NOAA FISHERIES

Atlantic Striped Bass Populations

2023

Cover: Atlantic striped bass being reeled in during 2022 State-Federal Cooperative Winter Tagging Program off of Virginia Beach, VA. Photo credit: Craig Weedon, Maryland DNR.

Introduction

The 1997 reauthorization of the Atlantic Striped Bass Conservation Act (16 U.S.C. 5151 *et seq*.; Striped Bass Act) mandates the Secretaries of the Departments of Commerce and the Interior to submit biennial reports to Congress and to the Atlantic States Marine Fisheries Commission on the progress and findings of studies of migratory and estuarine Atlantic striped bass (*Morone saxatilis*) populations. This report includes catch and landings data available through 2022 with an emphasis on calendar years 2021 to 2022, and the most recent information available on stock status.

Status of the Stocks

The coastwide Atlantic striped bass population includes four major stock components: the Hudson River, Delaware River and Bay, Chesapeake Bay, and Albemarle Sound-Roanoke River stocks. The Atlantic coastal migratory stock includes primarily Hudson River, Delaware River and Bay, and Chesapeake Bay–origin fish, and is managed at the coastwide-level by the Commission. The predominantly resident Albemarle Sound-Roanoke River stock is currently managed by the State of North Carolina with Commission oversight. Other striped bass stocks that occupy coastal rivers from the Tar-Pamlico River in North Carolina south are not included in this report because those stocks do not undertake extensive Atlantic Ocean migrations and are considered primarily endemic and riverine.

Crew holding striped bass during the 2022 State-Federal Cooperative Winter Tagging Program. Photo credit: Eric Packard.

Atlantic Stock (Commission Managed)

The 2018 Benchmark Stock Assessment for Atlantic Striped Bass was updated in 2022 to include catch and survey data from 2018-2021. The assessment update represents the best scientific information available on the status of the coastal

migratory stock for use in fisheries management. The results of the assessment indicate the Atlantic striped bass stock is not experiencing overfishing but is overfished. [1,2]

Total fishing mortality in 2021 was estimated at 0.14, which is below both the updated target (0.17) and threshold (0.20) fishing mortality reference points (Figure 1), indicating that overfishing is not occurring.[3]

Female spawning stock biomass in 2021 was estimated at 143 million pounds (64,805 metric tons), which is below the updated spawning stock biomass target of 235 million pounds (106,820 metric tons) and below the updated threshold of 188 million pounds (85,457 metric tons) (Figure 2), indicating the stock is overfished.

Spawning stock biomass has declined since a time-series high in 2003. The decrease in biomass is largely attributed to high fishing mortality coupled with a period of below average recruitment (age-1 fish) from 2006 to 2014 (Figure 3), and is also reflected in a declining trend of coast-wide catch from 2007 to 2021 (Figure 6). However, spawning stock biomass is trending up toward the threshold level from 2019-2021.

Definitions

Migratory – Individuals that leave the inshore rivers and estuaries and move into offshore habitats along the Atlantic Coast.
Resident – Individuals that remain in nearshore, river, and estuarine systems year-round and contribute minimally to the coastal migratory stock.
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.
Fishing mortality (F) – The rate of removals from a population by fishing.
Recruitment – The number of 1-year-old fish entering the population.
Overfished – A stock is overfished or depleted if the stock has reached critically low biomass or abundance.
Overfishing – A stock is experiencing overfishing if fishing is negatively affecting the stock through reduced growth and/or recruitment.
Landings – The number or pounds of fish caught and kept by commercial and recreational anglers.
Release mortality – The number or proportion of fish that die after being caught and released alive.
Total removals – The total number of fish removed from the population, which include both landings and release mortality.

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[1] Northeast Fisheries Science Center. 2018. 66th Northeast Regional Stock Assessment Workshop (66th SAW) Assessment Summary Report. US Dept. Commer. Northeast Fish Sci Cent Ref Doc. 19-01; 45 p.
[2] Atlantic States Marine Fisheries Commission (ASMFC). 2022. Atlantic Striped Bass Stock Assessment Update. ASMFC, Arlington, VA. 48 p.
[3] Overfishing is occurring when fishing mortality exceeds the fishing mortality threshold. The fishing mortality target provides a more conservative baseline for management purposes to ensure overfishing does not occur.

Figure 1. Coastal Migratory Atlantic Striped Bass Stock Fishing Mortality (F) Estimates and Biological Reference Points, 1982 to 2021.
Source: Atlantic Striped Bass Stock Assessment Update, 2022

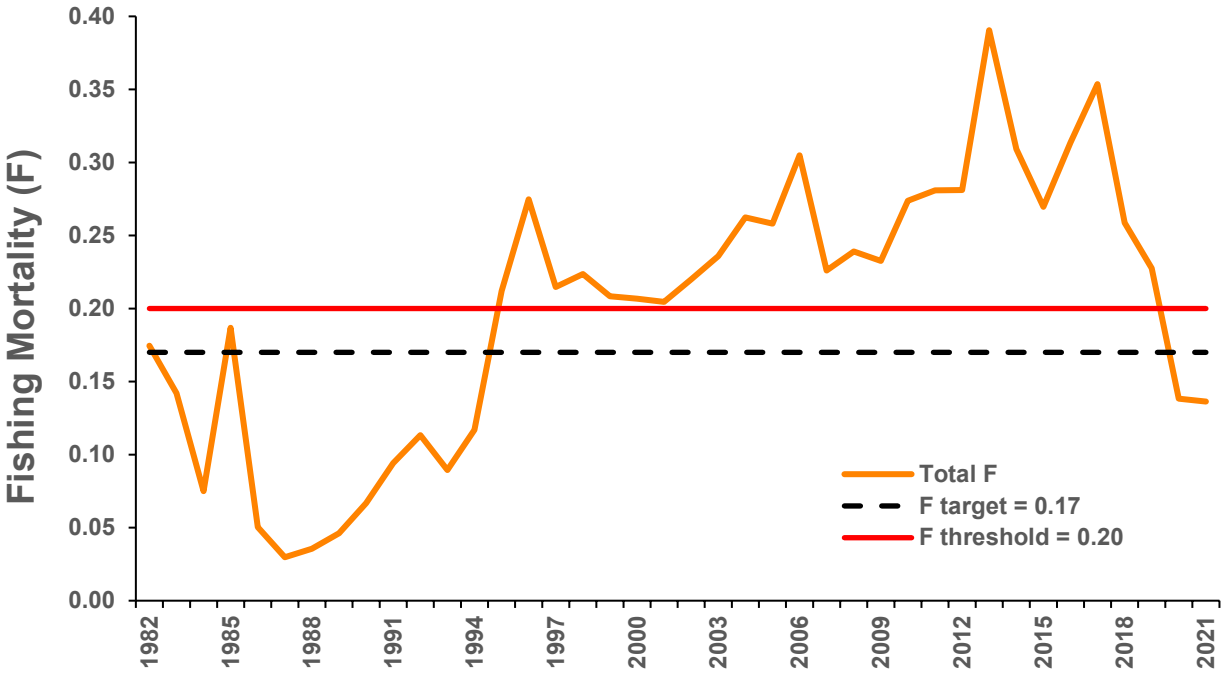


Figure 2. Coastal Migratory Atlantic Striped Bass Female Spawning Stock Biomass (SSB) Estimates and Biological Reference Points, 1982 to 2021.
Source: Atlantic Striped Bass Stock Assessment Update, 2022

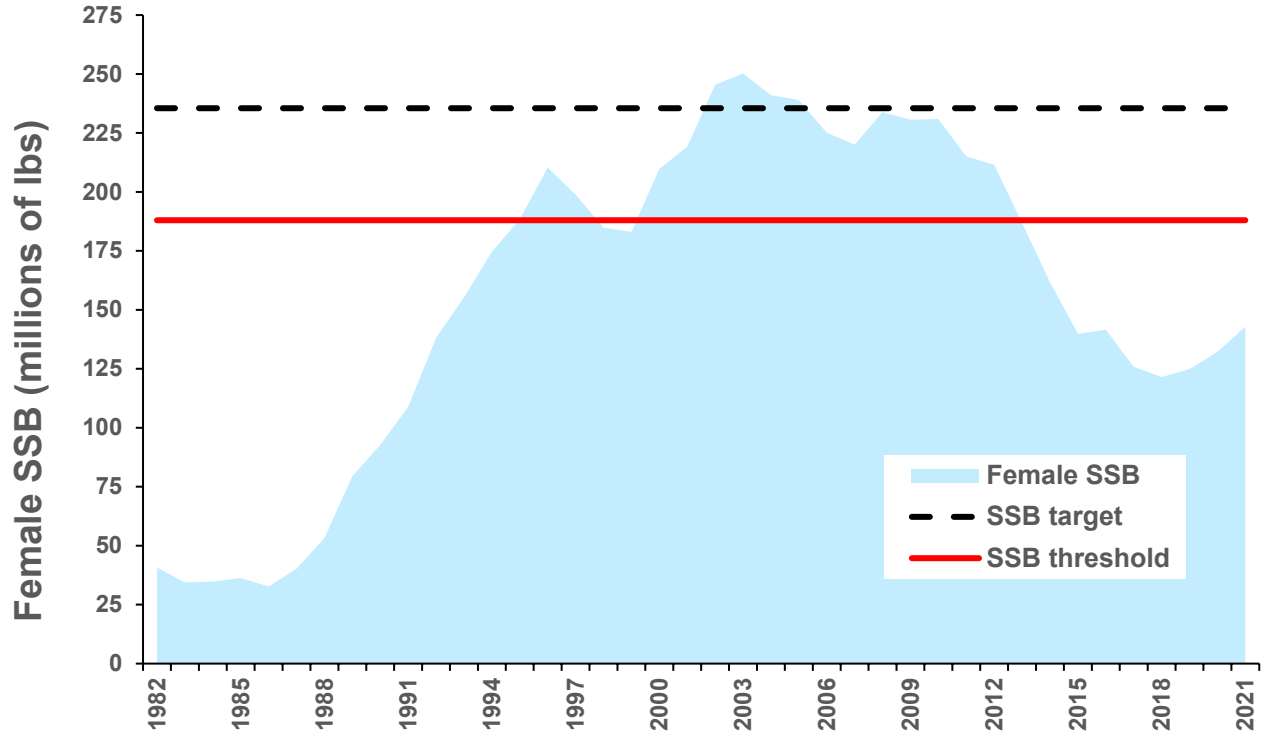
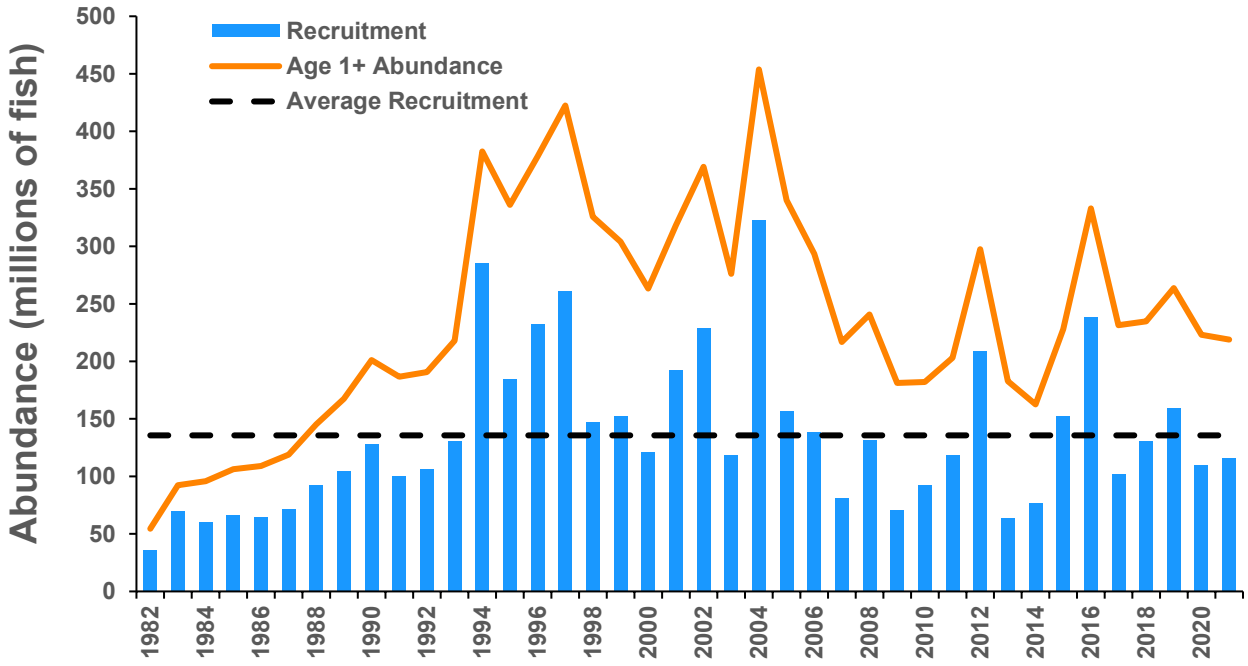


Figure 3. Coastal Migratory Atlantic Striped Bass Stock Recruitment (Abundance of Age-1 Fish) and Total Abundance Estimates, 1982 to 2021.
Source: Atlantic Striped Bass Stock Assessment Update, 2022



Albemarle Sound and Roanoke River Stock (North Carolina Managed)

The 2020 North Carolina benchmark stock assessment for the Albemarle Sound-Roanoke River striped bass stock was updated in 2022 using catch and survey data through 2021.[4] Based on the results of the updated assessment, the Albemarle Sound-Roanoke River Atlantic striped bass stock is experiencing overfishing and is overfished.

In 2021, fishing mortality for the Albemarle Sound-Roanoke River stock was estimated at 0.77, which is above both the target (0.14) and threshold (0.20) fishing mortality reference points. These fishing mortality reference points are specific to the Albemarle Sound-Roanoke River stock (Figure 4).

The Albemarle Sound-Roanoke River stock is several orders of magnitude smaller than the coastal migratory stock. Female spawning stock biomass in 2021 was estimated at 35,561 pounds (16 metric tons), which is below the spawning stock biomass target of 361,558 pounds (164 metric tons) and the threshold of 275,578 pounds (125 metric tons). These reference points are also specific to the Albemarle Sound-Roanoke River stock (Figure 5).

The trends in the Albemarle Sound-Roanoke River stock are similar to the coastal migratory stock described above, with a decline in spawning stock biomass since 2004 and only a few strong recruitment (age-1 fish) events since 2001 (Figure 5).

[4] Lee, L.M., C.J.C. Schlick, N. Hancock. C.H. Godwin, and J. McCargo (editors). 2022. Assessment of the Albemarle Sound-Roanoke River Striped Bass (Morone saxatilis) stock in North Carolina, 1991–2021. North Carolina Division of Marine Fisheries, NCDMF SAP-SAR-2022-03, Morehead City, North Carolina. 98 p.

Figure 4. Albemarle Sound-Roanoke River Striped Bass Stock Fishing Mortality (F) Estimates and Biological Reference Points, 1991 to 2021.

Source: Albemarle Sound-Roanoke River Atlantic Striped Bass Stock Assessment Update, 2022.[5]

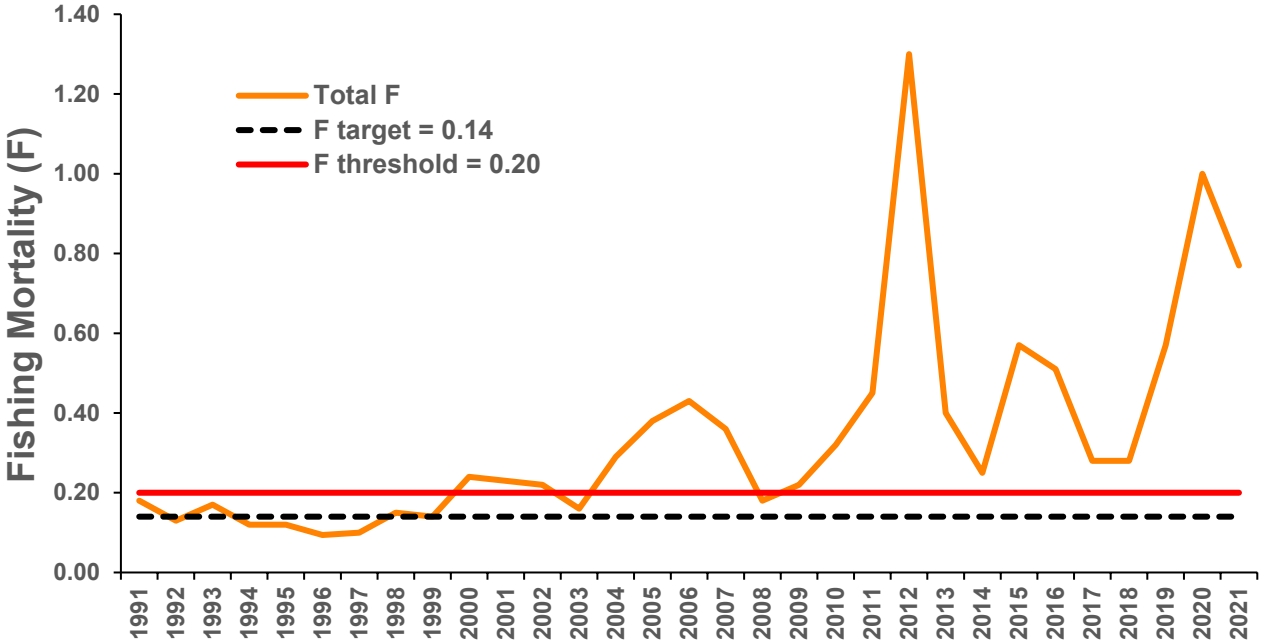
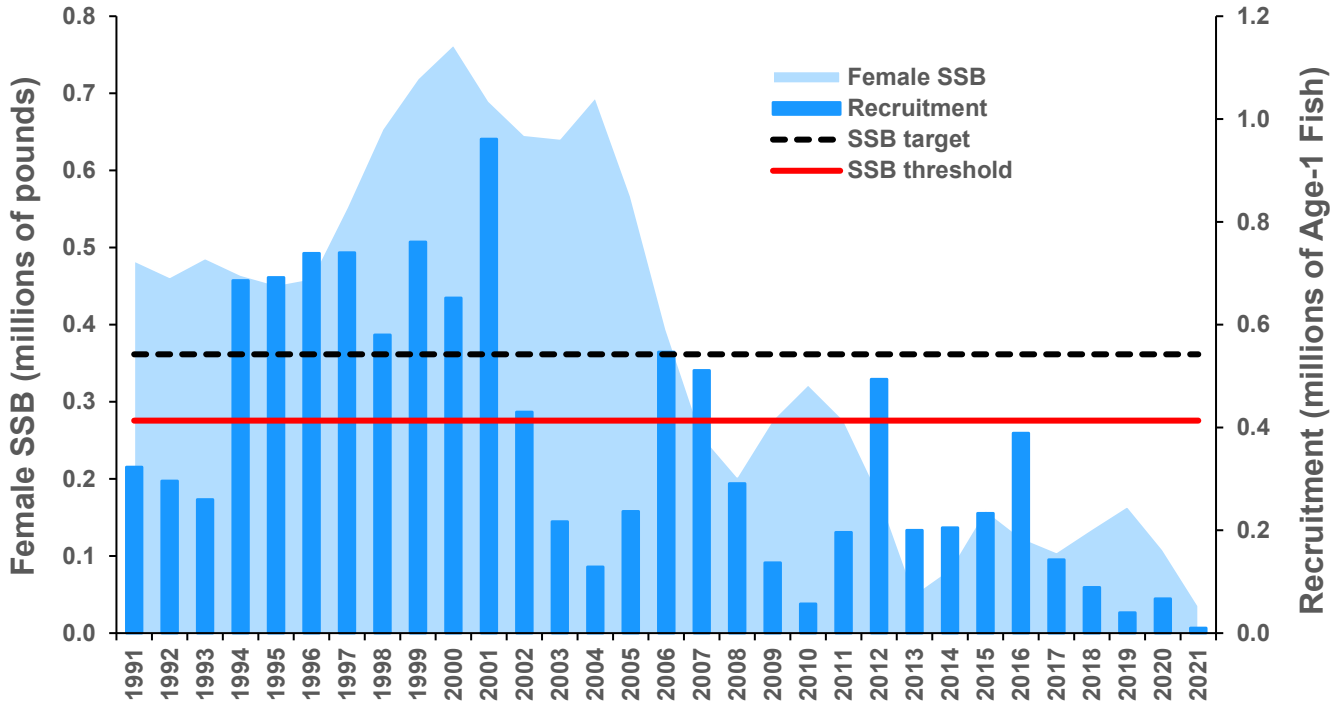


Figure 5. Albemarle Sound-Roanoke River Striped Bass Stock Female Spawning Stock Biomass (SSB), Recruitment (Abundance of Age-1 Fish) Estimates, and Biological Reference Points, 1991 to 2021.

Source: Albemarle Sound-Roanoke River Atlantic Striped Bass Stock Assessment Update, 2022.



[5] The 2022 Albemarle Sound-Roanoke River stock assessment update uses recreational catch data collected from the North Carolina creel survey, which started in 1991.

Status of the Fisheries

Atlantic Stock (Commission Managed)

Total Atlantic striped bass removals (which include commercial and recreational landings, commercial discards, and recreational release mortality) in 2021 were estimated at 5.16 million fish and 6.80 million fish in 2022 (Figure 6).

Total commercial removals (landings plus discards) were estimated at 0.73 million fish in 2021 and 0.68 million fish in 2022 (Figure 6).[6] The commercial landings were 4.34 million pounds (1,966 metric tons) for 2021 and 4.28 million pounds (1,941 metric tons) for 2022. The commercial landings had a landed value of $14.32 million for 2021 and $13.46 million for 2022.[7] The coastwide striped bass commercial landings by state for 2021 and 2022 are listed in Figure 8.

Total recreational removals (landings plus release mortality) in 2021 were estimated at 4.43 million fish and 6.12 million fish in 2022 (Figure 6). These numbers are derived from the revised Marine Recreational Information Program estimates and should not be directly compared to versions of this report published prior to 2019.

For all recreationally targeted species on the Atlantic Coast, Atlantic striped bass continues to be among the top ranked in landings by weight.[8] In 2021, recreational landings were 15.78 million pounds (7,158 metric tons). Landings more than doubled in 2022 to 35.81 million pounds (16,241 metric tons) due in part to increased fishing effort and the availability of legal-sized fish (refer to "Management Changes and Actions" for more information).

Albemarle Sound and Roanoke River Stock (North Carolina Managed)

In 2021, commercial landings in the Albemarle Sound Management Area were estimated at 27,930 pounds (6,552 fish), with a landed value of $72,567. The combined recreational landings in the Albemarle Sound and Roanoke River Management Areas were estimated at 35,804 pounds (10,053 fish; Figure 7).

In 2022, commercial landings in the Albemarle Sound Management Area were estimated at 24,026 pounds (4,824 fish), with a landed value of $63,808. The combined recreational landings in the Albemarle Sound and Roanoke River Management Areas were estimated at 14,486 pounds (4,738 fish; Figure 7).

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[6] Commercial discard estimates are derived via a generalized additive model (GAM), and are therefore re-estimated for the entire time series when a new year of data is added.

[7] Commercial landings values are from the NOAA Fisheries One Stop Shop (FOSS) database (queried September 18, 2023). FOSS is an automated program anyone can use to get a quick summary of U.S. commercial fisheries landings.

[8] NOAA Fisheries' Marine Recreational Information Program (queried September 18, 2023).

Figure 6. Commercial and Recreational Removals for the Coastal Migratory Atlantic Striped Bass Stock, 1982 to 2022.

Source: Commercial discards and recreational release mortality estimates are from ASMFC; landings data is from 2023 ASMFC state compliance reports and the Marine Recreational Information Program (queried June, 2023).

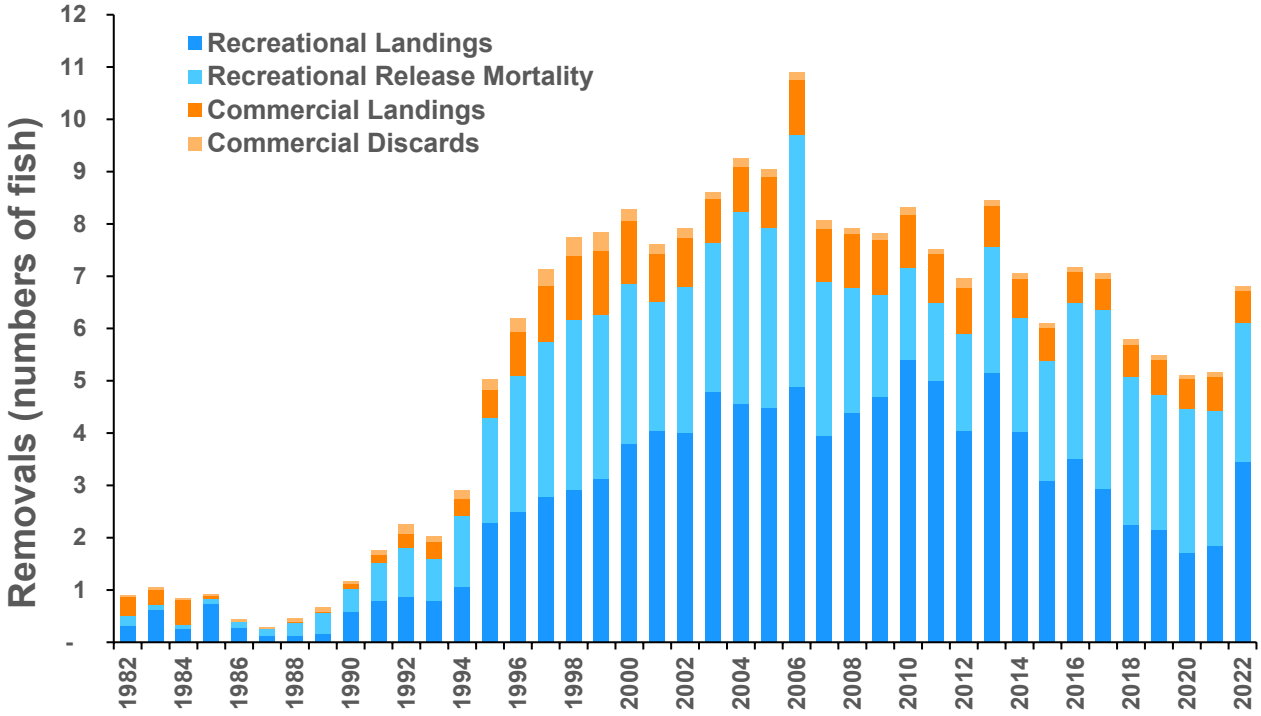


Figure 7. Commercial and Recreational Removals for the Albemarle Sound-Roanoke River Striped Bass Stock, 1991 to 2022.

Source: North Carolina Department of Marine Fisheries, 2023.

Note: The recreational creel surveys during spring 2020 were cut short due to the COVID-19 pandemic.

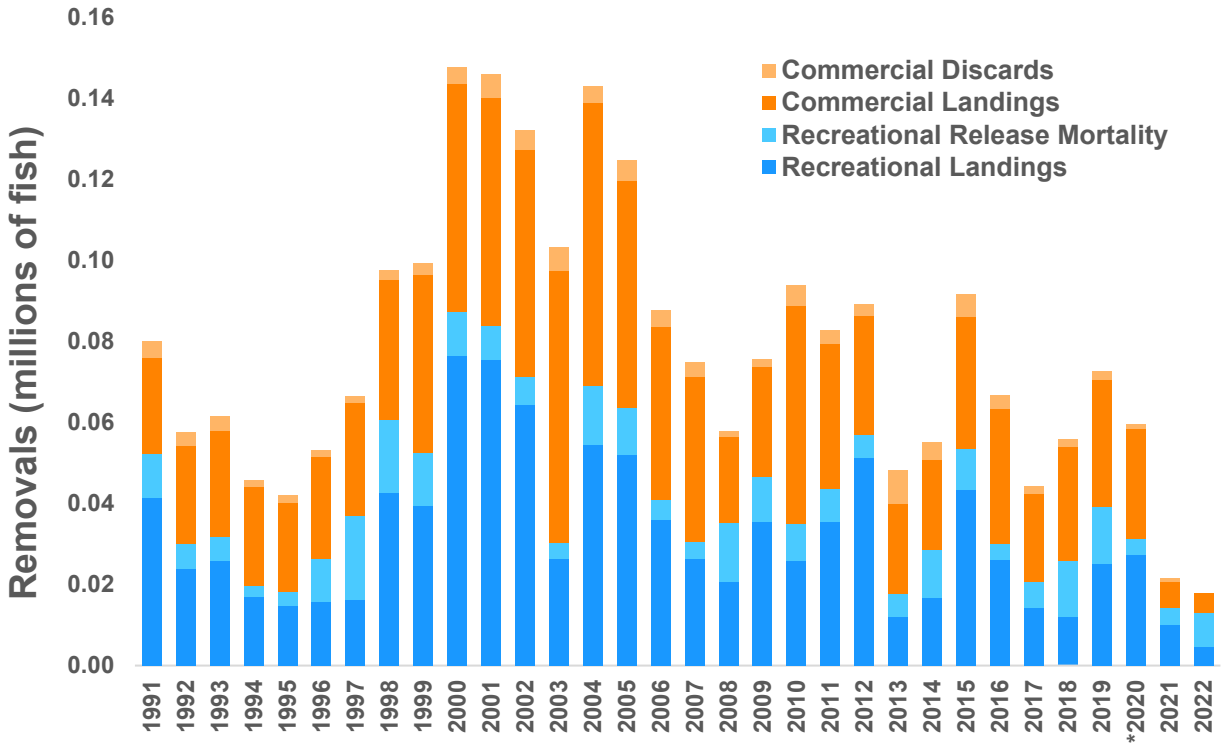
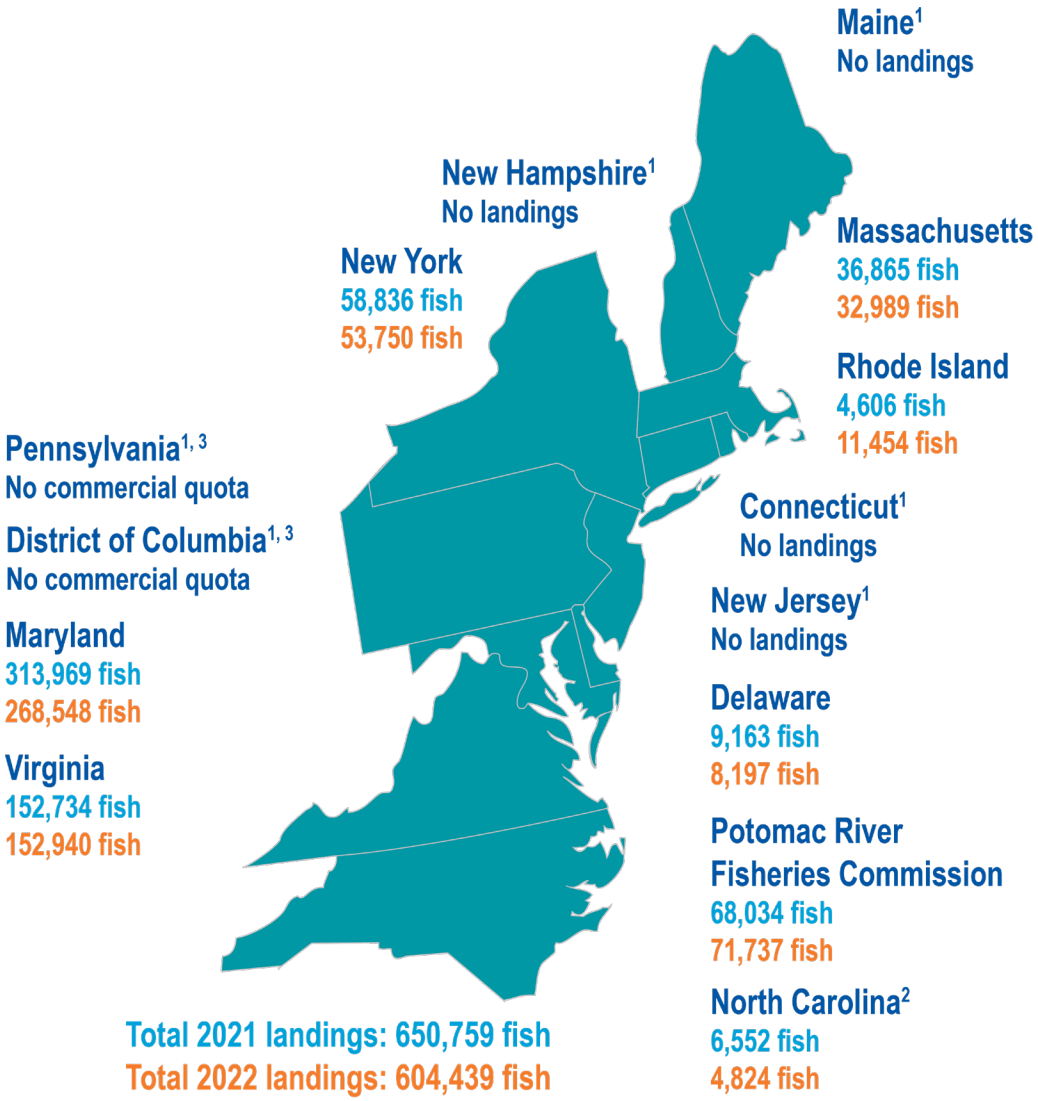


Figure 8. Coast-Wide Striped Bass Commercial Landings – 2021 (numbers in blue) and 2022 (numbers in orange) (landings do not include discards).
Sources: 2023 State Compliance Reports for Atlantic Striped Bass (ASMFC).



1. Commercial fishing for striped bass within these jurisdictions is prohibited.
2. Includes only harvest from within Albemarle Sound-Roanoke River.
3. Pennsylvania and the District of Columbia do not have a striped bass commercial quota.

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 continued to implement commercial fish market tagging programs to limit illegal landings and sale of striped bass.

The Commission's Interstate Fishery Management Plan (FMP) 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 Plan Review Team annually reviews the juvenile abundance indices for recruitment failure.

Additional Resources

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

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

NOAA Fisheries One Stop Shop (FOSS) – U.S. Commercial Fisheries Landings
https://www.fisheries.noaa.gov/foss/

Striped bass reeled in during the 2022 State-Federal Cooperative Winter Tagging Program. Photo credit: Eric Packard.

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's National Marine Fisheries Service (NOAA Fisheries), the U.S. Fish and Wildlife Service, and the states of Massachusetts, New York, New Jersey, Maryland, Virginia, and North Carolina continued their fishery-independent tag and release programs, which provide data used to determine survivorship and migration patterns.

Striped bass compliance reports are submitted annually and are reviewed by the Commission's Striped Bass Plan Review Team. Compliance reporting requirements are detailed in Amendment 7 and its addendum. No compliance issues have been identified at this time.

A continuing concern among anglers, and a factor that may contribute to increased natural mortality of striped bass in Chesapeake Bay, is the presence of mycobacteriosis, a disease caused by a group of bacteria that infects internal organs and causes skin ulcers. The impact of the disease to spawning stock biomass is unknown, but the 2018 benchmark stock assessment recommended investigating impacts of the disease in future benchmark stock assessments.

Stock assessments are typically updated every 2 years by adding the most recent catch and survey information to the existing time series and running the statistical catch-at-age model. Benchmark stock assessments are conducted roughly every 5 years (sometimes longer depending on current management goals and priorities) and explore new data sources and analytical advances to stock dynamics modeling. The next stock assessment update is tentatively scheduled for fall 2024 and a benchmark assessment, including external peer review, is being considered for 2027.

Management Changes and Actions

Atlantic Stock (Commission Managed)

In 2021 and 2022, the Commission developed and implemented a comprehensive amendment to the Atlantic Striped Bass Interstate FMP. Approved in May 2022, Amendment 7 consolidates Amendment 6 and its addenda into a single document.[9] The Amendment was developed as part of the Commission's response to the results of the 2018 benchmark assessment. It builds upon the previous action to address overfishing, and implements a rebuilding plan to rebuild the stock by 2029 in response to the stock's overfished status.[10] Amendment 7 includes a more conservative recruitment-based management trigger to help achieve the rebuilding goal. The amendment also adds new requirements to the conservation equivalency process to address scientific and management uncertainties, and adds measures to increase the chance of survival of striped bass caught and released alive in the recreational fishery.

The Commission also developed Draft Addendum I to Amendment 7 in 2021 and 2022 to consider the voluntary transfer of commercial quota between states in the ocean region, contingent on stock status, while broader issues with the commercial management program are anticipated to be addressed in a later action. The Commission approved the draft addendum for public comment in November 2022 and later implemented final addendum measures.[11]

In 2022, recreational harvest of striped bass nearly doubled relative to 2021 harvest. An updated projections analysis estimated a less than 15 percent probability of achieving the rebuilding goal if the higher 2022 fishing mortality rate continues each year. As a result, the

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[9] ASMFC. 2022. Amendment 7 to the Interstate FMP for Atlantic Striped Bass. ASMFC, Arlington, VA. 127p.

[10] ASMFC. 2019. Addendum VI to Amendment 6 to the Interstate FMP for Atlantic Striped Bass: 18% reduction in removals and circle hook measures. ASMFC, Arlington, VA. 27p.

[11] Final action on Addendum I occurred in May 2023: ASMFC. 2023. Addendum I to Amendment 7 to the Interstate FMP for Atlantic Striped Bass: commercial quota transfers in the ocean region. ASMFC, Arlington, VA. 20p.

Management Board approved an emergency action in May 2023 to change the recreational size limit, effective immediately. The emergency 31-inch maximum size limit is intended to reduce harvest of the strong 2015-year class, which has become the predominant year class in the ocean fishery. As part of the emergency action, the Management Board also initiated Addendum II to Amendment 7 to more formally address through the public process concerns about the effect increased recreational removals may be having on stock rebuilding. The addendum will follow the 2023 emergency action, and consider 2024 management measures to reduce fishing mortality to the target level. The Management Board will consider the results of the next assessment update (expected in late 2024) to inform measures in 2025 and beyond.

Albemarle Sound and Roanoke River Stock (North Carolina Managed)

Following the results of the 2020 Albemarle Sound-Roanoke River benchmark stock assessment, North Carolina implemented a 2020 Revision to Amendment 1 of the North Carolina Estuarine Striped Bass FMP. The revision lowered the annual total allowable landings (TAL) for the Albemarle Sound and Roanoke River management areas for 2021 and 2022 in order to reduce fishing mortality to the target level. Further, following the results of the 2022 updated stock assessment and continued low levels of recruitment, North Carolina will implement a harvest moratorium starting in 2024.

Top view of F/V *Midnight Sun* (left) and volunteer angler reeling in a striped bass (right) during the 2022 State-Federal Cooperative Winter Tagging Program. Photo credit: Eric Packard.

Status of Research

Literature was surveyed in the 2021-2022 period for relevant new information on Atlantic striped bass and citations for those studies are provided below, categorized by topic. Any papers published in 2020 that were not part of the previous report are included here for completeness.

Environmental Quality, Disease, Contaminants, and Physiology

Andrews, S.N., D.H. Roth, K.A. Kidd, T. Linnansaari, and R. A. Curry. 2021. Harvest and mercury levels of Striped Bass in Miramichi River, New Brunswick, Canada. North American Journal of Fisheries Management ISSN: 0275-5947 print / 1548-8675 online DOI: 10.1002/nafm.10657

Gauthier, D.T., A.N. Haines and W.K. Vogelbein. 2021. Elevated temperature inhibits *Mycobacterium shottsii* infection and *Mycobacterium pseudoshottsii* disease in striped bass *Morone saxatilis*. Diseases of Aquatic Organisms 144:159-174.

Jesse, J.A., M.V. Agnew, K. Arai, C.T. Armstrong, S.M. Hood, M.L. Kachmar, J.T. Long, A.J. McCarty, M.O. Ross, K.D. Rubalcava, J. Shaner, S. Tanaka, L. Wood, E.J. Schott and M.J. Wilberg. 2021. Effects of infectious diseases on population dynamics of marine organisms in Chesapeake Bay. Estuaries and Coasts 44:2334–2349.

McGilly, J.S. 2022. Mycobacteriosis of Striped Bass (*Morone saxatilis*) in Virginia tributaries of the Chesapeake Bay. Master of Science (MS), Thesis, Biological Sciences, Old Dominion University, DOI: 10.25777/gd2m-kn82

Ofek, T., M. Lalzar, S. Laviad-Shitrit, I. Izhaki and M. Halpern. 2021. Comparative study of intestinal microbiota composition of six edible fish species. Front. Microbiol. 12:760266. doi: 10.3389/fmicb.2021.760266

Seslar, C. 2021. Evaluating the economic impact of water quality changes on recreational fisheries in the Long Island Sound. MS thesis, Stony Brook University, NY.

Waldman, J.R. and T.P. Quinn. 2022. North American diadromous fishes: Drivers of decline and potential for recovery in the Anthropocene. Science Advances 8: eabl5486

Genetics

Hasegawa, E.H., I. Wirgin, L. Maceda, and N. Roy. 2021. Contribution of the Hudson River Striped Bass population to the mixed coastal recreational harvest at Montauk Point, NY. Section IV: 1-32 p. In S.H. Fernald, D.J. Yozzo, and H. Andreyko (eds.), Final Reports of the Tibor T. Polgar Fellowship Program, 2020. Hudson River Foundation.

Hasegawa, E.H., J. Waldman and I. Wirgin. 2022. Stock composition of Atlantic coastal migratory striped bass using microsatellite DNA analysis. Fisheries Research 254: 106384

LeBlanc, N.M. 2021. Developing genomic resources using Striped Bass (*Morone saxatilis*): genetic structure, associations and text-mining. PhD dissertation, University of New Brunswick, Canada. 219 p.

Wojtusik, K.J. 2021. Striped bass population genetic structure and bait panel development for mixed stock analysis. Master's Theses and Capstones. University of New Hampshire. 1524.

Wojtusik, K.J., Berlinsky, D.L., Kenter, L.W., and Kovach, A.I. 2022. River-of-origin assignment of migratory striped bass, with implications for mixed-stock analysis. Transactions of the American Fisheries Society. 2022; 00:1-20. 20p.

Habitat Use and Distribution

Bangley, C.W., D.J. Hasselman, J.M. Flemming, F.G. Whoriskey, J. Culina, L. Enders and R.G. Bradford. 2022. Modeling the probability of overlap between marine fish distributions and marine renewable energy infrastructure using acoustic telemetry data. Front. Mar. Sci. 9:851757. doi: 10.3389/fmars.2022.851757

Bell, R.J., B. Grieve, M. Ribera, J. Manderson and D. Richardson. 2022. Climate-induced habitat changes in commercial fish stocks. ICES Journal of Marine Science 79:2247–2264. DOI: 10.1093/icesjms/fsac154

Dixon, R.L., M.C. Fabrizio, T.D. Tuckey and A.J. Bever. 2022. Extent of suitable habitats for juvenile Striped Bass: dynamics and implications for recruitment in Chesapeake Bay. Virginia Institute of Marine Science, William & Mary. doi: 10.25773/v87b-6b43

Grothues, T.M., E.J. Hunter, C.M. Iwicki, G.L. Taghon and S. Borsetti. 2021. Data synthesis of NY Bight fish, fisheries, and sand features; Volume 0: front matter. Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2021-036. 6 p.

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Itakura, H., M. H. P. O'Brien and D. Secor. 2021. Tracking oxy-thermal habitat compression encountered by Chesapeake Bay striped bass through acoustic telemetry. ICES Journal of Marine Science 78: 1049-1062. doi:10.1093/icesjms/fsab009

Membreño, S.M. 2022. Determining effectiveness of Ecologically Significant Areas (ESAs) for protecting Striped Bass (*Morone saxatilis*) spawning habitat in the Stewiacke River, NS. Master of Marine Management, Dalhousie University, Halifax, Nova Scotia. 62 p. + appendices.

Nichols, Q.B. 2022. Phenology in a Changing Environment: Assessing and forecasting the timing of the spawning migration of the Albemarle Sound and Roanoke River stock of Striped Bass. MS thesis, Department of Biology, East Carolina University, Greenville, North Carolina. 126 p.

O'Halloran, L.L. 2021. Striped bass *Morone saxatilis* (Walbaum, 1792) population demographics and mixing in the Bay of Fundy. MS thesis, Acadia University. 152 p.

Taylor, R.B., M.E. Mather, J.M. Smith and K.M. Boles. 2021. Can identifying discrete behavioral groups with individual-based acoustic telemetry advance the understanding of fish distribution patterns? Front. Mar. Sci. 8:723025. doi: 10.3389/fmars.2021.72302

Tuckey, T. D., and M.C. Fabrizio. 2021. 2021 Annual report estimating relative juvenile abundance of ecologically important finfish in the Virginia portion of Chesapeake Bay (1 July 2020 – 30 June 2021). Virginia Institute of Marine Science, William & Mary. doi: 10.25773/bx0d-7n02

Tuckey, T. D., and M.C. Fabrizio. 2022. 2022 Annual report estimating relative juvenile abundance of ecologically important finfish in the Virginia portion of Chesapeake Bay (1 July 2021 – 30 June 2022). Virginia Institute of Marine Science, William & Mary. doi: 10.25773/9WV1-PS18

Wipplehauser, G. 2021. Recovery of Diadromous Fishes: A Kennebec River Case Study. Transactions of the American Fisheries Society 150:277-290.

Management Considerations

Andersen, L. K., J. Abernathy, D.L. Berlinsky, G. Bolton, M.M. Booker, R.J. Borski, T. Brown, D. Cerino, M. Ciaramella, R.W. Clark, M.O. Frinsko, S.A. Fuller, S. Gabel, B.W. Green, E. Herbst, R.G. Hodson, M. Hopper, L.W. Kenter, F. Lopez, A.S. McGinty, B. Nash, M. Parker, S. Pigg, S. Rawles, K. Riley, M.J. Turano, C.D. Webster, C.R. Weirich, E. Won, L. Curry Woods, III, B.J. Reading, and StriperHub. 2021. The status of striped bass, *Morone saxatilis*, as a commercially ready species for U.S. marine aquaculture. Journal of the World Aquaculture Society, 52(3), 710–730.

Atlantic States Marine Fisheries Commission (ASMFC). 2022. Review of the ASMFC Fishery Management Plan for Atlantic Striped Bass (*Morone saxatilis*). 2021 Fishing Year. Prepared by the Plan Review Team. ASMFC, Arlington, Virginia. 50p.

ASMFC. 2022. Atlantic striped bass stock assessment update. Prepared by the ASMFC Striped Bass Stock Assessment Subcommittee and Technical Committee. Accepted for management use by the Atlantic Striped Bass Management Board, November 2022. 48p.

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Bangley, C.W. and D. J. Hasselman. 2022. Integration of hydrodynamics and acoustic telemetry for predictive species distribution modelling in a dynamic marine environment: implications for marine renewable energy development. OCEANS 2022, Hampton Roads, Hampton Roads, VA, USA, 2022:1-10 doi: 10.1109/OCEANS47191.2022.9977109.

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