ocean ecosystems have a strong capacity to rebound.

"The data show us it's not too late," Worm said. "We can turn this around. But less than 1 percent of the global ocean is effectively protected right now. We won't see complete recovery in one year, but in many cases species come back more quickly than people anticipated—in three to five to 10 years. And where this has been done we see immediate economic benefits."

The buffering impact of species diversity also generates long-term benefits that must be incorporated into future economic valuation and management decisions, the authors found. "Although there are short-term economic costs associated with preservation of marine biodiversity, over the long term biodiversity conservation and economic development are complementary goals," said co-author Ed Barbier, an economist at the University of Wyoming.

The authors concluded that restoring marine biodiversity through an ecosystem-based management approach—including integrated fisheries management, pollution control, maintenance of essential habitats and creation of marine reserves—is essential to avoid serious threats to global food security, coastal water quality and ecosystem stability.

"This isn't predicted to happen, this is happening now," said co-author Nicola Beaumont, an ecological economist with the Plymouth Marine Laboratory. "If biodiversity continues to decline, the marine environment will not be able to sustain our way of life. Indeed, it may not be able to sustain our lives at all."

Source: Stanford University