Scientists integrate data in three dimensions to study climate effects on young fish

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From the surface, the two areas of ocean off the coasts of northern New Jersey and Long Island, New York look the same. But to NOAA scientists, the four-square-mile patches could not be more different as they view real-time underwater images and environmental data to try to figure out what lives there and how climate change is affecting marine life, especially very young fish.

"These areas are much more dynamic than terrestrial landscapes and not what we are used to thinking about the ocean," said John Manderson, a fishery biologist with NOAA's Northeast Fisheries Science Center (NEFSC) at the James J. Howard Marine Sciences Laboratory in Sandy Hook, N.J. "People look at the ocean floor as the habitat, but don't think about the connection with the water column above it and how ocean fronts, like atmospheric weather, move through to create a constantly changing environment that affects fish and other marine life. It is a seascape, a moving 3-D environment."

Manderson and colleagues in the NEFSC's Behavioral Ecology Branch recently completed their first two-week cruise to the study area for the 2008 Ecology of Coastal Ocean Seascapes (ECOS) project. Another two-week cruise will be conducted in July, a third in September. There were some scientific surprises on the first cruise, and an unexpected event. On June 9, near the end of the first cruise, they rescued three teenagers from a swamped boat.

The goal of ECOS is to view the two seascapes in an integrated way

using real-time data, focusing on the distribution and condition of early life stages of fishes, and develop models to aid fisheries research and management. For example, the models could ultimately be used to support fisheries managers to make informed decisions regarding the importance of habitat type for managed fish species, and to help answer questions about effects of climate change on the success of fish stocks.

One ECOS study site is south of the Hudson – Raritan River estuary and plume, the other about 20 kilometers (12 miles) north and east off Long Island. The scientists aboard the NEFSC's 50-foot research vessel Nauvoo for the first cruise were surprised by what they saw, especially the differences in bottom life in study areas just a few miles apart with similar bottom structure.

"Based on side-scan sonar data and other information, we selected two study areas that had similar sandy bottoms because we were towing a video camera close to the seafloor," Manderson said. "You would think they would look similar on video because they were not far apart, but what we found was more temperate marine life species like fluke, anchovies and sea robins off New Jersey, and scallops, squid egg mops and winter flounder more typical of New England off Long Island. The differences in the two seascapes were striking."

Technology has been a huge help to the ECOS project. The Nauvoo is equipped with side-scan sonar, fisheries hydroacoustics, a Wi-Fi link to shore that receives real-time satellite and high-frequency radar imagery of data collected by a regional ocean observing system, GPS, an underwater video camera, and environmental sensors that measure water temperature, salinity and other conditions.

Each day during the two-week cruises, the team of six scientists and ship's crew head out from the Atlantic Highlands Marina to the study sites, approximately 5 to 10 miles offshore. Working in depths up to 60

meters (about 100 feet), they use the various real-time data they receive from above and below the surface to develop a track line or sampling route of the ocean floor within their study areas. They tow a small video camera sled, stop at stations along the track to sample from the surface to the seafloor with a CTD (conductivity, temperature, density) recorder, and collect other environmental data. A beam trawl is used to collect specimens and to groundtruth the video imagery. Tissue and diet samples are collected from the animals and brought back to the laboratory.

"Right now we are characterizing the living marine resources and their habitats. We're mainly interested in how the early life histories of fish effect the survival and productivity of the commercially and recreationally important species of our region," Manderson said. "We hope to expand the studies to examine habitat effects on growth and mortality and the reproduction of adults. We will also be developing integrated laboratory and field experiments, allowing us to model distribution of species, recruitment of year classes, and other useful information."

Manderson says the ECOS project, funded by NOAA, is a step forward in coastal fisheries research because they are looking at fish habitats holistically and dynamically in areas close to shore that have not been well studied.

"We're using a variety of real and near real-time data that integrate information and present a three-dimensional view of the environment," he said. "We're able to move with a moving ocean, sampling with advanced technology and seeing it as it happens so we can adjust our sampling strategies as necessary. It is exciting to think of the possibilities."

Source: NOAA National Marine Fisheries Service