Spanish Mackerel

(Atlantic Spanish Mackerel)
Scomberomorus maculatus

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DESCRIPTION

Taxonomy and Basic Description

The Spanish mackerel is one of the smaller members of the family Scombridae, which contains other mackerels, wahoo, tunas, and bonitos. Of the tribe Scomberomorini, only Spanish mackerel, king mackerel, and to a lesser degree wahoo, are commonly encountered off the coast of South Carolina (SC). Cero mackerel may make occasional appearances off SC, but are much more commonly encountered in warmer waters, including south Florida (FL) and the Caribbean.

The body of the Spanish mackerel is laterally compressed, elongate, and fusiform. The dorsal surface bears two narrowly separated dorsal fins (first dorsal extends further back than is apparent in supplied photo), followed by 7-10 small finlets. The forward dorsal fin is roughly triangular in shape and black or blue-black for roughly the first third of its length, abruptly changing to whitish or translucent for the balance. The second dorsal fin has a greenish coloration and a concave shape to its trailing edge. Below the start of the second dorsal, the lateral line curves slightly downward as it continues towards the caudal peduncle (Collette 2002). At most sizes where the lateral line is apparent (~50 mm or 2 in. fork length and above, personal observation), it allows for relatively simple differentiation from king mackerel, as the lateral line of the king mackerel drops much more abruptly below the second dorsal fin. The body color of the Spanish mackerel is generally dark blue to blue-green along the dorsal surface, with a silvery coloration along the sides and ventral surface. The sides of the fish are marked with small yellow, bronzy, or orange spots (Collette 2002; Hill 2005). This patterning differentiates them from cero as spots are large and distinctly oval, with no tendency to form dashes and streaks as is seen with the cero. Collette (2002) notes that Spanish mackerel are common up to 50 cm (20 in.) and cites maximum size as at least 70 cm (28 in.) fork length. The state record for a recreationally caught Spanish mackerel off South Carolina is 11.0 lbs. and was set in 1983 (SCDNR 2013).

Status

The International Union for Conservation of Nature (IUCN) lists Spanish mackerel as a species of Least Concern (IUCN, 2013.2). Results of the latest stock assessment, via the SouthEast Data, Assessment, and Review process (SEDAR 2012), indicate that the Atlantic migratory group of Spanish mackerel is not experiencing overfishing nor is it overfished. Since it is not overfished, no rebuilding plan is required. However, this status is maintained by a variety of commercial trip limits, recreational bag limits, size limits, seasonal fishing restrictions, gear restrictions, and extensive monitoring of landings. While this is a popular sport fish for SC recreational fishermen (Fig. 1), as it is throughout the Southeast, it is not an important commercial fishery for SC, unlike NC and FL. As of commercial landings reports for 2012, NC commercial landings were primarily from gill nets and, to a much lesser degree, pound nets,

while FL commercial landings from the East Coast were primarily from a combination of gears including: cast net, hand line, rod and reel, and gill nets. There have been no reported SC commercial landings since 1994 (http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/index). Much of the relatively low commercial landings reported for SC in earlier years appears to have been incidental by-catch from the shrimp trawl fishery, which was marketed opportunistically (pers. comm. SCDNR Fisheries Statistics Section). Absence of commercial landings for SC over the last two decades suggests that implementation of turtle excluder devices (TEDs) reduced occurrence of market size fish in by-catch of the shrimp fishery to a point that it no longer even merited opportunistic marketing. The level to declining trend in SC recreational catch of Spanish mackerel differs from the trend of recreational catch for this species for all Atlantic states combined (dominated by NC and FL catches), which has generally increased over the time period (Pers. comm. National Marine Fisheries Service, Fisheries Statistics Division. Feb. 4, 2014).

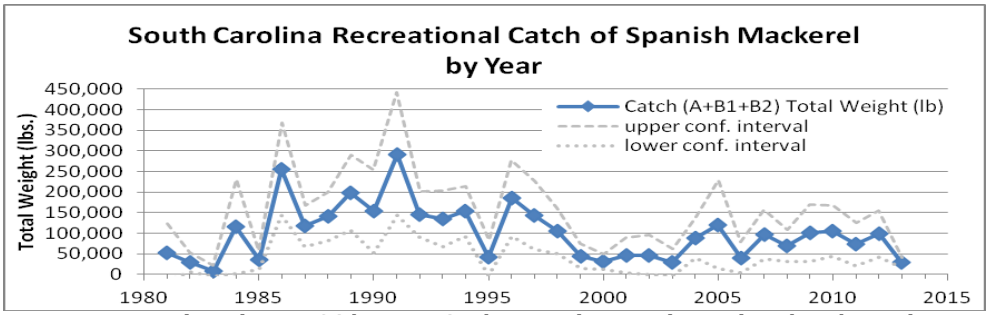

Fig. 1. Recreational Landings in SC by Year. Catch reported in pounds. Total catch = observed landings + reported landings + fish released alive. (Pers. comm. National Marine Fisheries Service, Fisheries Statistics Division. Jan 22, 2014).

POPULATION SIZE AND DISTRIBUTION

The Spanish mackerel ranges along the US coast of the western North Atlantic and the US and Mexican coasts of the Gulf of Mexico from the Gulf of Maine to the Yucatan Peninsula, predominantly in continental shelf waters (Collette 2002). For management purposes, the range is split into a Gulf of Mexico stock, under the jurisdiction of the Gulf of Mexico Fishery Management Council (GMFMC), and an Atlantic stock, which is under the jurisdiction of the South Atlantic Fishery Management Council (SAFMC). As of SEDAR 28 in 2012, the dividing line is (highway) US1 in the Florida Keys. West and north of US1, fish fall in the Gulf stock, and fish south and east of US1 are assigned to the Atlantic stock (SEDAR 2012). Thus, all fish off SC are Atlantic stock. However, it is not known how closely these management units come to representing actual genetically defined stocks. SEDAR 28 estimated total stock biomass to be 11,433 metric tons as of the start of year 2012, and spawning stock biomass to be 4,862 metric tons as of the start of 2011 (SEDAR 2012). Similar to their relative the king mackerel, Spanish mackerel are reported to concentrate in waters off FL in winter, migrate up along the East coast of the US as waters warm in spring, and then head back toward FL as waters cool again in the fall (Earll 1883, Berrian and Finan 1977). However, the term “migrate” tends to suggest the concept of a group of animals moving together from area A to area B. This does not appear to be the case for Spanish mackerel. The Southeast Area Monitoring and Assessment Program – South Atlantic (SEAMAP-SA) Coastal Survey is a fishery-independent trawl survey, funded by the National Marine Fisheries Service (NMFS) and operated by staff of the South Carolina

Department of Natural Resources, Marine Division, which samples near-shore oceanic waters from Cape Hatteras, NC to Cape Canaveral, FL. Each year, a seasonal compliment of stations is completed during each of three seasons: spring, summer, and fall each year. Data from this survey documents that fish are generally encountered from northeastern FL through southern North Carolina (NC) in each of these seasons. Given that this species is encountered even further north during summer, while individuals are still present off FL, it seems more accurate to characterize this "migration" as seasonal range expansion and contraction. Estimates of Spanish mackerel annual density from Coastal Survey data for waters sampled via trawl north of SC (Cape Hatteras, NC to the NC/SC border), waters off SC, and waters south of SC (Georgia and northeast FL, down to Cape Canaveral) suggest that regional density is often inversely related to latitude (Fig. 2). This fits with the range expansion explanation, as a larger portion of the stock would be present in southern waters for a greater period of this sampling window than would be encountered off NC.

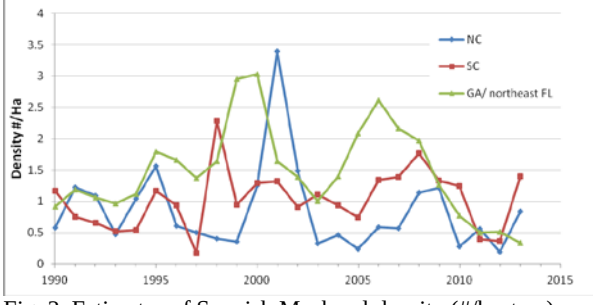

Fig. 2. Estimates of Spanish Mackerel density (#/hectare) from the fishery-independent SEAMAP-SA Coastal (trawl) Survey. Data are plotted for north of SC (Hatteras, NC to the NC/SC line), SC, and south of SC (GA and northeast FL,

Schmidt et al. (1993) found most (89%) male Spanish mackerel to mature within their first year of life, and all to be mature in their second year (age 1), with size at maturity falling between 209-336 mm (8-13 in.) fork length (FL). Females matured more slowly, and generally achieved a larger size before maturity, with only 5% found to be mature within their first year (age 0) and 95% within their second year (age 1). Length at maturity ranged from 288 mm-450 mm (11-18 in.) FL, with calculated length at which 50% of females were mature being 358 mm (14 in.) FL. Schmidt et al. (1993) also reported a larger range of ages for females in their samples (0-11 yrs.) than for males (0-6 yrs.) and reported that females typically reach a larger size. The spawning season of the Spanish mackerel is relatively long—April through late September—but varies with latitude, shifting later as the fish move up the Atlantic coast (Berrien and Finan 1977). Work by Finucane and Collins (1986) notes peak spawning in May for Georgia and Carolina. Marancik et al. (2005), studying larval fish assemblages across the coastal shelf off Georgia, characterized larval Spanish mackerel as occurring on the inner shelf during summer.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The Spanish mackerel is primarily a piscivorous pelagic occupant of coastal shelf waters. It is an opportunistic feeder that may be encountered in areas of structure (reef, live bottom, jetties), and is also commonly encountered in waters not associated with any structure. Saloman and Naughton (1983) suggest that anchovies were often the predominant prey species for smaller mackerels; with growth, fish remained the predominant prey item, but anchovies diminished in prevalence. Shrimp and squid seemed to make up the majority of the balance of the diet. While Spanish mackerel are occasionally encountered in estuarine waters (Berrien and Finan, 1977; SCDNR Inshore Fisheries Section unpub. data), they are much more commonly found in near-shore oceanic waters off SC. Indeed, all life stages from egg to adult appear to predominantly occur in ocean waters (Berrien and Finan 1977). In a paper revising Australian

species of Scomberomorus, Munro (1943) noted that, worldwide, the ranges of all Scomberomorus seemed to be limited to waters that fell within a 68˚ F summer isotherm. It should be noted that this appears to be a statement regarding range more than it is about temperature tolerance. Spanish mackerel have been captured in trawl tows of the Coastal Survey in waters with bottom temperatures ranging 14.4-30.5˚C (~58-87˚F) (Fig. 3; SEAMAP-SA unpub. data). In his fascinating natural history account of Spanish mackerel, published in 1883, Edward Earll made the following generalization: "They seem to prefer water ranging from 70˚ to 80˚ Fahr., and seldom enter that which is colder than 65˚." (Earll 1883). The pattern of distribution seen in Figure 3 appears to generally support his statement. Occurrence is indeed quite low below his low threshold value of 65˚F (18˚C), and the low end "preferred" range value, 70˚F (21˚C), has almost the highest rate of occurrence for Spanish mackerel in Coastal Survey collections. However, Coastal Survey data do suggest that they continue to appear with great regularity in waters up to 30˚C (86˚F), at least off the Southeastern US coast. Possibly, his upper threshold of 80˚F (27˚C) was a bit conservative.

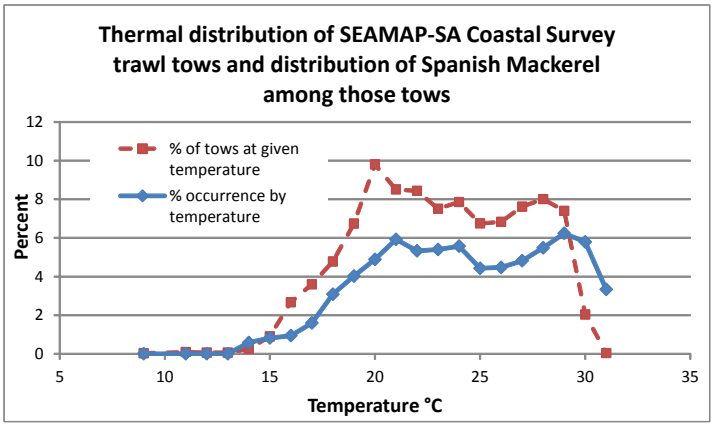

Fig. 3. Thermal Distribution of Spanish Mackerel Captured in the Fishery-independent SEAMAP-SA Coastal Survey 1990-2013; Hatteras, NC to Canaveral, FL. Red line indicates percent of total pool of trawl tows done at each temperature. Blue line depicts the percent of tows made at each temperature that had Spanish mackerel present.

CHALLENGES

Edward Earll had an impressive understanding of Spanish mackerel in 1883, roughly 131 years ago. We have filled in a few gaps since his time, and no doubt have refined and come to a better understanding of details for any number of general facts that he had at his disposal. However, we still lack absolute understanding of any number of factors which may be crucial to properly managing the species in an ever changing environment. Over 100 years down the line, we are still challenged to find the proper combination of environmental factors, spawning stock levels, and landings data that will reliably predict year class strength. The robust fishery-independent monitoring required to be able to confirm and tune those predictions, and robust creel monitoring that must be done for both recreational and commercial fisheries to properly quantify fishing mortality, cannot occur without equally robust funding. Also, in 131 years, man has managed to introduce many compounds into the environment that were never there before; each of these has the potential for independent and combined effects on numerous aspects of biology at every link of the food chain. Management of the food chain involves multiple levels of similar challenges itself. Much of the food chain is comprised of unmanaged species, for which biological knowledge is greatly lacking and funds for research and monitoring are already stretched thin and directed at apex species.

CONSERVATION ACCOMPLISHMENTS

(*Extremely Brief and Selective*) History of Spanish mackerel Management:
Current fisheries management in the Southeastern US is based on a series of management efforts. The first fishery management plan (FMP) that involved Spanish mackerel was the "Fishery Management Plan, Final Environmental Impact Statement, Regulatory Impact Review, Final Regulations for the Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic Region" prepared for the Gulf of Mexico and South Atlantic Fishery Management Councils, approved in 1983 (GMFMC and SAFMC 1983). This document was originally intended to manage stocks in the Fishery Conservation Zone (FCZ) which extended out to 200 miles off the US coastline. This was based on definitions in the Fishery Conservation and Management Act (FCMA) of 1975. However, subsequent amendments to the FCMA altered the area of coverage to the Exclusive Economic Zone (EEZ), which has the same seaward boundary, but has an inner boundary that is the seaward boundary of the state waters of the coastal states (FWS n.d.). With time, it was determined that this limited effective management of stocks in state waters. So, in 1990, the Atlantic States Marine Fisheries Commission (ASMFC) adopted the "Fishery Management Plan for Spanish Mackerel" to "…conserve the Spanish mackerel resource and to achieve compatible management among the states that harvest Spanish mackerel, and between the states and the federal government." (Mercer et al. 1990). However, until the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) was signed into law in December 1993, state compliance with (most) fishery management plans was entirely voluntary (SERO n.d.). Compliance with the terms of fisheries management plans enacted after the passage of ACFCMA is mandatory. However, the 1990 FMP for Spanish mackerel predated ACFMA, leaving Spanish mackerel management in a grandfathered state of voluntary compliance. Therefore, in 2011, the ASMFC approved the "Omnibus Amendment to the Interstate Fishery Management Plans For Spanish Mackerel, Spot, and Spotted Seatrout" (ASMFC 2011) to correct this grandfathered condition for these three species and allow ACFMCA to operate as originally intended. Meanwhile, the original GMFMC and SAFMC Migratory Pelagics FMP had been amended 18 times (as of 2011), and it continues to evolve through further amendments in order to facilitate management in federal waters.

Implementation in 1996 of by-catch reduction devices (BRDs) on shrimp trawls fished in the Exclusive Economic Zone (EEZ) of the Southeastern US should be improving survivorship of juvenile Spanish mackerel, as some BRDs have demonstrated an ability to reduce retention rates for this species in shrimp trawls (Watson et al. 1993). However, with or without BRDs, a juvenile Spanish mackerel may only be highly vulnerable to trawl capture for roughly 20 days of its life, although the protracted nature of spawning for this species places different individuals at risk throughout the most active shrimp trawling seasons (Harris and Dean 1998).

Fishery-independent catch and size data on Spanish mackerel has been collected through the SEAMAP-SA Coastal Survey (near shore trawl survey) since 1989. An index of presumed age 0 individuals from this survey was the only fishery-independent index available to the SEDAR 28 process (SEDAR 2012). A more detailed effort to collect age, reproduction, and diet data of Spanish mackerel began in 2011 with goals of refining the understanding of age structure in Coastal Survey catches, verifying size and age at maturity, and investigating the diet of juveniles along the Atlantic coast of the Southeastern US, to better inform future stock assessments.

CONSERVATION RECOMMENDATIONS

- Expand research/monitoring via fishery-independent sources. Life history data to complement and refine application of existing juvenile abundance data would be beneficial. Fishery-independent data on adult fish is virtually unavailable as they are not well represented in the sole current fishery-independent monitoring effort.
- Further investigation of migratory patterns through tagging and otolith micro-chemistry, and stocks through current genetic methods might help to better define Atlantic and Gulf stocks (or confirm that they are a single stock) and set biologically meaningful management boundaries.
- Examine how schooling or migratory dynamics may influence the catchability of the species. In particular, research the assumption of the hyperstability of indices that sample the schooling portion of the stock (SEDAR 28 Assessment Workshop Panel research recommendation).
- Increase observer coverage of the shrimp trawl fishery along the Atlantic coast of the Southeastern US in order to improve estimates of by-catch and discard mortality. As of SEDAR 28, existing data were deemed marginally sufficient to include in calculations, and improved data would likely increase confidence in mortality estimates generated by future calculations.
- Additional studies may be necessary in order to properly quantify rates of discard mortality for each fishing gear in each of the seasons in which it is commonly employed.

MEASURES OF SUCCESS

- Sufficient fishery-independent data is available to generate stock estimates with confidence.
- Diet data are available for all size classes for each managed area.
- The stock(s) can be clearly defined and identified.
- Estimates of abundance of age 1+ Atlantic stock fish increase.
- Estimate of spawning stock biomass (*SSB*) of Atlantic stock increases.
- Ideally, stock structure would improve to a point that calculations of maximum sustainable yield (*MSY*) result in total allowable catch (*TAC*) levels that can accommodate demand for commercial and recreational harvest.

LITERATURE CITED

ASMFC. 2011. Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout. Fishery Management Report of the Atlantic States Marine Fisheries Commission. Accessed: <http://www.asmfc.org/uploads/file/omnibusAmendment_TechAdd1A_Feb2012.pdf >. (Jan 22, 2014).

Berrien, P. and D. Finan. 1977. Biological and Fisheries Data on Spanish Mackerel, *Scomberomorus maculatus* (Mitchill). U.S. DOC/NOAA/NMFS/ Notheast Fisheries Center- Sandy Hook Laboratory. Technical Series Report No. 9 Nov. 1977.

Collette, B. 2002. Scombridae. p. 1836-1857. *In*: Kent Carpenter (ed.) FAO Species identification Guide for Fishery Purposes. The Living Marine Resources of the Western

Central Atlantic. Volume 3: Bony fishes part 2 (Opistognathidae to Molidae), sea turtles and marine mammals. 253 p.

Collette, B., Boustany, A., Carpenter, K.E., Fox, W., Graves, J., Juan Jorda, M., Nelson, R. & Oxenford, H. 2011. *Scomberomorus maculatus*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <www.iucnredlist.org>. Downloaded on 13 January 2014.

Earll, R.E. 1883. The Spanish Mackerel, Cybium maculatum (Mitch.). AG.; Its Natural History and Artificial Propagation, with an Acccount of the Origen and Development of the Fishery. Report of the commissioner of fish and fisheries. Smithsonian Institution. January 10, 1882, Part XIII: 395-426.

Finucane, J.H. and L.A. Collins. 1986. Reproduction of Spanish mackerel, *Scomberomorus maculatus*, from the Southeastern United States. Northeast Gulf Science 8(2): 97-106.

FWS. n.d. Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service: Fishery Conservation and Management Act of 1976. US Fish and Wildlife Service. Accessed: <http://www.fws.gov/laws/lawsdigest/fishcon.html>. (Jan 22, 2014).

GMFMC and SAFMC. 1983. Fishery Management Plan, Final Environmental Impact Statement, Regulatory Impact Review, Final Regulations for the Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic Region. Accessed: <http://safmc.net/Library/pdf/MackerelFMP.pdf >. (Jan. 23, 2014).

Harris, P.J. and J.M. Dean. (1998). Characterization of King Mackerel and Spanish Mackerel Bycatches of South Carolina Shrimp Trawlers. North American Journal of Fisheries Management 18(2): 439-453. DOI: 10.1577/1548-8675(1998)018<0439:COKMAS>2.0.CO;2

Hill, K. 2005. *Scomberomorus_maculatus*. Smithsonian Marine Station, 10 Mar. 2005. Accessed: <http://www.sms.si.edu/irlspec/Scombe_macula.htm>. (Dec. 3, 2013).

Marancik, K.E., L.M. Clough, and J.A. Hare. 2005. Cross-shelf and seasonal variation in larval fish assemblages on the southeast United States continental shelf off the coast of Georgia. Fish. Bull. 103: 108-129.

Mercer, L.P., L.R. Phalen, and J. R. Malolo. 1990. Fishery Management Plan for Spanish Mackerel. Fisheries Management Report No. 18. ASMFC. Washington, DC. Accessed: <http://www.asmfc.org/uploads/file/spanishMackerelFMP.pdf >. (Jan. 23, 2014).

Munro, I.S. R. 1943. Revision of the Australian species of Scomberomorus. Memoirs of the Queensland Museum 12(2): 65-95.

NOAA. 2013. Commercial Fisheries Statistics. NOAA Fisheries, Fisheries Statistics Division. Accessed: < http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/index >. (Jan 22, 2014).

Saloman, C.H and S.P. Naughton, 1983. Food of Spanish mackerel, Scomberomorus maculatus, from the Gulf of Mexico and southeastern seaboard of the United States. NOAA Technical Memorandum NMFS-SEFC-128.

SCDNR. 2013. Saltwater Game Fish Records for South Carolina. Accessed: <http://www.dnr.sc.gov/fish/saltrecs/records.html> . (Jan 22, 2014).

Schmidt, David J., Mark R. Collins, and David M. Wyanski. 1993. Age, Growth, Maturity, and Spawning of Spanish Mackerel, Scomberomorus Maculatus (Mitchill), from the Atlantic Coast of the Southeastern United States. Fishery Bulletin 91(3): 526-33.

SEDAR. 2012. SEDAR 28 –South Atlantic Spanish mackerel Stock Assessment Report. SEDAR, North Charleston SC. 444 pp. Available: <http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=28>. (Jan 23, 2014).

SERO. n.d.. Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). Accessed: <http://sero.nmfs.noaa.gov/operations_management_information_services/state_federal_liaison_branch/acfcma/index.html>. (Jan. 22, 2014).

Watson, J., I. Workman, D. Foster, C. Taylor, A. Shah, J. Barbour, and D. Hataway. 1993. Status report on the potential of gear modifications to reduce finfish bycatch in shrimp trawls in the southeastern United States, 1990-1992. NOAA Tech. Memo., NMFS-SEFC-327. Accessed: <https://grunt.sefsc.noaa.gov/publications/ >. (Jan 14, 2014).