Importance of Forage Fish in the Delaware River

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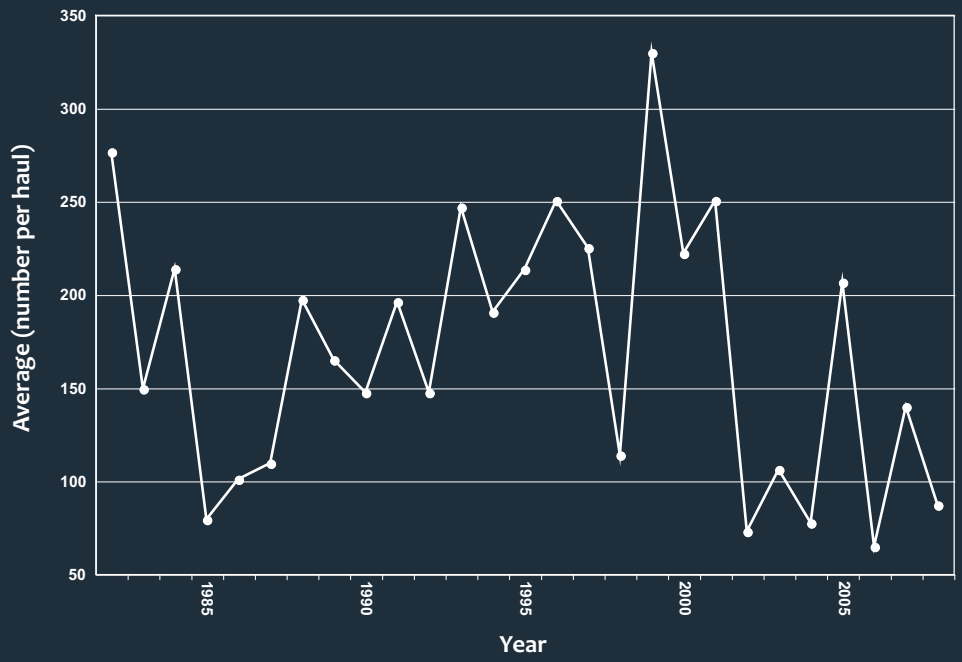
Since 1980, New Jersey Department of Environmental Protection's Division of Fish and Wildlife's Bureau of Marine Fisheries has conducted a beach seine survey for striped bass on the Delaware River. Data collected during this survey provides biologists with information on the population status of many species, not just stripers. For more details on this survey, read *New Jersey's Priceless Resource—Studying the Delaware River* on our Web site www.NJFishandWildlife.com/artdelstudy08.htm.

Many species captured during the survey are forage fish, commonly considered as bait fish. Their schooling behavior, size and abundance make them a significant food source for predator species including striped bass, bluefish, weakfish and white perch. These predators are important species recreationally, commercially as well as economically.

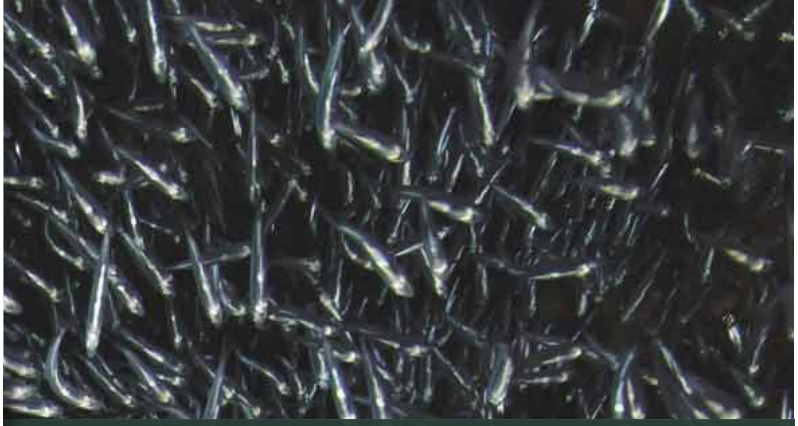
As a major food source for predator species, forage fish provide the sustenance necessary for predators to reach reproductive maturity. Forage species produce abundant offspring, enough to sustain both recreational and commercial fishermen and the natural predators that inhabit the ocean. Without healthy forage fish populations, the resulting predator-prey imbalance could become critical to a particular species.

In contrast, predators have an impact on all forage species populations. Since every fish consumed by a predator reduces the population, collectively, predators can prevent a single forage fish species from becoming dominant by lowering both survival and reproductive rates of the prey. Predation assures a "survival of the fittest" scenario. Without predation, certain forage species could overrun other fish populations. The predator-prey relationship is vital to maintain a balance among species.

The Delaware River beach seine survey provides an inventory of fish while most are still juveniles. The methodology and equipment used are designed to catch smaller fish on their nursery grounds close to the shoreline. Individual fish of each species are counted so biologists can assess the populations. Fish and Wildlife developed a forage fish index for the Delaware River which includes the following species: alewife, American shad, Atlantic silverside, Atlantic menhaden, banded killifish, bay anchovy, blueback herring, Eastern silvery minnow, gizzard shad, mummichog, spot and spottail shiners.



Over the years, past surveys showed that forage fish comprised more than 71 percent of the total catch. As with most surveys, the abundance of forage fish populations within the Delaware River can vary annually. Since 1985, the forage fish index increased steadily through 1999, peaking with an average of 330 fish per haul (see figure). Water quality improvements were most likely the driving force behind this increase, especially for anadromous



species such as shad and river herring. Not all species increased however. For example, while the forage fish *index* increased through 1999, Atlantic silverside *catches* peaked in 1993 (25 fish per haul) and have been declining ever since.

During years of severe flooding (2006) and drought (1998, 2002), total catches were lower than normal. During a flood year, there is an influx of fresh water causing a drop both in salinity and water temperature. Species that prefer saltier water will move out of the sampling area which will lower the forage fish index. During drought years there is no fresh water influx; salinity and water temperature both rise. As salinity increases, fish retreat into streams and tributaries where salt concentrations are lower. Likewise, most fish caught during a beach seine survey for striped bass are avoiding areas where water is too warm. For these reasons, the forage fish index in 2006 was the lowest average ever—at only 71 fish per haul.

The index has declined in recent years; currently, forage fish numbers in the Delaware River are at a similar level to those of the mid to late 1980s. Biologists are concerned, because the lack of forage fish is a signal that something is out-of-balance in the Delaware River. Of particular concern in New Jersey is the decline of the bay anchovy.

Typically one of the most abundant species in the Delaware estuary, the bay anchovy is a primary food source for young weakfish, bluefish and striped bass. The average number of bay anchovy caught per seine haul has been declining since 1997. During that year, catches averaged 105 fish per haul. From 1998 to 2001, average bay anchovy catches ranged from 28 to 87 fish per haul. Since 2001, there have been no averages greater than 15 fish per haul. Future effects from this serious decrease are not yet fully understood, but the recent decline in some predatory species such as weakfish may be a result of this food chain imbalance.

The Delaware River seine survey demonstrates that forage species are the backbone of the survey's total catch. As an essential tool for biologists to monitor species trends, this survey provides vital information on which to base smart fisheries management decisions.

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