



NOAA NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION
UNITED STATES DEPARTMENT OF COMMERCE



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July 16, 2012
SS12.07

Trio of factors drive marine fisheries production in Northern Hemisphere ecosystems

Comparative analyses of 13 ecosystems provides insight, potential management tools

Comparisons of marine fisheries in thirteen northern hemisphere ecosystems reveal that a trio of factors - fishing, food web/predator-prey interactions, and environmental conditions - drives marine fisheries production. Better understanding of the relative influence of this triad of drivers on fish populations can make fishery management more effective, as well as improve overall understanding of how fisheries work within an ecosystem.

Ten studies, published online July 12 in *Marine Ecology Progress Series*, identify trends and common patterns governing fisheries productivity in northern hemisphere temperate marine ecosystems. The papers are available as open access articles.

“Marine fisheries occur within the bigger picture of marine ecosystems, and their sustainability is linked to processes that affect the whole system,” said NOAA Fisheries Service researcher Sarah Gaichas of the Northeast Fisheries Science Center (NEFSC), who contributed to several of the studies. “It was a challenge to come up with a fairly simple way to view the data from individual species to the full system level in order to compare ecosystems in Canada, the US and Northern Europe. We did, through the use of a simple production model, a tool that allowed us to organize data from different systems within a common framework.”

Production models have long been used in fisheries and ecological sciences, and can provide valuable information on ecosystem-based fisheries management. The models require only basic data on catch and biomass, so they are applicable to both well known and more obscure species caught by fisheries. They can also be applied to multiple levels of organization, from single species to groups of species within ecosystems, and can provide ways to measure and express the condition of a stock, a group of stocks, functional groups and for whole ecosystems.

The studies resulted from two international workshops in 2010 and 2011 in Woods Hole, Mass. organized by Jason Link of NOAA’s Northeast Fisheries Science Center. At these meetings, participants assembled the large data set used in the studies. These data describe fisheries, food webs, biological and physical interactions, and environmental times-series information collected on northern hemisphere marine ecosystems.

Researchers have since used the data to compare 13 marine ecosystems off Canada, the US, and northern Europe, all northern subarctic temperate regions. They include the Bering Sea, Gulf of Alaska and Hecate Strait in the North Pacific, Georges Bank and the Gulf of Maine, the Gulf of St. Lawrence, Labrador and Newfoundland, and the Eastern and Western Scotian Shelves off Canada to the North Sea, Norwegian Sea, Baltic Sea and Barents Sea.

“We stepped back and took a big picture look at these thirteen ecosystems with a substantial amount of data and a simple modeling tool,” said Gaichas. “Different factors or drivers are important in different systems, but some common results were found as well, which suggests that our project has identified some fundamental features of marine ecosystems with important management implications.”

The standardized database built for this project provided the foundation for the comparative analyses presented in the studies. The database is itself a significant contribution to ecosystem-based fisheries management given the amount of information it contains: more than 70,000 records including 466 biological and 162 environmental time series across the 13 ecosystems.

“Using production modeling with the comparative approach makes valuable and rapid progress towards ecosystem-based fisheries management, whether the aim is a better understanding of the ecosystem or providing operational management advice,” Gaichas said. “Relatively simple models combined with long-term time series maintained by the participating international institutions are very useful, and highlight the benefits of collaborative projects.”

NOAA and other government researchers, as well as academic scientists from the US, Canada, and Europe contributed to the effort. NOAA Fisheries Service organized and hosted the 2010 and 2011 workshops. The workshops were jointly funded by the US Comparative Analysis of Marine Ecosystems Organization, the Norwegian Research Council, and Fisheries and the Oceans Canada Ecosystem Research Initiative. The NOAA, Canada’s Department of Fisheries and Oceans, and Norway’s Institute for Marine Research also contributed significant resources to this project.

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Marine Ecology Progress Series (Volume 459) Theme Section 42: <http://www.int-res.com/abstracts/meps/v459/p159-163/>

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