LENFEST OCEAN PROGRAM

A research project
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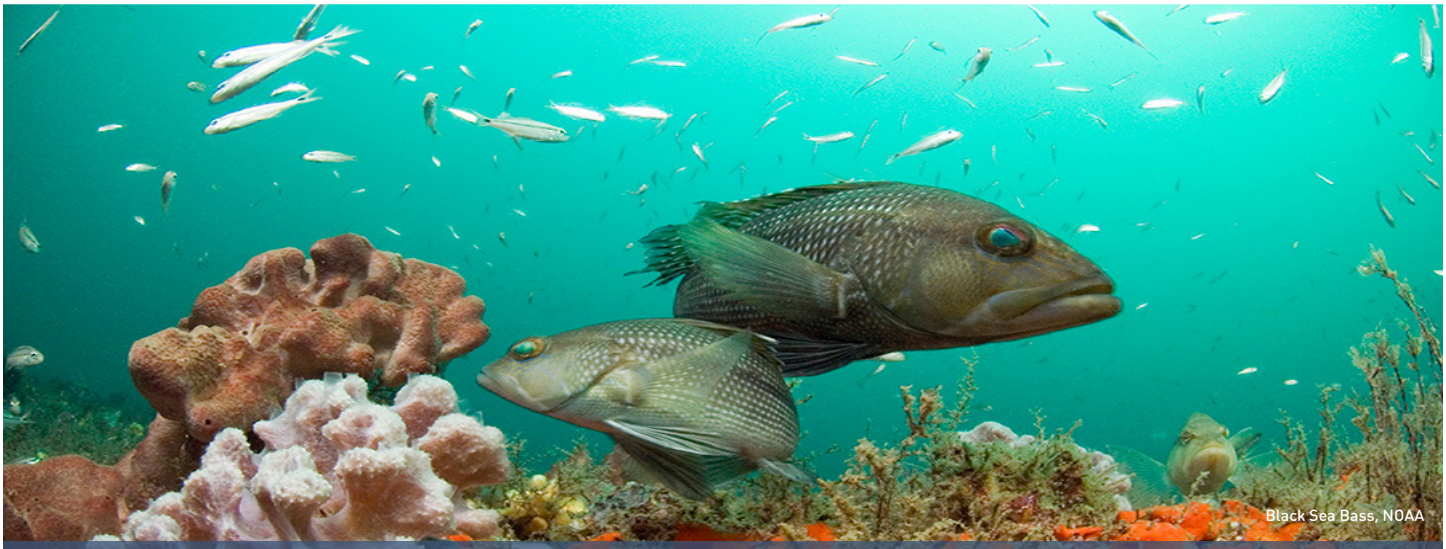

Black Sea Bass, NOAA

NEW STUDY TO DEVELOP SHORT-TERM SPECIES DISTRIBUTION FORECASTS FOR FISHERIES MANAGEMENT

As global oceans warm, many fish and invertebrate species are shifting their distributions, affecting both their availability to fisheries and their productivity. Fisheries scientists have already worked to provide long-term projections of distribution shifts, which can be useful to managers in a strategic sense. However, these long-term forecasts do not provide the concrete, short-term information that is of greatest need to fisheries managers.

Decisions regarding population reference points, catch limits, spatial allocation of harvest, and other management actions are typically made for the upcoming year or several years. Species distribution forecasts can best inform those discussions if they operate on similar timescales. To address this need, the Lenfest Ocean Program is supporting Dr. Malin Pinsky of Rutgers University and his team to develop models to forecast how the distributions of four economically important species along the U.S. East Coast will change over the next 1-10 years.

AS SPECIES SHIFT, MANAGEMENT CHALLENGES ARISE

Along the U.S. East Coast, climate change has already affected species distribution, abundance, productivity, and interactions with other species, presenting dilemmas for management. For example, the northward expansion of summer flounder has led to conflicts over harvest access. The Mid-Atlantic Fishery Management Council (MAFMC) has expressed interest in better incorporating climate impacts into management approaches through development of its Ecosystem Approach to Fisheries Management (EAFM) Guidance Document.

As part of the EAFM process, the MAFMC reviews the National Oceanic and Atmospheric Administration's State of the Ecosystem and Ecosystem Status Reports. These reports provide ecosystem context for management decisions, including identifying priority species for adapting fisheries management to climate change and clarifying long-term risks. Shorter-term projections could provide more concrete and immediate guidance

> **"BY PREDICTING MOVEMENTS OF STOCKS IN THE NEAR TERM, WE CAN MORE CLOSELY MATCH THE TIMESCALES AT WHICH FISHERIES MANAGEMENT DECISIONS ARE MADE."**
>
> - Malin Pinsky

for key fisheries management decisions, including: (1) allocation of harvest; (2) consideration of ecosystems; (3) annual catch limits; and (4) spatial planning for offshore energy development.

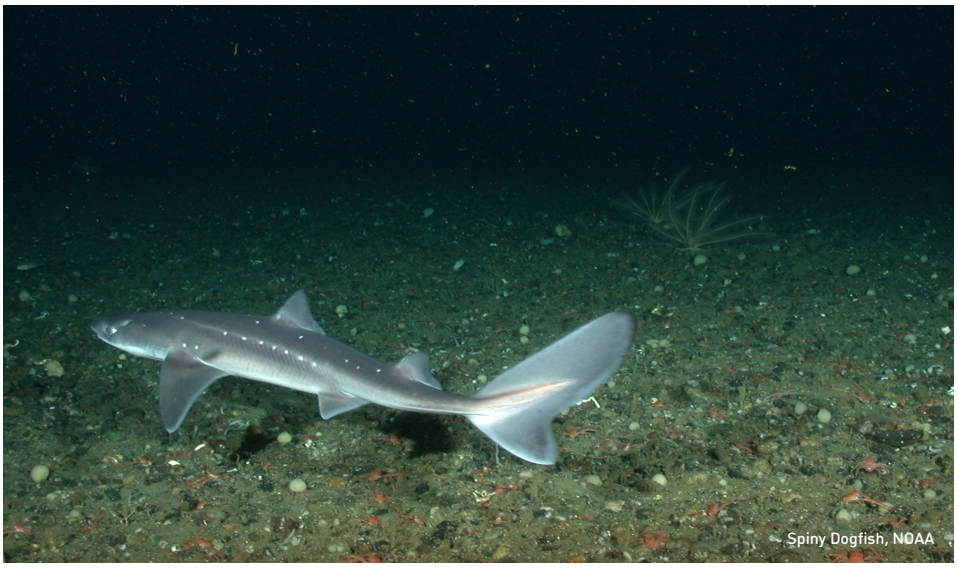
LINKING CLIMATE FORECASTS WITH BIOLOGY TO PREDICT MOVEMENTS

In this project, Pinsky and his colleagues will produce 1-to-10-year distribution forecasts for shortfin squid, spiny dogfish, summer flounder, and gray triggerfish. These four economically important species exhibit diverse life-history strategies and are subject to different management challenges. Eventually, the methods tested in this project could be expanded to other species.

For each species, the team will use oceanographic conditions such as temperature and oxygen, coupled with each species' unique population dynamics, to model short-term changes in distribution using an approach known as dynamic range modeling. The researchers expect that, compared to previous projections that rely solely on habitat characteristics, the dynamic range model will provide more accurate forecasts for the short-term timescales of most immediate interest to managers.

To ground-truth their method's accuracy, after developing models for each species based on size-specific abundance data from trawl surveys and historical oceanographic data, the researchers will predict species distributions from previous years and observe how the model performs. Using historical catch data, they will also test whether fishing activities significantly influence distributions.

The three-year project began in March 2019. The research team plans to convene meetings with fisheries managers, scientists, and stakeholders to co-design the forecast system, refine graphics and statistics to communicate its findings, and discuss how it will be used. The researchers will also make the forecast system available on an open-access repository that scientists and managers can use to develop predictions for other fisheries.



Spiny Dogfish, NOAA

RESEARCH TEAM

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