In this winter Coastlines,

Coastal Habitat Restoration and Essential Fish Habitat

are featured, two leading coastal issues of our day.

1998 was the International Year of the Ocean. However, a press release by the White House on January 11, 1999, reads: "Today's announcement that 1998 was the warmest year on record is yet more evidence that global warming is real." According to Vice President Al Gore, "We owe our children and grandchildren a healthy planet that will support strong, sustainable economic growth. Today's announcement makes the task all the more urgent." With New York's 3400 miles of coastline, some of which is the most populated in the country, restoring coastal ecosystems to a healthy state is a priority. We urge our readers to consider Robert Kent's feature article entitled **"Restoring Coastal Ecosystems."**

Photo by Barbara Branca

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—Vice-President Al Gore

Essential Fish Habitat

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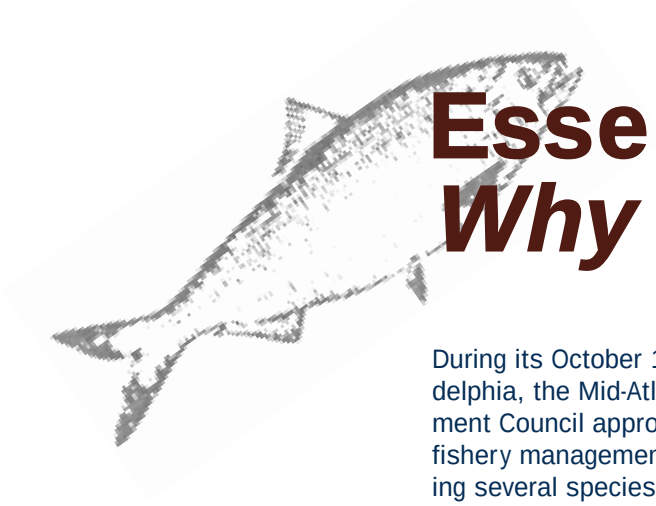
—National Sea Grant Director Ronald C. Baird

is a concept that sprang from the Sustainable Fisheries Act of 1996. Referring to this law, Ronald Baird, Director of NOAA's National Sea Grant College Program says, "This is the most significant piece of environmental legislation since the Clean Water Act of 1972." Continues Baird, "The law now mandates not only the management of the harvest of commercial species, but the environment necessary for the reproduction, feeding and growth of those species as well. The full implications of essential fish habitat are not widely appreciated by the public. They will be shortly." With Mark Malchoff's featured article entitled **"Essential Fish Habitat: Why all the fuss,"** *Coastlines* aims to familiarize our readers about this essential concept.

Photo and wooden fish sculpture by James Cook



Essential Fish Habitat: *Why all the fuss?*

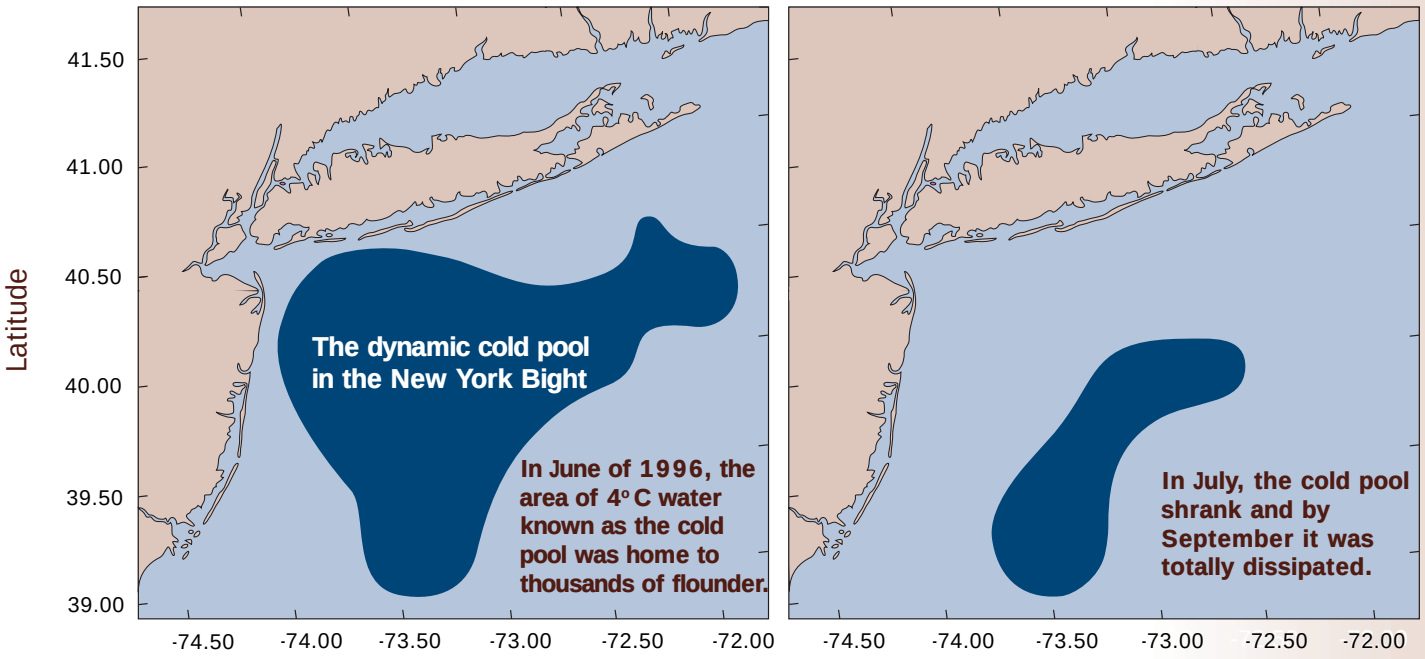
During its October 1998 meeting in Philadelphia, the Mid-Atlantic Fisheries Management Council approved amendments to fishery management plans (FMPs) governing several species of importance to New York coastal residents. Four FMPs governing the management of surfclams, ocean quahogs, squid, mackerel, butterfish, summer flounder, scup, black sea bass, and bluefish, were modified in accordance with the requirements of the reauthorized Magnuson-Stevens Act, better known as the Sustainable Fisheries Act (SFA) of 1996. Among the requirements of the SFA are sections within the plans that address the thorny problems of overfishing, bycatch minimization, and identification of essential fish habitat (EFH). Prior to the passage of the SFA, critics of the federal fisheries management process successfully argued that the tools traditionally available to fisheries managers such as mortality reduction by harvest restrictions, were insufficient to deal with many of the challenges facing coastal fisheries. From Alaska to Maine to the Gulf of Mexico, many fish population declines have been attributed to lost wetlands and seagrass beds, dammed rivers, contaminated sediments, polluted coastal bays, and other habitat loss or degradation. The essential fish habitat provisions of the SFA were developed to meet the ecological and economic imperative to address the nation's habitat problems before the treasured finfish and shellfish that depend on them disappear.

Aboard the *F/V Illusion,* graduate student Brian Steves collects conductivity, temperature and depth data using a CTD instrument. Biological sampling was conducted using 6-foot beam trawls. Photo by Mark Malchoff

Under the SFA, essential fish habitats must be identified for all life stages of species managed under fishery management council plans. Activities that damage that habitat, including fishing, must also be identified, as well as conservation and enhancement measures. In addition, the SFA requires that federal agencies consult with the Secretary of Commerce through the National Marine Fisheries Service on any activity that may adversely affect EFH.

All of this sounds great, but the task is much more involved than the legislative language would lead one to believe. Imagine trying to describe the habitat requirements for all the life stages (egg, larvae, juvenile, and adult) for the dozens of species managed by NMFS and the regional council. How, for example, does temperature or salinity or dissolved oxygen or light influence the survival or distribution of summer flounder during each life stage? Also, how do anthropogenic factors influence the biological and physical environments frequented by any of these life stages? An amendment to the Summer Flounder, Scup, and Black Sea Bass FMP drafted last summer by the Management Council utilized 114 pages of text to accomplish this task. Fortunately for those authors, these three species are fairly well studied. Oftentimes this information is simply not available for all of the stages of all of the 600 plus fish stocks covered by the management plans.

The depth of the problem may partially explain why a coalition of U.S. environmental groups



issued statements of concern after learning that several regional fishery management councils had missed the October 11, 1998 deadline to revise FMPs to better address overfishing, bycatch minimization, and habitat protection. Fortunately, efforts by government agencies, non-government agencies such as the American Fisheries Society, Sea Grant, resource users and others are starting to plug some of the data gaps which need filling if the EFH provisions of SFA are to be met.

In 1995, well before the passage of the SFA, a NY Sea Grant specialist, a university faculty member, and a commercial dragger worked together to complete a project designed to increase our understanding of how juvenile groundfish (especially yellowtail flounder) distribute themselves in the Mid-Atlantic Bight. This research, funded through the Saltonstall-Kennedy Fisheries Development Program, was aimed at filling in some of our knowledge gaps about the habitat requirements of recently settled groundfish.

Dr. Robert Cowen, formerly of the State University of New York at Stony Brook (currently with the Rosenstiel School of Marine Science at the University of Miami), and Sea Grant Specialist Mark Malchoff proposed a 12-18 month sampling regime during 1996 and 1997. Graduate student Brian Steves conducted most of the fieldwork and analyses with several objectives in mind. Steves sought to identify habitat requirements of young-of-year (YOY) continental shelf groundfish throughout the year. Commonly, most groundfish start out life as floating eggs. The larvae produced from these eggs are free swimming and are usually found well up in the water column. These larvae metamorphose after several weeks. In about 45 days, after hatching, yellowtail flounder take on more adult-like behavior and appearances as they begin side swimming, and their eyes migrate to the upper side. At the same time, these fish settle out of the water column onto the ocean floor within a period of a few days or possibly hours for some species. Larvae making this transition to the juvenile stage may encounter a variety of substrates. They may also encounter different water masses (shelf water, slope water), with varying temperatures and salinities. In many cases we do not yet know what mix of habitat characteristics constitutes "the right stuff" enabling the survival and growth of a particular species.

Project scientists also analyzed the information to see how fish were distributed and how such distributions changed over time, or from one location to the next. By studying these "spatial and temporal distributions," Steves and Cowen hoped to explain some of the year to year recruitment variability seen in groundfish.

Eight sampling cruises were conducted aboard the *F/V Illusion,* a commercial dragger owned by Mark and Mary Bess Phillips based in Greenport, New York,

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The Cold Pool

First studied by oceanographers several decades ago, a cold pool forms when surface water temperatures off NY's Atlantic Coast begin warming in the spring. As water temperature increases, its density decreases and by mid-summer, a layer of warm, low salinity water floats above the colder, saltier bottom waters. The two layers stay separated by a zone known as a thermocline across which no mixing occurs. This annual cold pool stretches from Cape Cod to Cape Hatteras, NC and to the edge of the continental shelf and most pronounced in the New York Bight. It is bounded offshore by warmer, higher saline "slope water," and inshore by shallow coastal water masses which have been heated by the sun and mixed by the tides. Fish who prefer the temperature of the cold pool are effectively prevented from leaving it during the summer months. Come fall, the water column "destratifies," as the warm surface waters cool and begin sinking, at which point even light winds can cause mixing between the two layers.

In 1996, the turnover was abrupt, early and "hot" relative to average years as two strong late summer hurricanes put out enough wave energy to disrupt the seasonal thermocline, and dissipate the cold pool. Unlike a normal turnover in which cool waters gradually sink, these storms suddenly forced warm water into zones that would normally remain cool well into fall.

"Rating" Fish Habitat

If EFH is to become the tool envisioned by Congress, "habitat ratings" may be key. Habitat restoration, protection and enhancement all involve socio-economic trade-offs, and it's likely that only the "best" habitat will receive maximum protection under the EFH provisions.

Several presenters at a recent EFH Symposium spoke to the fact that habitat quality is difficult to define and measure, especially in the Mid-Atlantic where migratory species often dominate the fisheries community. Several scientists related their experience in trying to better define the habitats of killifish, winter flounder, summer flounder, tautog, spotted seatrout, and spiny lobsters from New Hampshire to Florida. These experts concurred that research including multiple-year data sets and habitat modeling in concert with geographic information systems may greatly facilitate the tough decision making process that lies ahead.

and two aboard the State University of New York at Stony Brook's *R/V Onrust.* During each of the ten cruises, sampling tows were made during daylight hours at depths of 65 to 300 feet on three transects in the New York Bight. After ten cruises, the research confirmed that 49 species utilize these environments. Ten of them were flatfish such as deepwater flounder, plaice, yellowtail founder, fourspot flounder, and windowpane flounder. Yellowtails headed the list with about 20,000 specimens recovered.

Fish density data confirmed that juvenile yellowtail habitat, like that of the adults, seems to include the coldest bottom waters found on the shelf during the summer. The highest juvenile yellowtail abundances recorded during the study were in the summer months, coinciding with distribution of cold (less than 46°F) bottom water known as the cold pool (see p. 11 sidebar). This pattern changed dramatically by late September when the cold pool had dissipated and juvenile yellowtail numbers had plummeted. Steves and Cowen hypothesize that most of the yellowtails died either directly or indirectly from the temperature increase after the turnover. A sharp increase in bottom temperature, more than 18°F at mid-shelf, caused by a passing hurricane was likely a large source of metabolic stress. Aside from any direct temperature induced mortality, such stress undoubtedly increased rates of predation upon the yellowtail juvenile population.

The project successfully added to our knowledge of the early life history of several economically and/or ecologically important species. "Up to now, our knowledge of the habitat requirements of a whole suite of important fish has been limited. Now we're getting that knowledge," said Cowen. He went on to offer the following analogy: "Saying that the continental shelf in the New York Bight is essential fish habitat, is like saying humans live along the coast. It doesn't tell us if the humans are using wetlands, or beaches or cliffs." Such generalized information doesn't offer much in the way of predictive power, but the detailed, species-specific habitat requirements identified in this project will aid in our understanding recruitment processes of these species. Predicting whether a population is increasing or decreasing remains a long-term effort for fisheries scientists.

Other data from the cruises and related projects in Cowen's lab should continue to add to what we know about juvenile groundfish habitat interactions. Yet to be analyzed are growth rate data. With the ability of scientists to measure juvenile fish growth on a daily basis, it may be possible to compare growth rates within the study area, and see if some areas produce faster growth than others. Such differences may provide another tool that biologists can use to rate habitat.

—Mark Malchoff

Mark Malchoff is New York Sea Grant's recreational fisheries specialist.

Photo by Mark Malchoff

Newly hatched yellowtail flounder, the most abundant denizens of the deep waters of the cold pool.