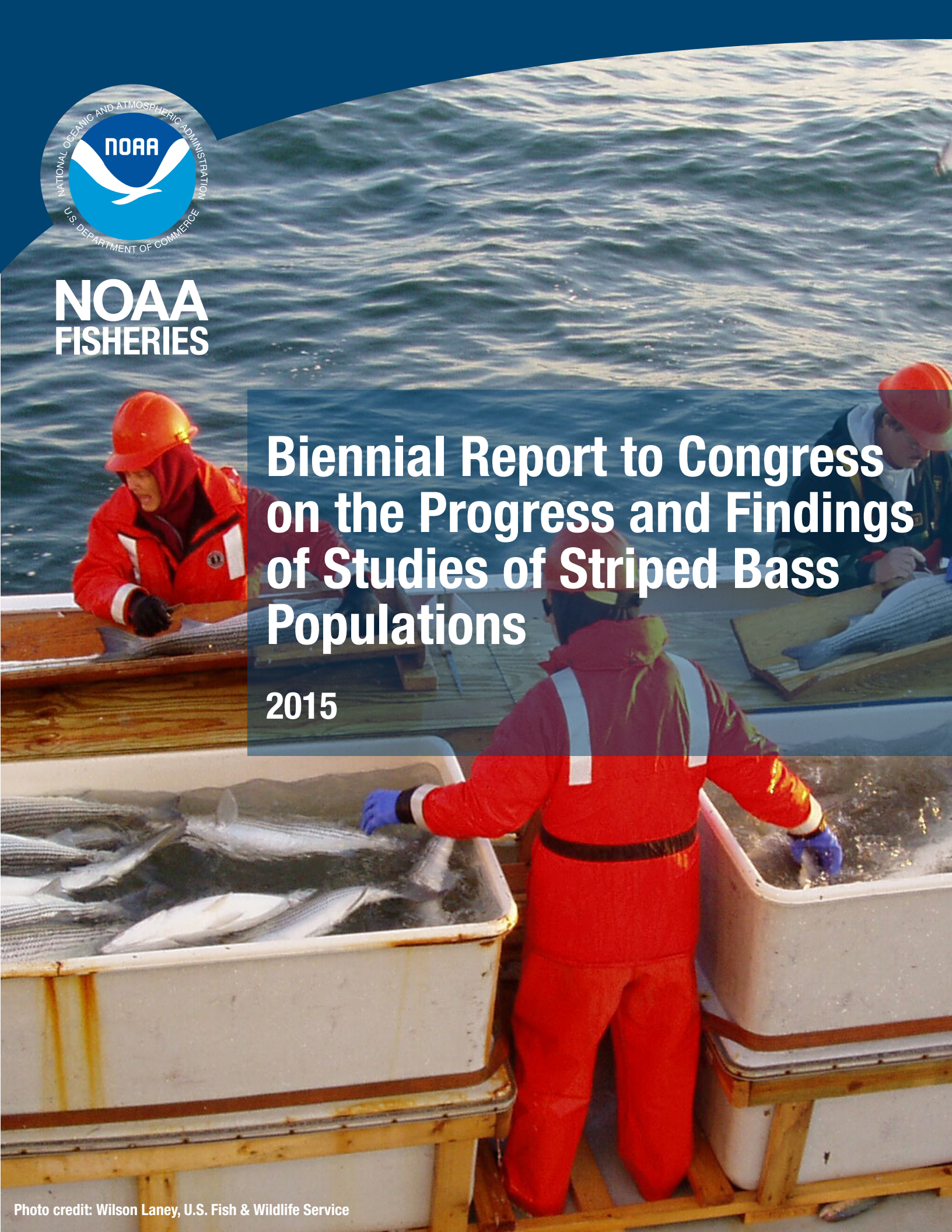




**NOAA
FISHERIES**

Biennial Report to Congress on the Progress and Findings of Studies of Striped Bass Populations

2015



Introduction

The 1997 reauthorization of the Atlantic Striped Bass Conservation Act mandated biennial reports to Congress and to the Atlantic States Marine Fisheries Commission (Commission) from the secretaries of the Department of Commerce and the Department of the Interior. The report highlights the progress and findings of studies of migratory Atlantic striped bass (*Morone saxatilis*). This document is the eighth such report to Congress and includes data available through 2014 with an emphasis on calendar years 2013 and 2014.

Status of the Stock

The coast-wide Atlantic striped bass population includes four major components: the Hudson River, Delaware River/Bay, Chesapeake Bay, and Albemarle Sound/Roanoke River. The Atlantic stock includes primarily Hudson River, Delaware River/Bay, and Chesapeake Bay origin fish, and is managed by the Commission. The Commission delegated management authority of the Albemarle Sound/Roanoke River origin fish to the State of North Carolina because these fish primarily remain off the coast of North Carolina, and do not usually migrate north.

Atlantic Striped Bass Stock (Commission Managed)

- The Atlantic striped bass stock is not overfished, and overfishing is not occurring.
- The most recent stock assessment update was completed in November 2015. The next benchmark stock assessment is scheduled for 2018 (See Figure 1).
- In 2014, female spawning stock biomass was estimated at 140 million pounds (63,503 metric tons), which is above the spawning stock biomass threshold of 127 million pounds (57,606 metric tons) but below the target of 159 million pounds (72,121 metric tons).
- The spawning stock biomass has declined since a time series high in 2003. The decrease in abundance is reflected in a declining trend of coast-wide catch from 2007 to 2014, particularly in recreational discards comprised of smaller fish (See Figure 2).
- In 2014, total fishing mortality was estimated at 0.21, which is just below the fishing mortality threshold of 0.22 but above the target of 0.18 (See Figure 3).

Albemarle Sound/Roanoke River Stock (North Carolina Managed)

- Based on results of the 2014 North Carolina state-specific stock assessment, the Albemarle Sound/Roanoke River striped bass stock is not overfished and overfishing is not occurring.
- Female spawning stock biomass in 2012 was estimated at 835,462 pounds (379 metric tons), which is above the spawning stock biomass threshold of 772,588 pounds (350 metric tons) but below the target of 969,496 pounds (440 metric tons). These spawning stock biomass reference points are specific to the Albemarle Sound/Roanoke River stock (See Figure 4).
- Similar to the Atlantic striped bass stock, the Albemarle Sound/Roanoke River female spawning stock biomass has declined steadily since 2003 (See Figure 4).
- In 2012, fishing mortality for the Albemarle Sound/Roanoke River stock was estimated at 0.34, which is just above the target of 0.33 and below the threshold of 0.41. These fishing mortality reference points are also specific to the Albemarle Sound/Roanoke River stock (See Figure 5).
- The next stock assessment for the Albemarle Sound/Roanoke River stock is currently underway, and scheduled for completion in early 2016.

Definitions

Fishing mortality (F) – 1. Roughly the proportion of the fishable stock that is caught in a year. 2. A measurement of the rate of removal from a population by fishing.

Migratory – Individuals that leave the inshore rivers and estuaries and move into offshore habitats.

Resident – Individuals that remain in nearshore river and estuarine systems year-round and contribute minimally to the Atlantic complex.

Spawning Stock Biomass (SSB) – The total weight of the fish in a stock that are large enough to spawn; the biomass of all fish beyond the age or size class in which 50 percent of the individuals are mature.

Figure 1. Atlantic Striped Bass Stock Recruitment and Abundance Estimates from 1982 to 2014.

Source: Atlantic States Marine Fisheries Commission Atlantic Striped Bass Stock Assessment Update, 2015

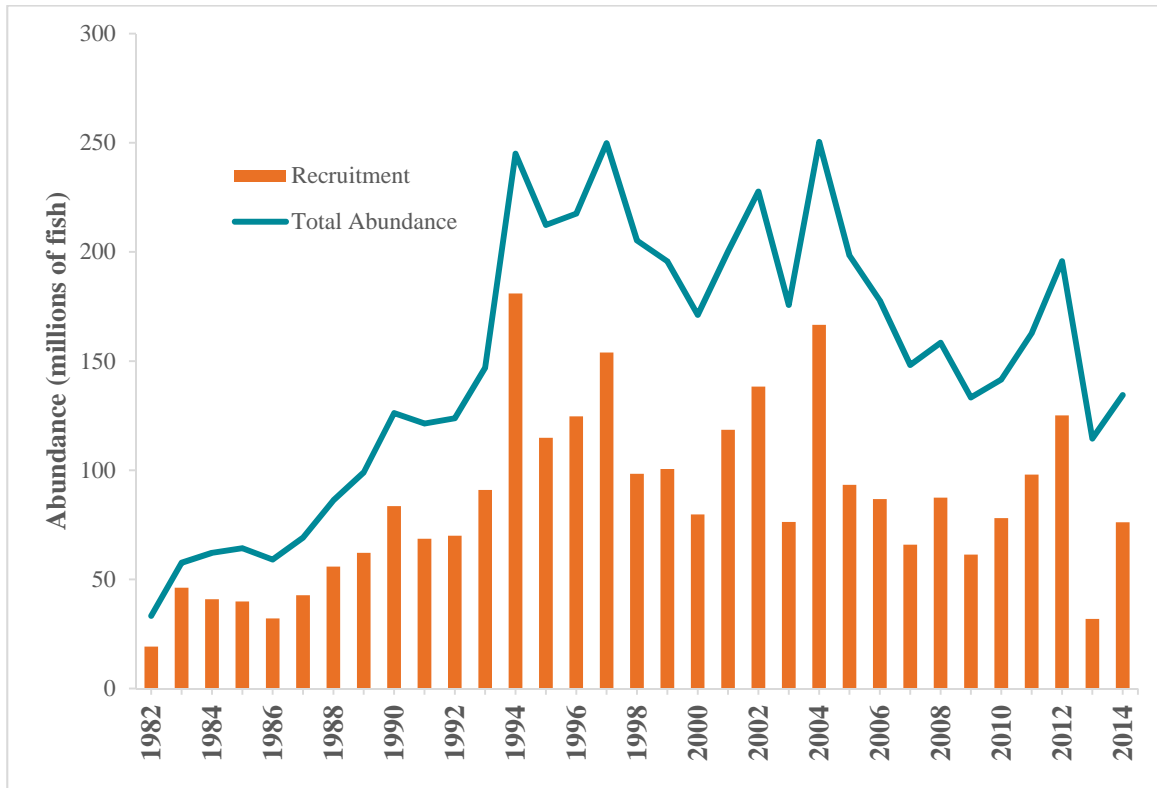


Figure 2. Atlantic Striped Bass Stock Female Spawning Stock Biomass (SSB) from 1982 to 2014 from the Statistical Catch at Age (SCA) Model and Biological Reference Points.

Source: Atlantic States Marine Fisheries Commission Atlantic Striped Bass Stock Assessment Update, 2015

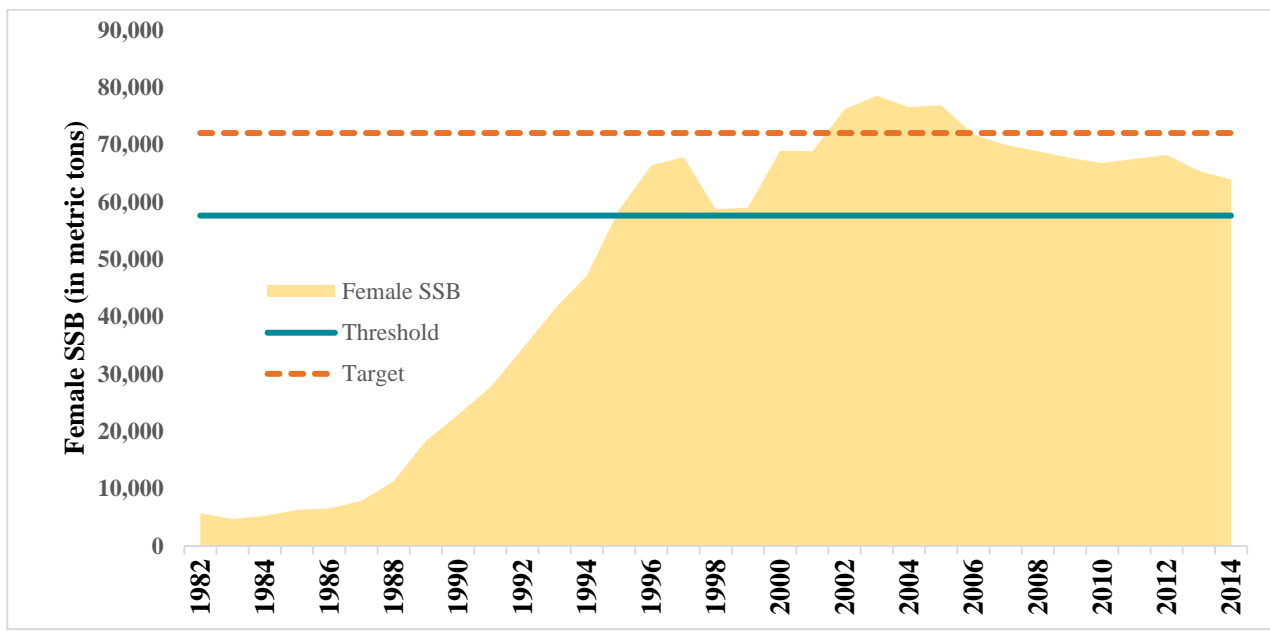


Figure 3. Atlantic Striped Bass Stock Fishing Mortality (F) Estimates from 1982 to 2014 from the Statistical Catch at Age (SCA) Model and Biological Reference Points.

Source: Atlantic States Marine Fisheries Commission Atlantic Striped Bass Stock Assessment Update, 2015

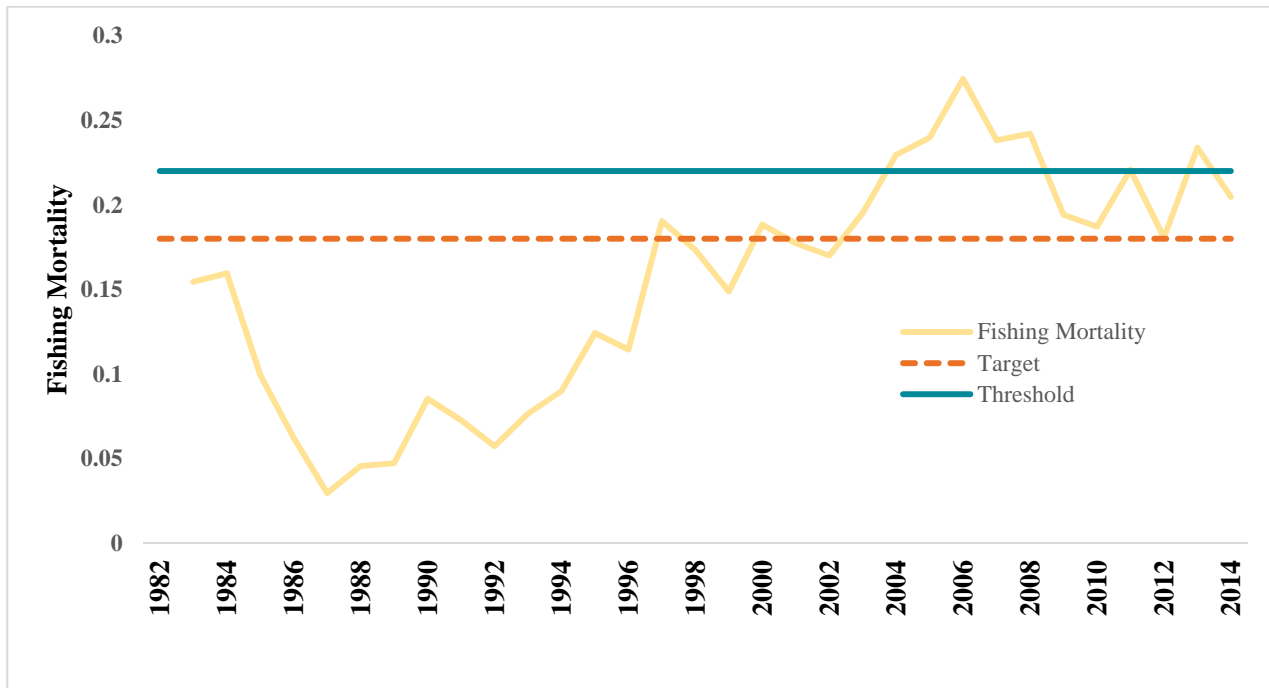


Figure 4. Albemarle/Roanoke Striped Bass Female Spawning Stock Biomass (SSB) and Recruitment (Abundance of Age-1).

Source: Albemarle Sound/Roanoke River Striped Bass Stock Assessment, 2014

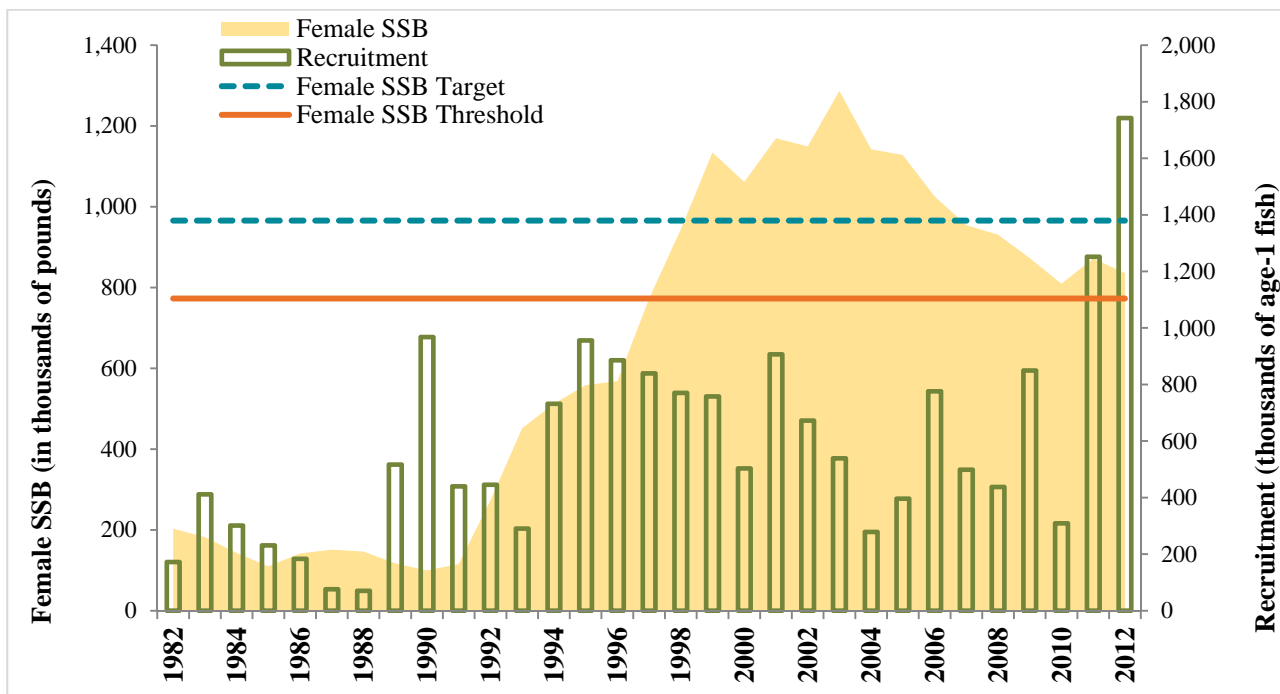
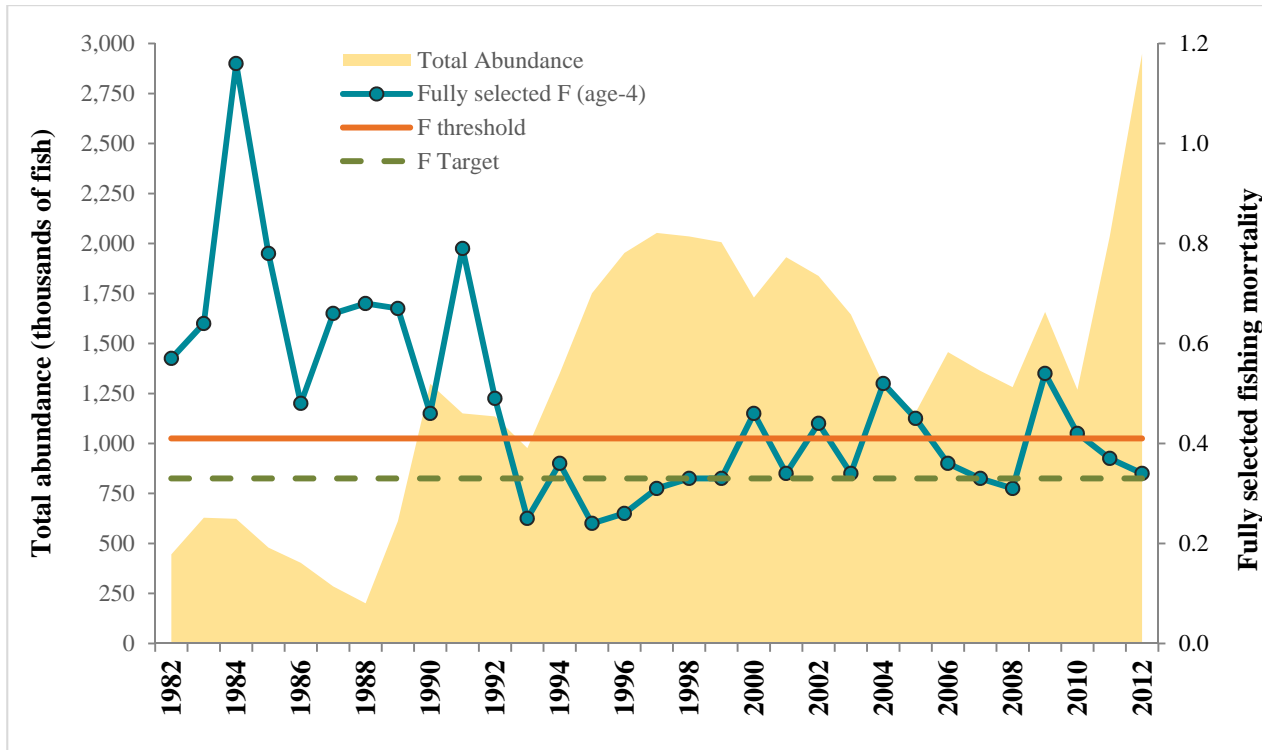


Figure 5. Albemarle/Roanoke Striped Bass Total Stock Abundance and Fishing Mortality.
 Source: Albemarle Sound/Roanoke River Striped Bass Stock Assessment, 2014



Tagging Atlantic striped bass. Photo credit: Charlton Godwin, North Carolina Department of Environment and Natural Resources.

Status of the Fishery

Atlantic Striped Bass Stock (Commission Managed)

- Total commercial catch (landings and dead discards) in 2013 and 2014 were 1.29 million and 1.70 million fish, respectively (See Figures 6 and 7).
- The commercial landings for 2013 were 6.046 million pounds (2.74 metric tons) with a landed value of \$24.3 million. For 2014 commercial landings were 6.215 million pounds (2.80 metric tons) with a landed value of \$21.8 million.
- Total recreational catch (landings and dead discards) in 2013 and 2014 were 2.92 million and 2.44 million fish, respectively (See Figure 6).
- For all recreationally targeted species in the United States, Atlantic striped bass were the largest harvests by weight for 2013 (12.03 metric tons) and 2014 (11.00 metric tons).
- Total Atlantic striped bass harvest (commercial and recreational catch and discard) in 2013 and 2014 is estimated at 4.21 million fish and 4.14 million fish, respectively.

Albemarle Sound/Roanoke River Stock (North Carolina Managed)

- Total commercial and recreational harvest in the Albemarle Sound and Roanoke River management areas in 2014 was 121,956 pounds (31,114 fish).

Figure 6. Commercial and Recreational Atlantic Striped Bass Stock Landings.

Source: Atlantic States Marine Fisheries Commission Atlantic Striped Bass Stock Assessment Update, 2015

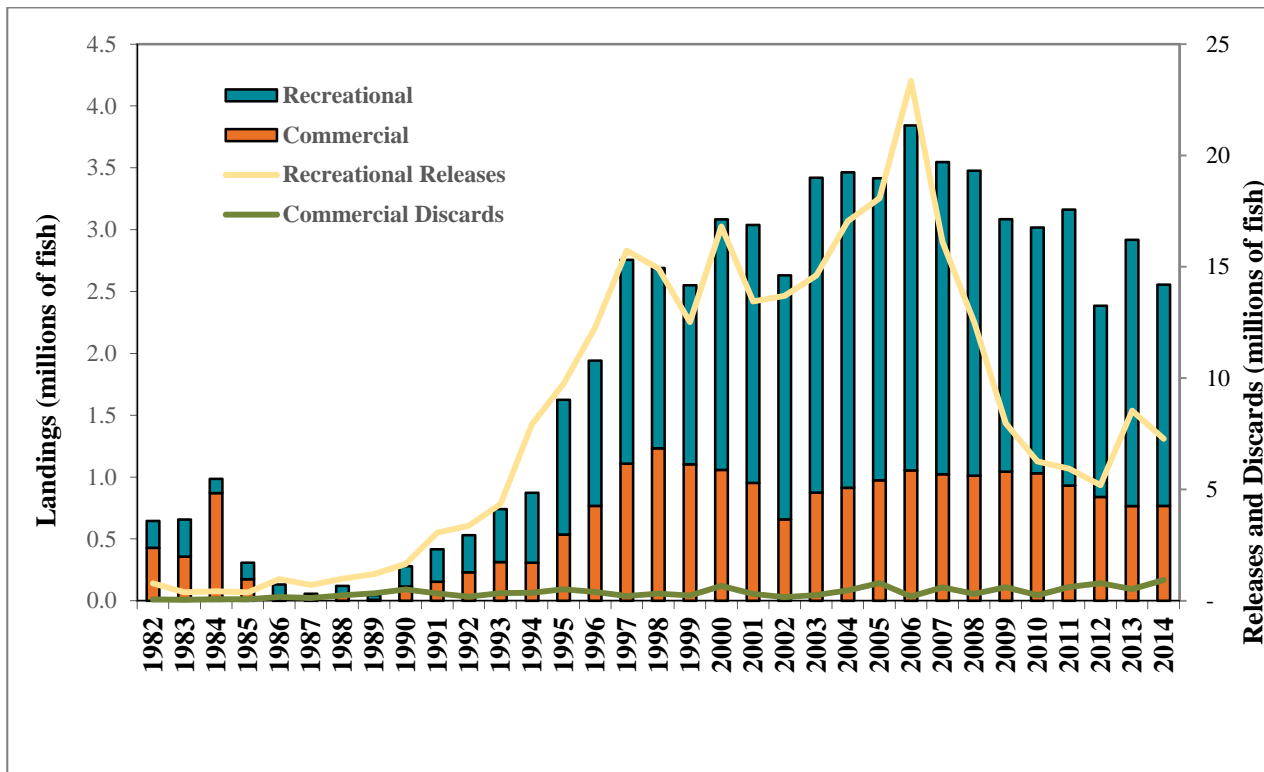
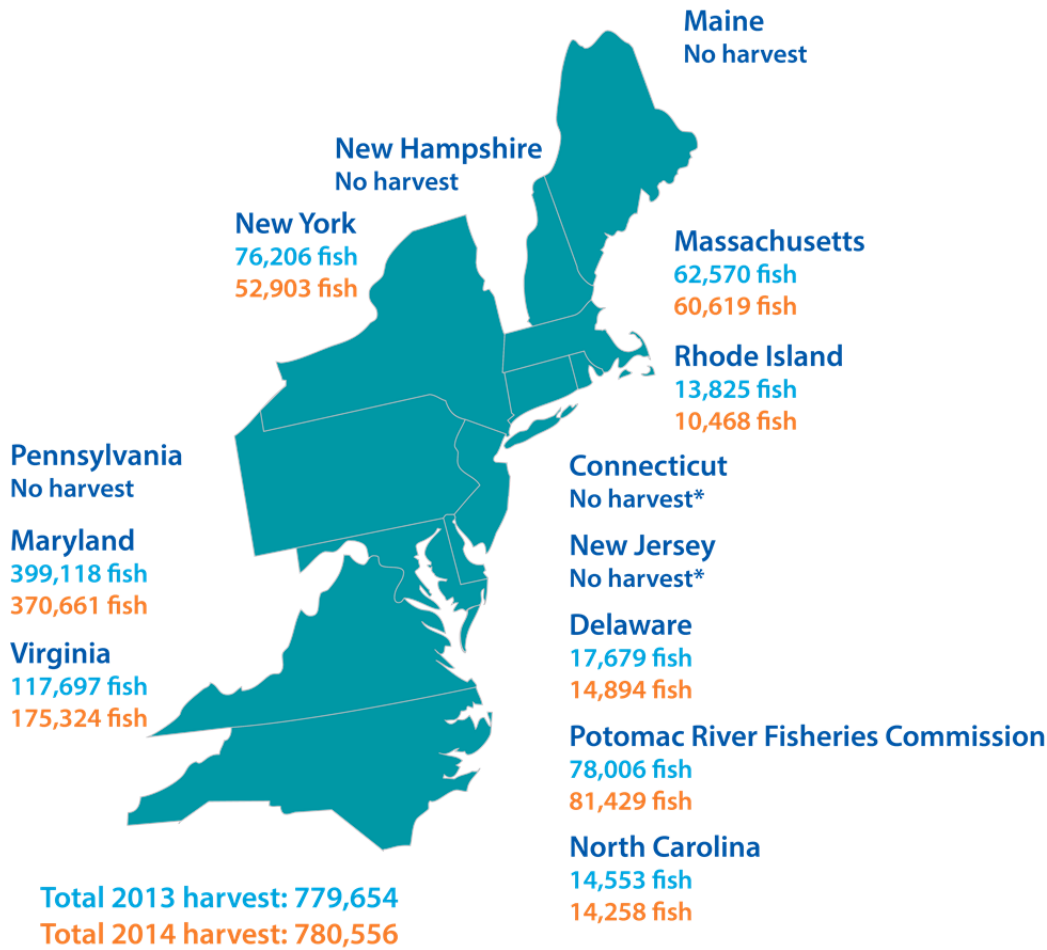


Figure 7. Coast-Wide Striped Bass Commercial Harvest – 2013 and 2014.

Sources: Atlantic States Marine Fisheries Commission Atlantic Striped Bass Stock Assessment Update, 2015 and Albemarle Sound and Roanoke River Striped Bass Stock Assessment, 2014



* Commercial quota used for recreational fishery.



Commercial catch of Atlantic striped bass. Photo credit: Kate Taylor, NOAA

Status of Monitoring

- Implementation of fishery-dependent monitoring programs for striped bass continued for all jurisdictions with commercial fisheries or substantial recreational fisheries. These programs define the catch and effort composition of these fisheries.
- All states and jurisdictions with a commercial fishery have implemented commercial fish market tagging programs to stem the illegal harvest of striped bass.
- The management plan requires certain states to monitor the striped bass population independent of the fisheries.
 - Juvenile abundance indices are required from Maine (Kennebec River), New York (Hudson River), New Jersey (Delaware River), Maryland (Chesapeake Bay tributaries), Virginia (Chesapeake Bay tributaries), and North Carolina (Albemarle Sound).
 - The Commission’s Striped Bass Technical Committee annually reviews the juvenile abundance indices for recruitment failure.
 - Spawning stock sampling is mandatory for New York (Hudson River), Pennsylvania (Delaware River), Delaware (Delaware River), Maryland (Upper Chesapeake Bay and Potomac River), Virginia (Rappahannock River and James River), and North Carolina (Roanoke River and Albemarle Sound).
 - NOAA Fisheries, the U.S. Fish and Wildlife Service, Massachusetts, New York, New Jersey, Maryland, Virginia, and North Carolina will continue their fishery-independent tag and release programs, which provide data used to determine survivorship and migration patterns.
- NOAA Fisheries’ Marine Recreational Information Program (MRIP) is implementing new ways of collecting, analyzing, and reporting recreational fishing data. The new angler catch and recreational fishing effort surveys will improve the data used to manage striped bass starting in 2017.
- Striped bass compliance reports are submitted annually and are reviewed by the Commission’s Plan Review Team. Compliance reporting requirements are detailed in Amendment 6 and its Addenda I-IV. No compliance issues have been identified.
- Stock assessments are completed biennially. Benchmark stock assessments are completed every 5 years.

Additional Resources

Atlantic States Marine Fisheries Commission – Atlantic Striped Bass webpage
www.asmfc.org/species/atlantic-stripped-bass

Atlantic States Marine Fisheries Commission – Striped Bass compliance reports
 Available at www.asmfc.org or upon request from Commission staff.

FishWatch – Atlantic Striped Bass profile
www.fishwatch.gov/profiles/atlantic-stripped-bass

Marine Recreational Information Program (MRIP)
www.st.nmfs.noaa.gov/recreational-fisheries

Management Changes

In 2012, Addendum III to Amendment 6 of the fishery management plan was approved by the Commission, and requires all states and jurisdictions with a commercial striped bass fishery to implement a commercial harvest market tagging program.

The Commission approved Addendum IV in 2014 in response to the 2013 benchmark assessment, which indicated a steady decline in spawning stock biomass since the mid-2000s. The Addendum established new fishing mortality reference points (fishing mortality target and threshold). It also required coastal states to reduce harvest in order to reduce fishing mortality to a level at or below the new target. Specifically, a 25 percent reduction from 2013 harvest levels was implemented along the coast and a 20.5 percent reduction from 2012 harvest levels was implemented in the Chesapeake Bay. The details of state-specific management measures can be found on the [Commission website](#). Additionally, since the Albemarle/Roanoke stock is thought to contribute minimally to the coast-wide complex, the Addendum delegates management of the Albemarle/Roanoke stock to the State of North Carolina using stock-specific biological reference points approved by the Commission.

Pending Management Action

In November 2015, the Commission’s Striped Bass Management Board (Board) discussed a motion to initiate an Addendum that would reconsider management options from Addendum IV for implementation in 2016. This decision came as a result of hearing public comment from Chesapeake Bay stakeholders indicating economic hardships endured in 2015 due to Addendum IV regulatory changes. It also followed review of the 2015 Stock Assessment Update, which indicated a slightly more favorable stock status compared to the 2013 Benchmark Assessment. After the discussion, the motion was tabled to the February 2016 meeting primarily because the 2015 stock assessment update does not reflect the Addendum IV regulatory changes. Subsequently, the Board tasked the Technical Committee to conduct a stock assessment update in 2016 utilizing catch and index data through 2015.



Tagging Atlantic striped bass. Photo credit: Wilson Laney, U.S. Fish and Wildlife Service.

In February 2016, because the 2016 Stock Assessment Update would not be available for Board review until November, the Board again postponed the tabled motion with the intent that it will be available for reconsideration following review of the 2016 Stock Assessment Update.

Status of Research

Recent (2010–2015) literature was surveyed for relevant new information on Atlantic striped bass and citations for those studies are provided below, categorized by topic.

Environmental Quality, Disease, and Contaminants

- Burger, Joanna, Christian Jeitner, and Michael Gochfeld. 2011. Locational differences in mercury and selenium levels in 19 species of saltwater fish from New Jersey. *Journal of Toxicology and Environmental Health, Part A*, 74:13, 863-874, doi: 10.1080/15287394.2011.570231.
- Cladis, Dennis P., Alison C. Kleiner, and Charles R. Santerre. 2014. Mercury content in commercially available finfish in the United States. *Journal of Food Protection* 8:1361-1366.
- Gochfeld, M., Joanna Burger, Christian Jeitner, Mark Donio, and Taryn Pittfield. 2012. Seasonal, locational and size variations in mercury and selenium levels in Striped Bass (*Morone saxatilis*) from New Jersey. *Environmental Research* 112:8–19.
- Kraus, Richard T., David H. Secor and Rebecca L. Wingate. 2015. Testing the thermal-niche oxygen-squeeze hypothesis for estuarine Striped Bass. *Environmental Biology of Fishes* 98(10):2083-2092.
- Lapointe, Dominique, Wolfgang K. Vogelbein, Mary C. Fabrizio, David T. Gauthier, and Richard W. Brill. 2014. Temperature, hypoxia, and mycobacteriosis: effects on adult Striped Bass *Morone saxatilis* metabolic performance *Diseases of Aquatic Organisms* 108: 113–127. doi: 10.3354/dao02693.
- Latour, Robert J., David T. Gauthier, James Gartland, Christopher F. Bonzek, Kathleen A. McNamee, and Wolfgang K. Vogelbein. 2012. Impacts of mycobacteriosis on the growth of Striped Bass (*Morone saxatilis*) in Chesapeake Bay. *Can. J. Fish. Aquat. Sci.* 69: 247–258. doi:10.1139/F2011-158.

Nelson, J.A. and G.K. Lipkey. 2015. Hypoxia tolerance variance between swimming and resting Striped Bass *Morone saxatilis*. *Journal of Fish Biology* 87(2):510-518.

Skinner, Lawrence C. 2011. Distributions of polyhalogenated compounds in Hudson River (New York, USA) fish in relation to human uses along the river. *Environmental Pollution* 159(10):2565-2574.

Stine, C.B., A.S. Kane and A.M. Baya. 2010. Mycobacteria isolated from Chesapeake Bay fish. *Journal of Fish Diseases* 33(1):39-46. doi: 10.1111/j.1365-2761.2009.01087.x.

Habitat Use and Distribution

Able, Kenneth W., Thomas M. Grothues, Jason T. Turnure, Donald M. Byrne, and Paul Clerkin. 2012. Distribution, movements, and habitat use of small Striped Bass (*Morone saxatilis*) across multiple spatial scales. *Fishery Bulletin* 110(2):176-192.

Able, Kenneth W., Thomas M. Grothues, Jason T. Turnure, Margaret A. Malone, and Gregory A. Henkes. 2014. Dynamics of residency and egress in selected estuarine fishes: evidence from acoustic telemetry. *Environ. Biol. Fish.* 97:91–102. doi: 10.1007/s10641-013-0126-6.

Callihan, Jody L., Charlton H. Godwin, and Jeffrey A. Buckel. 2014. Effect of demography on spatial distribution: movement patterns of the Albemarle Sound–Roanoke River stock of Striped Bass (*Morone saxatilis*) in relation to their recovery. *Fish. Bull.* 112:131–143. doi:10.7755/FB.112.2-3.3.

Callihan, Jody L., Charlton H. Godwin, Kevin J. Dockendorf, and Jeffrey A. Buckel. 2014. Growth and mortality of hatchery-reared Striped Bass stocked into nonnatal systems. *North American Journal of Fisheries Management* 34 (6):1131-1139. doi: 10.1080/02755947.2014.951805.

Callihan, Jody L., Julianne E. Harris and Joseph E. Hightower. 2015. Coastal migration and homing of Roanoke River Striped Bass. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science*, 7 (1):301-315. doi: 10.1080/19425120.2015.1057309.

Gahagan, Benjamin I., Dewayne A. Fox, and David H. Secor. 2015. Partial migration of Striped Bass: revisiting the contingent hypothesis. *Mar. Ecol. Prog. Series* 525: 185–197. doi: 10.3354/meps11152.

Jacobs, John M., Reginal M. Harrell, Jim Uphoff, Howard Townsend, and Kyle Hartman. 2013. Biological reference points for the nutritional status of Chesapeake Bay Striped Bass. *North American Journal of Fisheries Management* 33:468–481.

Kneebone, Jeff, William S. Hoffman, Micah J. Dean, and Michael P. Armstrong. 2014. Movements of Striped Bass between the Exclusive Economic Zone and Massachusetts state waters. *North American Journal of Fisheries Management* 34(3):524-534.

Kneebone, Jeff, William S. Hoffman, Micah J. Dean, Dewayne A. Fox, and Michael P. Armstrong. 2014. Movement patterns and stock composition of adult Striped Bass tagged in Massachusetts coastal waters. *Transactions of the American Fisheries Society* 143(5): 1115-1129.

Martino, E. J., and E. D. Houde. 2010. Recruitment of Striped Bass in Chesapeake Bay: spatial and temporal environmental variability and availability of zooplankton prey. *Mar Ecol Prog Ser* 409: 213–228.

- Mather, M.E., J.T. Finn, S.M. Pautzke, D. Fox, T. Savoy, H.M. Brundage, III, L.A. Deegan, and R.M. Muth. 2010. Diversity in destinations, routes and timing of small adult and sub-adult Striped Bass *Morone saxatilis* on their southward autumn migration. *Journal of Fish Biology* 77(10):2326-2337.
- Mohan, John A., Norman M. Halden, and Roger A. Rulifson. 2014. Habitat use of juvenile Striped Bass *Morone saxatilis* (Actinopterygii: Moronidae) in rivers spanning a salinity gradient across a shallow wind-driven estuary. *Environ Biol Fish* doi: 10.1007/s10641-014-0344-6.
- Nelson, Gary A., Michael P. Armstrong, Jennifer Stritzelthomson and Kevin D. Friedland. 2010. Thermal habitat of Striped Bass (*Morone saxatilis*) in coastal waters of northern Massachusetts, USA, during summer. *Fish. Oceanogr.* 19(5):370–381.
- Nye, Janet A., Matthew R. Baker, Richard Bell, Andrew Kenny, K. Halimeda Kilbourne, Kevin D. Friedland, Edward Martino, Megan M. Stachura, Kyle S. Van Houtan, and Robert Wood. 2014. Ecosystem effects of the Atlantic Multidecadal Oscillation. *Journal of Marine Systems* 133:103–116.
- O’Connor, Megan P., Francis Juanes, Kevin McGarigal, and Jon Caris. 2012. Describing juvenile American Shad and Striped Bass habitat use in the Hudson River Estuary using species distribution models. *Ecological Engineering* 48:101– 108.
- O’Connor, Megan P., Francis Juanes, Kevin McGarigal and Steven Gaurin. 2012. Findings on American Shad and Striped Bass in the Hudson River Estuary: A Fish Community Study of the Long-Term Effects of Local Hydrology and Regional Climate Change. *Marine and Coastal Fisheries* 4 (1):327-336. doi: 10.1080/19425120.2012.675970.
- Patrick, Wesley S. 2010. Are marine migrations of Striped Bass genetically pre-determined? An investigation of Albemarle Sound-Roanoke River Striped Bass migratory patterns. Coastal Resources Management Ph.D. Program, East Carolina University, Greenville, NC. 188 pp.
- Pautzke, Sarah M., Martha E. Mather, John T. Finn, Linda A. Deegan, and Robert M. Muth. 2010. Seasonal use of a New England estuary by foraging contingents of migratory Striped Bass. *Transactions of the American Fisheries Society* 139:257–269. doi: 10.1577/T08-222.1.
- Sadler, Philip W., Matthew W. Smith, John M. Hoenig, Shelley E. Sullivan, Robert E. Harris, Jr., and Lydia M. Goins. 2013. Evaluation of Striped Bass stocks in Virginia: monitoring and tagging Studies, 2010-2014. Department of Fisheries Science, School of Marine Science, Virginia Institute of Marine Science, The College of William and Mary, Gloucester Point, VA. Progress Report F-77-R-25, 1 September 2011 - 31 August 2012. 227 pp.
- Williams, Kimberly, and John Waldman. 2010. Aspects of the wintering biology of Striped Bass at a power plant discharge. *Northeastern Naturalist* 17(3):373-386. doi: <http://dx.doi.org/10.1656/045.107.0303>.
- Wingate, Rebecca L., David H. Secor and Richard T. Kraus. 2011. Seasonal patterns of movement and residency by Striped Bass within a sub-estuary of the Chesapeake Bay. *Transactions of the American Fisheries Society* 140(6):1441-1450.

Species Interactions

- Boyd, Jacob. B. 2011. Maturation, fecundity, and spawning frequency of the Albemarle/Roanoke Striped Bass stock. Department of Biology, East Carolina University, Greenville, NC. MS thesis. 132 pp.
- Davis, Justin P., Eric T. Schultz, and Jason C. Vokoun. 2012. Striped Bass consumption of Blueback Herring during vernal riverine migrations: does relaxing harvest restrictions on a predator help conserve a prey species of concern? *Marine and Coastal Fisheries* 4(1):239-251. doi: 10.1080/19425120.2012.675972.
- Duston, J., and T. Astatkie. 2012. Prey density and nonvisual feeding by larval Striped Bass. *Transactions of the American Fisheries Society* 141(3):610-614.
- Ferry, Kristen H., and Martha E. Mather. 2012. Spatial and temporal diet patterns of subadult and small adult Striped Bass in Massachusetts estuaries: data, a synthesis, and trends across scales. *Marine and Coastal Fisheries* 4(1):30-45. doi:10.1080/19425120.2011.642747.
- Figueira, Will F., and Felicia C. Coleman. 2010. Comparing landings of United States recreational fishery sectors. *Bulletin of Marine Science* 86(3): 499–514.
- Frisk, M.G., T.J. Miller, R.J. Latour, and S.J.D. Martell. 2011. Assessing biomass gains from marsh restoration in Delaware Bay using Ecopath with Ecosim. *Ecological Modelling* 222: 190–200.
- Garrison, L. P., J. S. Link, D. P. Kilduff, M. D. Cieri, B. Muffley, D. S. Vaughan, A. Sharov, B. Mahmoudi, and R. J. Latour. 2010. An expansion of the MSVPA approach for quantifying predator–prey interactions in exploited fish communities. *ICES Journal of Marine Science* 67:856–870.
- Gauthier, David T., Corinne A. Audemard, Jeanette E.L. Carlsson, Tanya L. Darden, Michael R. Denson, Kimberly S. Reece and Jens Carlsson. 2013. Genetic population structure of US Atlantic coastal Striped Bass (*Morone saxatilis*). *Journal of Heredity* 104(4):510-520.
- Hall, Carolyn J., Adrian Jordaan, and Michael G. Frisk. 2012. Centuries of anadromous forage fish loss: consequences for ecosystem connectivity and productivity. *Bioscience* 62(8):723-731.
- Harris, Julianne, and Joseph E. Hightower. 2015. Estimating mortality rates for Albemarle Sound-Roanoke River Striped Bass using an integrated modeling approach. Final report to North Carolina Division of Marine Fisheries, Morehead City. 40 pp.
- Martino, E.J., and E.D. Houde. 2012. Density-dependent regulation of year-class strength in age-0 juvenile Striped Bass (*Morone saxatilis*). *Canadian Journal of Fisheries and Aquatic Sciences* 69(3):430-446.
- Petitgas, P., D. H. Secor, I. McQuinn, G. Huse, and N.Lo. 2010. Stock collapses and their recovery: mechanisms that establish and maintain lifecycle closure in space and time. *ICES Journal of Marine Science*, 67: 1841–1848.
- Rosenblatt, A.E., M.R. Heithaus, M.E. Mather, P. Matich, J. Nifong, W.J. Ripple, B. Silliman. 2013. The roles of large top predators in coastal ecosystems: New insights from long term ecological research. *Oceanography* 26: 156-167. doi: 10.5670/oceanog.2013.59.
- Sagarese, Skyler R., Robert M. Cerrato and Michael G. Frisk. 2011. Diet composition and feeding habits of common fishes in Long Island Bays, New York. *Northeastern Naturalist* 18(3):291-314.

- Shideler, Allison Rae Chandler. 2011. Patterns in distribution, growth, and trophodynamics of Striped Bass early life stages in the estuarine transition region of upper Chesapeake Bay. University of Maryland, College Park. MS thesis. 162 pp.
- Shideler, Allison C., and Edward D. Houde. 2014. Spatio-temporal variability in larval-stage feeding and nutritional sources as factors influencing Striped Bass (*Morone saxatilis*) recruitment success. *Estuaries and Coasts* 37(3):561-575.
- Slacum, H. Ward, Jr., William H. Burton, Elizabeth T. Methratta, Edward D. Weber, Roberto J. Llansó and Jodi Dew-Baxter. 2010. Assemblage structure in shoal and flat-bottom habitats on the inner continental shelf of the middle Atlantic bight, USA. *Marine and Coastal Fisheries* 2(1):277-298.
- Smith, Brian E., and Jason S. Link. 2010. The trophic dynamics of 50 finfish and 2 squid species on the northeast US continental shelf. US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, Massachusetts NOAA Technical Memorandum NMFS-NE-216. 646 pp.
- Waldman, J., L. Maceda, and I. Wirgin. 2012. Mixed-stock analysis of wintertime aggregations of Striped Bass along the mid-Atlantic coast. *Journal of Applied Ichthyology* 28:1-6.
- Woodroffe, Jennifer R. 2011. Historical ecology of Striped Bass stocking in the southeastern United States. Department of Biology, East Carolina University, Greenville, NC. MS thesis. 118 pp.



2016 Atlantic striped bass tagging cruise. Photo credit: Kirby Rootes-Murdy, Atlantic States Marine Fisheries Commission.

Appendix

Prepared and Edited by:

Gary R. Shepherd
National Marine Fisheries Service

R. Wilson Laney
U.S. Fish and Wildlife Service
North Carolina State University, Department of Applied Ecology

Max Appelman
Atlantic States Marine Fisheries Commission

Darcie Honabarger
National Marine Fisheries Service

Christopher L. Wright
National Marine Fisheries Service

This document should be cited as follows:

Shepherd, G.R., R.W.Laney, M. Appelman, D. Honabarger, and C.L. Wright. 2016. Biennial Report to Congress on the Progress and Findings of Studies of Striped Bass Populations - 2015, 13 p. National Marine Fisheries Service, Silver Spring, MD.



U.S. Secretary of Commerce
Penny Pritzker

Administrator of National Oceanic and Atmospheric Administration and Undersecretary of Commerce
Kathryn D. Sullivan, Ph.D.

Assistant Administrator for Fisheries
Eileen Sobeck

December 2015

www.fisheries.noaa.gov

OFFICIAL BUSINESS

National Marine Fisheries Service

1315 East-West Highway
SSMC 3, F/SF, Room 13362
Silver Spring, MD 20910



U.S. Secretary of the Interior
Sally Jewell

Principal Deputy Assistant Secretary for Fish and Wildlife and Parks
Michael Bean

Director of the U.S. Fish and Wildlife Service
Dan Ashe