Journal details how global warming will affect the world's fisheries

May 16 2007

Watching the ebb and flow of populations of fisheries around the world can provide some insight into understanding the effects of global warming on our planet, according to a group of researchers writing in the summer 2007 issue of *Natural Resource Modeling*. The fact that fisheries are closely tied to human health and species health across the globe adds to their significance.

"Fisheries are a globally important economic activity, not the least from the perspective of human nutrition and underdeveloped societies," writes Rognvaldur Hannesson, of the Norwegian School of Economics and Business Administration, in the issue's introduction. "Fisheries, due to their primitive nature, are among the human activities most exposed to climate changes."

The output of fisheries, as well as their costs and benefits, are "directly and strongly affected by variations in natural conditions," Hannesson adds. "Habitat conditions, which are the main determinants of the productivity and location of fish stocks, are strongly affected by ocean and atmospheric temperatures. The current prospect of substantial global warming, therefore, leads to concern about what this is likely to mean for the world's fisheries."

The summer 2007 issue of Natural Resource Modeling is devoted to fisheries and global climate change. Its six articles discuss various aspects of global warming's effect on fisheries and its consequences. Natural Resource Modeling is an international journal devoted to

mathematical modeling of natural resource systems. It is produced by the Rocky Mountain Mathematics Consortium.

"This issue of Natural Resource Modeling is particularly timely as it calls attention to important future changes in global food supplies from marine fish," says Thomas Sherman, executive director of the Rocky Mountain Mathematics Consortium and a mathematics professor at Arizona State University.

The first three papers in Natural Resource Modeling look at predictions by existing climate models and study the effects on specific fish stocks or areas.

The first paper, by Ragnar Arnason of the University of Iceland, deals with the possible effects of ocean warming on the fisheries and economies of Iceland and Greenland. Waters around Iceland and Greenland were considerably warmer in the 1920s and 1930s than before or after, and in the 1960s, these waters cooled considerably, which reduced the range of cod and drove herring away. Higher temperatures in these areas are, therefore, likely to improve yields in cod and herring fisheries.

A paper by Arne Eide, Norwegian College of Fishery Science, examines the effects of global warming on the cod fishery in the Barents Sea. He allows for cooling and warming because the Barents Sea could be an area where global warming actually causes cooling due to a weakening of the Gulf Stream. He finds that the management regime is much more important for development of the stock and the economics of the fishery than the temperature changes being considered.

A paper by Christine Rockmann (Institute of Marine Resources & Ecosystems in The Netherlands) et al. also deals with cod fishery, but this time in the Baltic Sea. In this paper, scenarios based on existing

climate models show that the Baltic cod is likely to become extinct in the next 50 years.

Peter Golubtsov, a physicist from Moscow State University, and Robert McKelvey, a mathematician from University of Montana, discuss environmental variability causing variations in growth and migrations of a fish stock shared by two countries. They consider how incomplete information may affect fishery exploitation when countries do and do not cooperate. They found that being sufficiently "in the dark" and facing the risk of stock extinction, insufficient knowledge may entice countries to be more cautious. Better management would improve the yield from the stock and postpone its ultimate disappearance but probably not prevent it altogether, they write.

Hannesson's paper deals explicitly with global warming, which is modeled as a trend with fluctuations. The warming effects of migrations of a fish stock, which originally is controlled by one country, gradually spills over into the other country's economic zone and ends up there. Here again, insufficient information may have an upside. If a country sees a fish stock slipping out of its zone for good, it might be tempted to ruin it completely before it disappears. But if it is not clear what is going on, then it might abstain from this in the belief that all will not be lost.

A paper by Janne Kaje, King County Department of Natural Resources and Parks, Seattle, and Daniel Huppert, School of Marine Affairs at the University of Washington, brings up the question of forecasting climate change. To be useful, the authors state, forecasts need to be timely and reliable and they must be worthwhile in the sense of yielding improvements in economic results that outweigh their costs. Kaje and Huppert's fundamental point is that not all forecasts, even very accurate ones, meet these self-evident criteria.

"These six papers all contribute to the understanding of how global

warming can affect our fisheries and subsequently our economies," Hannesson writes. "These papers provide a beginning to tackling this large and very important task."

Source: Arizona State University