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Cod

CONNECTIONS WITH OTHER COMMUNITIES

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of different communities**

Cod have been a major fishery in New England since colonial times. Over the years, fishermen and scientists have tracked the movements of cod, located their major spawning grounds and developed methods to estimate their abundance. Our understanding about how cod fit into the natural world, though incomplete, shows that cod are part of a complex and fascinating biological community.

Adult cod are opportunistic feeders and consume a variety of species ranging from tunicates, sea anemones and hydroids, various mollusks and crustaceans, to herring, redfish and even young cod. Mollusks are the major source of food for cod, with any other species encountered small enough to swallow making up the rest. Cod are notorious for feeding on schools of squid and small fish of any kind.

Most cod reproduce for the first time in the spring of their fourth year when they are about two feet long and five pounds in weight. Cod can grow to impressive size. There are numerous reports of fish being caught that weighed over 100 pounds.

When they were abundant in the Gulf of Maine, large cod could frequently be found feeding close to shore in the fall. As winter approached, they would move into the basins and channels to await the onset of spawning season.

In contrast, smaller, younger adults, while still remaining in the general area, often travel much farther along fairly definite routes to and from their spawning ground. During this nomadic period, some tagged cod have traveled great distances prior to returning.

Cod have synchronized their spawning to coincide with seasonal plankton blooms. They are "broadcast" spawners releasing their eggs into the water column where they drift until hatching. Copepod and other minute crustacea become the first prey. Successful reproducing depends on the eggs hatching when the plankton are still small enough to eat. If the larvae arrive too early, they starve; too late, and they are eaten.

Rather than releasing their eggs all at once, cod release small quantities over an extended period of time. The survival advantages are clear: by releasing eggs over an extended period of time, some of the spring will be more likely to find the right size of plankton to eat and survive. Most will not.

By early spring, cod begin to arrive at their spawning grounds. These are areas with sandy, gravelly bottom and often are located near gyres or eddies. A few weeks later, spawning begins — and marks the start of the cod's greatest adventure. As they grow, the developing stages of cod are to become part of a whole series of different communities, for the habitat needs of larvae, juveniles and adults differ greatly.

Tides and currents disperse cod eggs throughout the Gulf of Maine. Depending on temperature, the eggs hatch in a few weeks (about two weeks at 43 degrees Fahrenheit) with an attached yolk sac. After one or two weeks, during which the yolk sac is absorbed, the mouth has fully developed. The larvae commence feeding on copepods and other small crustaceans.

During this period, schools of migrating mackerel and herring, clams and other mollusks, various zooplankton and even larger cod larvae are feeding on the developing cod. Survivors of this stage grow rapidly and soon metamorphose to tiny juveniles and settle to the bottom, where the cod must quickly find shelter. Gravel of a size that allows them to hide is required. If the particles are too large, predators quickly eat them. If too small, they will have no shelter and again they will be eaten. Gravel such as that found beneath gyres and eddies provides high survival rates.

Unlikely as it seems that larvae carried on currents for so long would remain on the same "ground" in significant numbers, those cod that survive to adulthood do return each year to the same spawning area.

Coinciding with metamorphosis and settlement are the appearance of larval stages of barnacles and various mollusks, amphipods and tiny worms, all of which the cod add to their previous diet. At the same time, the cod shares its new habitat



with many additional predators. Lobsters, crabs and a multitude of young fish not only compete with cod for shelter and food; those that are large enough also eat them.

Shelter continues to be critical for the juvenile cod. After growing too large for the gravelly shelters of the settling area, they move to bordering benthic communities to feed and hide. As they continue to grow, they simultaneously leave one community as they become part of another.

If the necessary critical habitat is located too far away to reach safely, or is too damaged to support them, the young cod will soon starve or be eaten, creating a bottleneck that makes it difficult if not impossible for cod to survive.

Soon the juveniles are big enough to begin foraging over larger areas. With their varied diet, cod are able to find food in most of the habitats surrounding them. But now they must compete for food and space with other young groundfish such as pollock and haddock. Each species spends much of the time over certain bottom types, cod tending to rockier bottom than the others. (Little is known about the rela-

tionships with competitors during juvenile stages, but a single pollock of the same size reportedly will send a school of young cod into hiding.)

At this time in their lives, young cod are exposed to larger predators. Year-old pollock devour them in great numbers. Mackerel, sculpin, hakes, flounders, dogfish and even larger cod take their toll during the first year.

By the time the water begins to cool in the fall, the cod have grown to six inches or more and gradually move to deeper water, along with young herring and other groundfish. Having greater tolerance for temperature differences than adults, the juveniles aggregate around the safety of the edges and tops of deeper reefs, with larger fish predictably occupying the deeper soundings.

By winter, the cycle has begun again. Cod, according to their ages, have abandoned their summer haunts for deeper, more comfortable places and now await the beginning of the next year.

— Ted Ames
Stonington, Maine

