Weakfish
Cynoscion regalis

Common Nmes: Tide runner, sea trout, gray trout, squeteague

Interesting Facts:
*** Weakfish are members of the drum family (Sciaenidae), which also includes spotted sea trout, croaker, spot and red drum. The males of these fish species are all noted for the drumming noise they produce, particularly during spawning periods.**
*** The name weakfish refers to the tender, easily torn membrane of the fish's mouth, rather than its fighting ability.**
*** Delaware declared weakfish its state fish in 1981.**

Largest Recorded: 38 inches, 19 lbs and 2 oz. (Delaware Bay, 1989)

Maximum Age: 17 years

Age at Maturity: 90% mature at age 1, 100% mature at age 2

Stock Status: Depleted, overfishing is not occurring

Species Profile: Weakfish
Recovery of Historically Important Species Hindered by High Natural Mortality

Introduction
Weakfish, *Cynoscion regalis*, have supported fisheries along the Atlantic coast since at least the 1800s. However, in recent years, commercial and recreational fishermen alike have had increasing difficulty landing weakfish. In 2010, total weakfish harvest reached an all time low of 278,000 pounds. For comparison, total harvest was greater than 31 million pounds in 1986.

The reduction in harvest reflects a drastic decline in weakfish biomass since 1996. Over the last 14 years, while fishing mortality has been modest and stable, natural mortality (deaths due to predation, starvation, and other natural causes) has increased to levels previously unseen. The result is a weakfish stock that is not subject to overfishing, but is depleted.

In response to these findings, the Commission's Weakfish Management Board implemented more restrictive management measures in 2010 intended to reduce the level of harvest without creating a large amount of discards, poising the stock for recovery should natural mortality decrease in the future.

Life History
Weakfish occur along the Atlantic coast of North America from Nova Scotia to southeastern Florida, but are more common from New York to North Carolina. Warming of coastal waters in the spring prompts an inshore and northerly migration of adults from their offshore wintering grounds between Chesapeake Bay and Cape Lookout, North Carolina to nearshore sounds, bays, and estuaries. Spawning occurs shortly afterwards, peaking from April to June, with some geographical variation in timing. Females continuously produce eggs during the spawning season and release them over a period of time rather than once. In the fall, an offshore and southerly migration of adults coincides with declining water temperatures. Feeding on microscopic animals, larval weakfish journey from spawning areas to nursery areas, located in deeper portions of coastal rivers, bays, sounds, and estuaries. They remain in these areas until October to December of their first year, after which the juveniles migrate to the coast. Growth in weakfish is especially rapid in the first year and they mature at a young age. Size at age-1 is variable but most fish are 10 to 11 inches long. As adults, weakfish are often found near the periphery of eelgrass beds, perhaps because weakfish feed primarily on shrimp, other crustaceans, and small fish that are found near these grass beds.

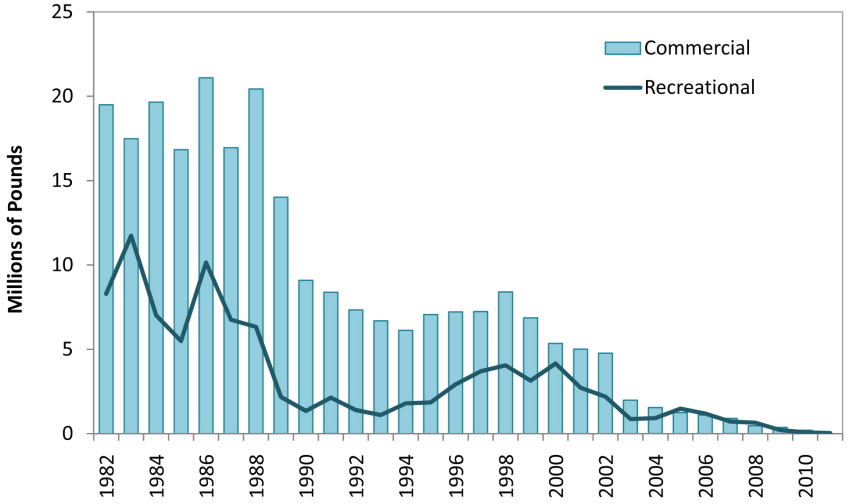
Recreational & Commercial Fisheries
Weakfish have supported fisheries along the Atlantic coast since the 1800s. Over the last 15 years, however, fishermen have had increasing difficulty landing weakfish. From 1950 to 1970, commercial landings fluctuated without trend, ranging from three to nine million pounds. The early 1970s began a period of tremendous growth in the fishery, with landings peaking at 36 million pounds in 1980.

The commercial fishery declined steadily throughout the 1980s, dropping to a low of six million pounds in 1994. Following an increase in abundance due to management measures, commercial harvest increased slowly through 1998. Beginning in 1999, commercial landings began to decline again, and by 2008, were reduced to less

than 500,000 pounds. Commercial landings in 2010 reached an all-time historic low of less than 200,000 pounds (see Figure 1). The primary commercial gears for weakfish are trawls and gillnets, although weakfish are also landed using pound nets and haul seines.

Recreational landings have followed a similar trend to that of commercial landings. After several harvests above 10 million pounds in the early 1980s, landings decreased to two million pounds by 1989, and hovered between one and two million pounds through the early 1990s. Harvest then increased to over four million pounds by the late 1990s, before exhibiting a decline like that in the commercial fishery. The 2011 recreational harvest is also at an historic low of below 37,000 pounds.

Figure 1. Commercial and Recreational Weakfish Landings
Source: Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division, 2012



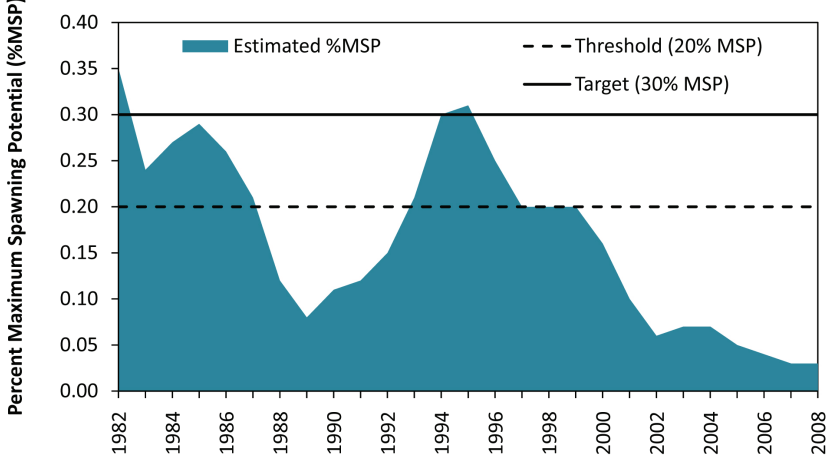
Timeline of Management Actions: FMP (1985); Amendment 1 (1991); Amendment 2 (1995); Amendment 3 (1996); Amendment 4 (2002); Addendum I (2005); Addenda II & III (2007); Addendum IV (2009)

Stock Status

Based on the latest benchmark stock assessment, which was conducted and peer reviewed in 2009, the weakfish stock is depleted, with spawning stock biomass (SSB) estimated at 10.8 million pounds (compared to 62 million pounds in 1996). While the decline in the stock primarily results from a change in the natural mortality of weakfish in recent years, it is further exacerbated by continued removals by commercial and recreational fisheries.

Natural mortality has risen substantially since 1995, with factors such as predation, competition, and changes in the environment having a stronger influence on recent weakfish stock dynamics rather than fishing mortality. Given current high natural mortality levels, stock projections indicate that the stock is unlikely to recover rapidly. In order to rebuild the stock, total mortality will need to be reduced, although this is unlikely to occur until natural mortality decreases to previous levels.

Figure 2. Weakfish Maximum Spawning Potential
Source: ASMFC Weakfish Technical Committee, 2009



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On a positive note, juvenile abundance surveys indicate that young-of-the-year weakfish continued to be present in numbers similar to previous years, suggesting that recruitment at this point has not been severely impacted despite low stock size. The next benchmark stock assessment is scheduled for 2014.

Atlantic Coast Management

In 1985, as a result of population declines and limited biological information, the Commission developed an Interstate Fishery Management Plan for Weakfish. While the goals of the plan and its two subsequent amendments were well intentioned, rebuilding of the stocks did not occur until the mid-1990s when the states implemented more restrictive regulations, first voluntarily, and then for compliance purposes once the Atlantic Coastal Fisheries Cooperative Management Act enabled implementation of a mandatory plan (Amendment 3). A subsequent stock assessment showed a weakfish resource that had experienced modest growth, which prompted the development of Amendment 4 to build upon these gains. Amendment 4 was implemented in 2003 to establish appropriate biological reference points, set a rebuilding schedule if limits were exceeded, revise the reference period on which recreational management options were based, increase the bycatch allowance, and establish a biological sampling program. Two subsequent addenda in 2005 and 2007 replaced Amendment 4's biological sampling program and bycatch reduction device certification requirements for the southern penaeid shrimp trawl fishery.

Despite the gains seen in the late 1990s, a stock assessment following the implementation of Amendment 4 depicted falling biomass after 1999. However, that stock assessment could not technically be used as a basis for management action, seeing as a review panel did not endorse the methods employed. Recognizing that fishing mortality was not the cause for biomass decline, but that low fishing morality would be required for a timely recovery if natural mortality declines, the Weakfish Management Board approved several management options under Addendum II aimed at controlling expansion of the fishery when stock status improves. The Addendum reduced most states' recreational creel limits, reduced the bycatch allowance, and established several management triggers to facilitate prompt response to a change in landings.

In response to the findings of 2009 stock assessment, which concluded that stock rebuilding can only occur if total mortality (fishing plus natural) is reduced, the Board implemented further harvest reductions in 2010 through Addendum IV. The implemented measures include a one fish recreational creel limit, 100 pound commercial trip limit, 100 pound commercial bycatch limit, and 100 undersized fish per trip allowance for the finfish trawl fishery. Further, all other management measures previously adopted to conserve the stock and reduce bycatch were maintained. The Addendum also established percentage based biological reference points with an overfished/depleted threshold of 20% SSB and a target of 30% SSB, relative to an unfished stock (100% SSB would be the SSB of an unfished stock).

In August 2010, the Weakfish Board approved a conservation equivalency proposal from North Carolina to implement commercial regulations allowing 10% bycatch of weakfish up to 1000 pounds, in place of the 100 pound trip limit. Analysis of North Carolina commercial data for 2005-2008 indicated that the alternative regulations would result in an equivalent landings reduction as the 100 pound commercial trip limit. Concern that the bycatch allowance may not reduce landings the same amount as a trip limit under a rebuilding weakfish stock prompted the Management Board to request that the Technical Committee annually review the fishery to ensure that conservation equivalency is maintained. The latest Board review of these measures in February 2012 concluded the amount of mortality from North Carolina's bycatch allowance has an insignificant impact on the weakfish total mortality, especially considering the continued decreased in overall weakfish landings.

Understanding Natural Mortality

Fisheries scientists and managers continually work on data collection and analysis methods to improve the reliability of stock status determination and improve confidence in management actions. However, one topic of fisheries science that continues to inspire both great interest and debate is natural mortality.

Fish die of either natural mortality (depicted by the symbol M) or fishing mortality (depicted by the symbol F), and the two added together constitute the total mortality (Z) experienced by a population. Assessment methods based on catch (removals of fish from a population) and its composition (i.e. the size, age, and sex of the caught fish) indicate total mortality, and F only comes from subtraction of M from Z. The challenge is determining natural mortality.

Natural mortality rates generally vary between fish species. For example, fish like anchovies, mackerel, and herring have high natural mortality rates, due to the fact they mature early, grow fast, and have short life spans. By comparison, fish such as tautog, cod, sturgeon, and haddock, have lower natural mortality rates because they mature later, grow slower, and have long life spans. However, natural mortality can also vary during each life stage of a particular species of fish. Environmental variation such as temperature, competition, food availability, and predation can also have significant and often immeasurable effects on fish survival as they mature from eggs and larvae to juveniles and adults.

Fisheries scientists attempt to include natural mortality in stock assessment calculations, because it is known that not all fish losses are due to fishing and that in some situations natural losses may be of greater significance to a population than fishing losses. Classically, there are two methods for deriving natural mortality, one involving a constant rate of mortality among ages, and another involving age-specific mortality. Constant mortality rate assumes each life stage experiences the same rate of loss or same chance of dying from natural causes. Age-specific mortality, on the other hand, assumes that an age-1 fish will die from natural causes at a different rate (generally higher rate) than an age-10 fish. It is estimated by using information on maximum age, growth, temperature, and female reproductive maturity.

Fisheries scientists continue to try and account for all of the components of natural mortality, and their constant fluctuations in amount and impact. They use population modeling, tagging, and general life history characteristics, to better understand of how these natural mortality process functions in managed stocks. In doing so, they continue to strive to develop measures that are based on the best available science. For more information on natural mortality or other fisheries sciences topics, download a copy of the Commission's Guide to Fisheries Science and Stock Assessments at http://www.asmfc.org/publications/GuideToFisheriesScienceAndStockAssessments.pdf. Printed copies can also be requested at info@asmfc.org.