

Striped Mullet

Mugil cephalus

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DESCRIPTION

Taxonomy and Basic Description

The Striped Mullet is in the order Mugiliformes, family Mugilidae. There are 9 species of mullet found in the western central Atlantic, the most common being the Striped Mullet (*Mugil cephalus* Linnaeus, 1758). There are two species of mullet found in South Carolina territorial waters: the Striped (*M. cephalus*) and White Mullet (*M. curema*). The remaining species within this family are found mostly in the Caribbean and Central/South America.



Striped Mullet are dark above (blue to green with some brown) and silvery on the sides. Conspicuous stripes on the sides are formed from dark spots at the base of scales. Dorsal and anal fins are unscaled. The second dorsal fin begins directly above the point where the anal fin begins. The anal fin has 3 spines and 8 soft rays; juveniles have 2 spines and 9 soft rays (Robins et al. 1986). Maximum recorded size for this species from the eastern Atlantic is 1,500 mm (59 in.) total length (TL) (Harrison 2002); however, the most common sizes in South Carolina range from 250 to 350 mm (10 to 14 in.) TL (McDonough et al. 2003).

Striped Mullet spawn offshore, and their offshore migrations in large schools have been well documented historically in South Carolina (Ravenel 1887; Jacot 1920; Anderson 1958; Arnold and Thompson 1958). Striped Mullet are considered isochronal spawning fishes; they have synchronous gamete development, and individuals spawn all of their reproductive material at once or in batches over a very short period of time (days as opposed to weeks) (Greeley et al. 1987; Render et al. 1995). Collins and Stender (1989) concluded that Striped Mullet spawn in and around the edge of the Continental Shelf off the coasts of North Carolina, South Carolina, Georgia and the east coast of Florida. These areas make up a larger area often referred to as the South Atlantic Bight. There is a protracted spawning season from October to April, with most spawning occurring from December through February (McDonough and Wenner 2003; McDonough et al. 2003). Most Striped Mullet in South Carolina recruit to estuarine nursery grounds from January through May and range in size from 18 to 30 mm (0.5 to 0.7 in.) TL (Anderson 1958; McDonough and Wenner 2003). Females mature at 3 years of age and at a size from 300 to 400 mm (12 to 16 in.) TL (Thomson 1963; Greeley et al. 1987; McDonough unpub. data). Male Striped Mullet begin to mature at 2 years of age and approximately 250 mm (10 in.) TL (Stenger 1959; McDonough et al., 2005). Juvenile Striped Mullet are omnivorous and feed on zooplankton and phytoplankton. Adults are herbivorous and feed primarily on diatoms and

algae siphoned from soft bottom mud, except in areas of submergent vegetation where they often feed on attached algae (Collins, unpub. data).

Status

The Striped Mullet is not listed as either an endangered or threatened species in any state in the Southeastern United States. Striped Mullet are a commercially important fish throughout the world for both fisheries and aquaculture purposes. In the Southeastern United States, there are significant commercial fisheries for Striped Mullet in North Carolina and Florida, and in all of the Gulf Coast states (a wholesale landings value of \$38.2 million for 1994 to 1998) (NMFS, 2001).

Striped Mullet are also one of the most important forage fishes in the estuaries of the Southeast and represent a significant food source to upper level piscivores (Wenner et al. 1990). Because Striped Mullet are ubiquitous throughout the estuaries of South Carolina and provide an important food resource for many recreationally important finfish species, the species is an excellent candidate as an indicator species for the relative health of finfish in South Carolina's estuaries.

POPULATION SIZE AND DISTRIBUTION

The Striped Mullet is distributed worldwide between latitudes 51° N and 42° S, although it is less abundant in the tropics (Thompson 1963; Rossi et al. 1998; Harrison 2002). Striped Mullet are euryhaline; they are able to tolerate the entire range of salinities from freshwater to oceanic water. As such, they can be found year-round throughout the full range of estuarine salinities as well as freshwater in South Carolina (Jacot 1920; Anderson 1958). In many river basins, Striped Mullet have been documented hundreds of miles from marine habitats with their only apparent limitation being physical barriers such as dams (Gunter 1938; Johnson and McClendon 1969). The population size of Striped Mullet in South Carolina is not known. The estimated annual mortality for each year-class from 1989 through 1998, based upon SCDNR surveys, suggested only slight annual variations (McDonough, unpub. data), which indicated a relatively stable population. This cohort-specific annual mortality rate is simply the annual percentage of each year-class that dies due to either natural or fishing mortality.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

Striped Mullet are found in most habitats throughout South Carolina estuaries including mud flats, oyster bars, salt marshes, submerged aquatic vegetation beds, reservoirs, and tidal freshwater and riverine environments. Striped Mullet in South Carolina prefer salinities less than 18 parts per thousand (ppt), but are commonly found throughout the entire estuarine salinity range (McDonough and Wenner 2003; McDonough et al. 2003). Juveniles less than 40 mm (1.5 inches) TL prefer salinities greater than 18.0 ppt, while juveniles and adults greater than this size can be found throughout the entire estuarine salinity range (McDonough and Wenner 2003). Larger Striped Mullet (greater than 350 mm or 14 in. TL) are frequently found in low salinity brackish water (less than 5.0 ppt) and freshwater, but this is more likely due to capture methods rather than the actual distribution of larger Striped Mullet. Striped Mullet may stratify by depth

according to size with the larger individuals moving into deeper water habitats, particularly in winter (Whitfield and Blaber 1978; Chubb et al. 1981). However, during the spawning migration—particularly in November and December—larger, reproductively developing Striped Mullet are seen in greater numbers closer to the mouth of most estuaries in high salinity habitats (McDonough et al. 2003; McDonough et al. 2005).

CHALLENGES

There is currently a lack of information on population size and distribution of Striped Mullet in South Carolina. Striped Mullet feed primarily on soft mud and other detritus. Therefore, Striped Mullet may be adversely affected by contaminants (organics, pesticides, and heavy metals) that settle out from the water column or become bound to sediment since their feeding strategy offers a vector for these contaminants to enter the food chain. While these types of contaminants are not currently considered a direct threat to Striped Mullet as a species, they could pose a threat in highly contaminated areas where bioaccumulation up the food chain may have an effect on gamefish, birds, and human health through direct consumption.

CONSERVATION ACCOMPLISHMENTS

South Carolina currently has no significant commercial Striped Mullet fishery, primarily due to gear restrictions and a lack of interest by commercial fishermen. Long term commercial catch statistics show a significant decrease in the commercial landings of Striped Mullet in South Carolina since 1982 (Figure 1). Although limited inshore net bans were instituted in the 1950s, these regulations primarily targeted the trawl fishery, and the use of seines, gill nets, and stop nets accounted for most of the commercial catch up until the complete inshore net ban in 1986 (NMFS 2013).

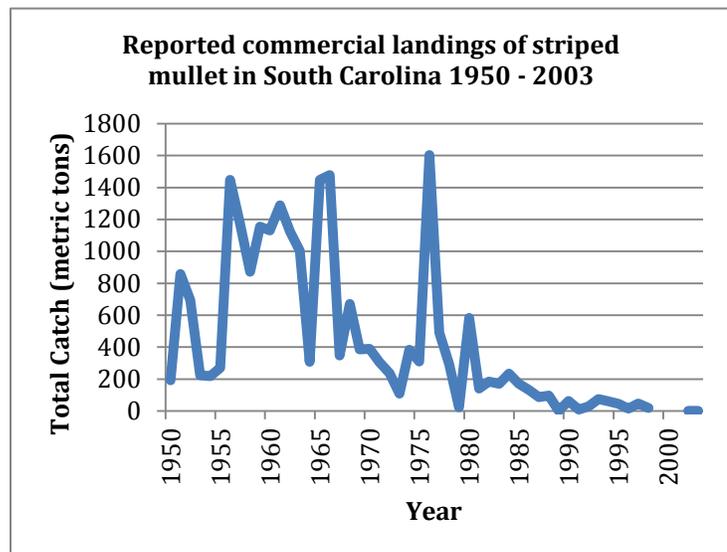


Figure 1: Striped Mullet catch in SC

CONSERVATION RECOMMENDATIONS

- Study basic biological aspects of Striped Mullet ecology such as population size and reproduction.
- Determine seasonal movement and distribution of Striped Mullet in tidal freshwater systems by initiating a tagging project.
- Determine the level of contaminants (organics, pesticides, and heavy metals) found in Striped Mullet as well as the sediments in the areas in which they are caught. Relate that to the potential effects of bioaccumulation in predators.

- Protect water quality in marine ecosystems by encouraging municipalities to use Best Management Practices (BMPs) to reduce runoff from highways, agricultural fields, and housing developments.
- Plan development based on sound terrestrial and estuarine ecology that takes into consideration all factors that will affect the long-term health of the estuary ecosystem.
- Identify the origin of non-point source pollution and specific point source pollution and develop a plan of action to mitigate any negative effects to the affected aquatic systems.
- Improve BMPs in areas already impacted by non-point source pollution.
- Identify important or essential habitat types for different life stages of Striped Mullet and partner with other regulatory agencies (e.g. DHEC) to reduce impacts of development on these fish habitats.
- Partner with other state agencies in order to improve resource management at the whole estuary or drainage basin level using a more holistic ecological approach. Such restructuring should provide for greater regulatory authority in implementing migratory fish management plans.

MEASURES OF SUCCESS

Currently, the Striped Mullet is a secure and abundant species. By learning more about this species and protecting the habitat upon which it depends, we can ensure that this important forage fish remains abundant. In addition, by monitoring Striped Mullet populations in response to environmental contaminants, South Carolina will be better able to detect problems and work to correct them more quickly.

LITERATURE CITED

- Anderson, W.W. 1958. Larval development, growth, and spawning of Striped Mullet (*Mugil cephalus*) along the south Atlantic coast of the United States. *Fish. Bull.* 58:501-519.
- Arnold, E.L. and J.R. Thompson. 1958. Offshore spawning of the Striped Mullet, *Mugil cephalus*, in the Gulf of Mexico. *Copeia*. 1958:130-132.
- Chubb, C.F., I.C. Potter, C.J. Grant, R.C.J. Lenanton, and J. Wallace. 1981. Age, structure, growth rates, and movements of sea mullet, *Mugil cephalus* L., and yellow eye mullet, *Aldrichetta forsteri* (Valenciennes), in the Swan-Avon river system, Western Australia. *Austral. J. Mar. Fresh. Res.* 32:605-628.
- Collins, M.R. and B.W. Stender. 1989. Larval Striped Mullet (*Mugil cephalus*) and white mullet (*Mugil curema*) off the southeastern United States. *Bull. Mar. Sci.* 45(3):580-589.
- Greeley, M.S., D.R. Calder and R.A. Wallace. 1987. Oocyte growth and development in the Striped Mullet, *Mugil cephalus*, during seasonal ovarian recrudescence: relationship to fecundity and size at maturity. *Fish. Bull.* 85:187-200.

- Gunter, G. 1938. Notes on invasion of fresh water by fishes of the Gulf of Mexico, with special reference to the Mississippi-Atchafalaya river system. *Copeia*. 1938(2):69-72.
- Harrison, I.J. 2002. Mugilidae: mullets. Pages 1071-1085. *In*: The living marine resources of the western central Atlantic. Volume 2. Bony fishes part 1 (Ascipenseridae to Grammatidae), K.E. Carpenter, editor. FAO Species Identification Guide for Fishery Purposes, American Society of Ichthyologists and Herpetologist Special Publication 5. Rome. 1373 pp.
- Jacot, A.P. 1920. Age, growth, and scale characters of the mullets, *Mugil cephalus* and *Mugil curema*. *Trans. Amer. Fish. Soc.* 39(3):199-229.
- Johnson, D.W. and E.L. McClendon. 1969. Differential distribution of the Striped Mullet *Mugil cephalus* L. *Cal. Fish and Game*. 55:138-139.
- McDonough, C.J. and C.A. Wenner. 2003. Growth, recruitment, and abundance of juvenile *Mugil cephalus* in South Carolina Estuaries. *Fish. Bull.* 101:343-357.
- McDonough, C.J., W.A. Roumillat and C.A. Wenner. 2003. Fecundity and spawning season of Striped Mullet (*Mugil cephalus* L.) in South Carolina estuaries. *Fish. Bull.* 101:822-834.
- McDonough, C.J., W.A. Roumillat, and C.A. Wenner. 2005. Sexual differentiation and gonad development in Striped Mullet (*Mugil cephalus* L.) from South Carolina estuaries. *Fish. Bull.* 103:601-619.
- National Marine Fisheries Service (NMFS). 2001. Statistics and Economics Division. Available: <http://www.st.nmfs.gov/st1/index.html> (Accessed January 2005).
- Ravenel, W. 1887. Information bearing upon the artificial propagation of mullet. *US. Fish. Comm. Bull.* 7:197-202.
- Render, J.H., B.A. Thompson, and R.L. Allen. 1987. Reproductive development of Striped Mullet in Louisiana estuarine waters with notes on the applicability of reproductive assessment methods for isochronal species. *Trans. Amer. Fish. Soc.* 124(1):26-36.
- Robins, C.R., G.C. Ray and J. Douglass. (eds.) 1986. *Atlantic Coast Fishes*. Houghton Mifflin Co. Boston, Massachusetts. 354 pp.
- Rossi, A.R., M. Capula, D. Crosetti, D.E. Campton and L. Sola. 1998. Genetic divergence and phylogenetic inferences in five species of Mugilidae (Pisces: Perciformes). *Mar. Biol.* 131:213-218.
- Stenger, A.H. 1959. A study of the structure and development of certain reproductive tissues of *Mugil cephalus* Linnaeus. *Zoologica*. 44(2):53-70.
- Thomson, J.M. 1963. Mullet life history strategies. *Austr. J. Sci.* 25:414-416.

Wenner, C.A., W.A. Roumillat, J.E. Moran M.B. Maddox, L.B. Daniel and J.W. Smith. 1990. Investigations on the life history and population dynamics of marine recreational fishes in South Carolina, part 1. South Carolina Marine Resources Research Institute, Completion reports, Project F-37, Charleston and Project F-31, Brunswick.

Whitfield, A.K. and S.J.M. Blaber. 1978. Food and feeding ecology of piscivorous fishes at Lake St. Lucia, Zululand. *J. Fish Biology*. 13:675-691.