

2018 REVIEW OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION
FISHERY MANAGEMENT PLAN FOR
ATLANTIC STURGEON (*Acipenser oxyrinchus oxyrinchus*)

2016 FISHING YEAR



Prepared by the Atlantic Sturgeon Plan Review Team:

Max Appelman, Chair, ASMFC
Dewayne Fox, Delaware State University
Kim McKown, New York DEC

Assistance provided by:
Jessica Kuesel, ASMFC

Approved August 2018

**REVIEW OF THE ASMFC FISHERY MANAGEMENT PLAN FOR
ATLANTIC STURGEON (*Acipenser oxyrinchus oxyrinchus*) FOR 2016**

I. Status of the Fishery Management Plan

<u>Date of FMP Approval:</u>	November 1990
<u>Amendments:</u>	Amendment 1 (July 1998)
<u>Addenda:</u>	Technical Addendum #1 (October 2000) Addendum I (January 2001) Addendum II (May 2005) Addendum III (November 2006) Addendum IV (September 2012)
<u>Management unit:</u>	Migratory stocks of Atlantic sturgeon from Maine through Florida
<u>Jurisdictions with declared interest:</u>	Maine through Florida, including District of Columbia and the Potomac River Fisheries Commission
<u>Committees:</u>	Sturgeon Management Board, Plan Review Team, Plan Development Team, Technical Committee, Stock Assessment Subcommittee, Advisory Panel, Culture and Stocking Committee

The Atlantic Sturgeon Fishery Management Plan (FMP) was approved by the Atlantic Sturgeon Management Board (Board) in 1990. By 1995, the member states and jurisdictions determined that the FMP was insufficient for conservation and restoration of Atlantic sturgeon stocks, and initiated development of Amendment 1, which was approved by ASMFC in June 1998. The goal of the Amendment is “to restore Atlantic sturgeon spawning stocks to population levels which will provide for sustainable fisheries, and ensure viable spawning populations.” Based on recommendations of the 1998 ASMFC Atlantic Sturgeon Stock Assessment, the specific objectives to achieve this goal include:

- Establish 20 protected year classes of females in each spawning stock;
- Close the fishery for a sufficient time period to reestablish spawning stocks and increase numbers in current spawning stocks;
- Reduce or eliminate bycatch mortality of Atlantic sturgeon;
- Determine the spawning sites and provide protection of spawning habitats for each spawning stock;
- Where feasible, reestablish access to historical spawning habitats for Atlantic sturgeon; and
- Conduct appropriate research as needed, especially to define unit stocks of Atlantic sturgeon.

Under Amendment 1, states must maintain complete closure of any directed fishery for Atlantic sturgeon and prohibit landings from any fishery. Additionally, possession of Atlantic sturgeon,

or any parts thereof including eggs, is prohibited. Exemptions to the moratorium on possession for the purpose of scientific research or educational display are detailed in Technical Addendum 1. Applicants for exemption for the purpose of aquaculture and importation of non-indigenous Atlantic sturgeon (i.e., originating from outside U.S. jurisdiction) must adhere to the terms, limitations, enforcement and reporting requirements which were approved by the Commission in January 2001, and receive approval from the Board through the adaptive management process (e.g., see Addenda I-III detailed below).

Amendment 1 requires that, beginning in 1999, states report annually on the following topics to ASMFC:

- Results of bycatch monitoring for Atlantic sturgeon in other fisheries (Table 1);
- Monitoring results (tagging, juvenile abundance indices, etc.; Table 2);
- Habitat status (restoration efforts, FERC relicensing studies, etc.), in accordance with the recommendations in the FMP; and
- Aquaculture operations authorized, status of regulations, disease-free certification status, etc., including any additional reporting requirements outlined in the ASMFC Terms, Limitations, Enforcement and Reporting Requirements Document (2001).

Addendum I (2001) to the Atlantic Sturgeon FMP exempts Florida from the possession moratorium for the purposes of developing private aquaculture facilities for cultivation and propagation of the species. Addendum II (2005) exempts a private company in North Carolina from the moratorium on possession, propagation, and sale of Atlantic sturgeon meat and eggs, and allows a Canada-based exporter to export Atlantic sturgeon fry and fingerlings into North Carolina. Addendum III (2006) similarly allows a private company in North Carolina to import Atlantic sturgeon from a Canada-based exporter. Addendum IV (2012) updates habitat information for Atlantic sturgeon and identifies areas of concern and research needs.

II. Status of the Stock

In 1998, a benchmark stock assessment conducted by the Commission concluded that Atlantic sturgeon populations throughout the species' range were either extirpated or considered to be at historically low abundances. Also in 1998, NOAA Fisheries evaluated the status of the species with regard to listing under the Endangered Species Act (ESA) and concluded that listing was not warranted at the time (NOAA 1998). In 2007, a Status Review Team (SRT) identified five Distinct Population Segments (DPS; discrete population units with distinct physical, genetic, and physiological characteristics) along the Atlantic coast (NOAA 2007).

In 2009, and based on the recommendations from the 2007 Status Review, the National Resources Defense Council petitioned NOAA Fisheries to list Atlantic sturgeon under the provisions of the ESA. Following review, NOAA Fisheries published two proposed rules (75 FR 61872 and 75 FR 61904) in October 2010 to list each DPS under the provisions of the ESA. In April, 2012, NOAA Fisheries published two final rules (77 FR 5880 and 77 FR 5914) declaring the Gulf of Maine DPS as threatened and the remaining four DPSs as endangered. In 2013, in

response to the ESA listing, the Board initiated the development of a coast-wide benchmark stock assessment to evaluate stock status, stock delineation, and bycatch. The benchmark assessment was externally peer-reviewed in August 2017 by a panel of independent experts, and approved by the Board for management use in October.

The Stock Assessment Subcommittee (SAS) explored a number of different models and analyses to evaluate the status of Atlantic sturgeon, including trend analysis, data poor methods, genetic methods, per recruit models, and a multi-state Jolly-Seber tagging model based on telemetry records to estimate mortality. Unfortunately, efforts to assess the status of Atlantic sturgeon are hampered by a lack of data. Of the 50 fishery-independent surveys that were evaluated, only nine of the surveys met the criteria to be used as indices of relative abundance in the assessment. The accepted surveys ranged from Maine to South Carolina and mostly caught juveniles and sub-adults. The other surveys were not used because they rarely encountered sturgeon or because their methods were inconsistent throughout the time series.

The assessment based stock status on the results of the ARIMA (Auto-Regressive Integrated Moving Average) trend models and the tagging models. The ARIMA model uses fishery-independent indices of abundance to estimate how likely an index value is above or below a reference value. The tagging model estimated the survival rate of Atlantic sturgeon at the coast-wide and DPS levels. An egg-per-recruit (EPR) model was used to compare recent total mortality (Z) with a total mortality reference point that would result in 50% of the egg production of an unexploited population. This reference point ($Z_{50\%EPR}$) was used in the 1998 benchmark assessment and continued in the 2017 assessment as an appropriate target to aid in stock recovery. The survival estimate from the tagging model was compared to $Z_{50\%EPR}$ to determine if total mortality was too high.

According to the 2017 Atlantic Sturgeon Stock Assessment Report, Atlantic sturgeon populations remain depleted at the coast-wide and DPS-levels relative to historical abundance (Table 1). The “depleted” determination was used instead of “overfished” because of the many factors that contribute to the low abundance of Atlantic sturgeon. On a coast-wide basis, however, the population appears to be recovering slowly since 1998 – the year the moratorium was implemented. Despite the fishing moratorium, the population still experiences mortality from several sources, but the assessment indicates that total mortality is sustainable.

Impediments to recovery include directed and incidental fishing, habitat loss, ship strikes, and climate change. The 2017 report indicates that anthropogenic mortality is a leading cause of Atlantic sturgeon mortality. Despite there being no directed fisheries for Atlantic sturgeon for nearly two decades, sturgeon are caught as bycatch in fisheries for other species, predominantly in gillnets, and to a lesser extent trawls and pound nets. Other potential emerging threats include invasive species, such as blue (*Ictalurus furcatus*) and flathead (*Pyrodicteis olivaris*) catfishes. In regions where sturgeon from different DPS mix in coastal aggregations, threats to these aggregations (e.g., bycatch mortality and ship strikes) may have disproportionate population effects at the DPS-level. Poaching of Atlantic sturgeon, at an unknown level, also occurs.

III. Status of the Fishery

Directed Harvest

Atlantic sturgeon have been harvested for their flesh and eggs (i.e., caviar) along the Atlantic coast since pre-colonial times. Commercial landings records for Atlantic sturgeon were first kept in 1880. At that time, landings were high and concentrated in the Delaware and Chesapeake systems, although commercial fisheries rapidly expanded to include most known spawning rivers. Reported landings of Atlantic sturgeon peaked in 1890 at 7.5 million pounds and declined precipitously thereafter. During the 1970's and 80's, the bulk of fishing effort and landings shifted to South Carolina, North Carolina, and Georgia (NOAA 1998). During the 1980's, landings from these states declined, and coast-wide landings shifted to New York and New Jersey.

By 1996, following approval of the 1990 Interstate FMP which suggested that the dramatic decline in landings was likely caused by overfishing, Atlantic sturgeon fishery closures were instituted in 10 states and jurisdictions along the Atlantic coast. Since 1997, all states have enacted bans on harvest and possession of Atlantic sturgeon and sturgeon parts. NOAA Fisheries enacted a ban on harvest and possession of Atlantic sturgeon in federal waters in 1998. Per Amendment 1, these moratoria will remain in effect until stocks exhibit a minimum of 20 protected year classes of spawning females and the FMP is modified to permit harvest and possession.

Bycatch

Since Atlantic sturgeon are an anadromous species spending portions of their lives in rivers, estuaries, and both nearshore and offshore ocean waters, they are vulnerable to incidental capture in many different fisheries conducted along the Atlantic coast. Accordingly, bycatch is one of the most significant threats to the viability of Atlantic sturgeon populations (ASMFC 2017). The Commission hosted several workshops between 2003 and 2007 that focused on collecting information on Atlantic sturgeon bycatch, identifying bycatch issues, estimating fishery-specific bycatch, and developing recommendations for dealing with Atlantic sturgeon bycatch in other directed fisheries. Amendment 1 requires states and jurisdictions to report Atlantic sturgeon bycatch, although the quality of available data varies (Table 2). Anecdotal evidence suggests that many Atlantic sturgeon bycatch encounters are unreported, indicating the need for reliable state-directed reporting programs.

The 2017 benchmark stock assessment was able to estimate bycatch from three different data sources; the Federal observer program, i.e., the Northeast Fisheries Observer Program (NEFOP) and the At-sea Monitoring Program (ASM), the North Carolina estuarine gill-net fishery observer program, and the South Carolina American shad fishery logbook program. However, it is hard to compare the estimates from the Federal and North Carolina observer programs to the estimates from the South Carolina logbook program due to the differences in how the data are collected. The South Carolina data are self-reported and are most likely an underestimate, since under-reporting is known to occur, while the Federal and North Carolina estimates are

developed from a sample of fishing trips in these regions and have their own degree of uncertainty.

Estimates of total bycatch from the Federal observer programs (gillnets and trawls combined) were lower than estimates from the North Carolina observer programs, but estimates of dead discards were similar because the Federal observer program encountered a higher proportion of dead fish on gillnet hauls than North Carolina did. Estimates of bycatch from the Federal observer data averaged 1,139 Atlantic sturgeon caught per year with 295 dead in the gillnet fishery and 1,062 a year with 41 dead in the otter trawl fishery. Estimates of bycatch from the North Carolina gillnet fishery were averaged 4,179 per year with 218 dead. The South Carolina American shad fishers reported an average of 4.3 Atlantic sturgeon caught per year in rivers in the South Atlantic DPS and 92.4 per year in waters in the North Carolina DPS. Refer to ASMFC 2017 for more information regarding bycatch and bycatch mortality estimates.

Aquaculture

A management objective of the 1990 FMP is to enhance and restore Atlantic sturgeon stocks. The use of aquaculture aims to achieve that objective by providing a unique opportunity to research conservation, restoration, and recovery techniques for wild-spawning Atlantic sturgeon.

The U.S. Fish and Wildlife Service (FWS) received an Endangered Species Act Section 10(a)(1)(A) Permit for Scientific Research from NMFS on March 14, 2013 (permit number 17367-01). The U.S. FWS maintains 45 Atlantic sturgeon at the Northeast Fishery Center in Lamar, Pennsylvania. Primary research goals include cryo-preserved and extending the viability of fresh milt of wild versus hatchery-reared sturgeon. The U.S. FWS also maintains eight adult Atlantic sturgeon at the Bears Bluff National Fish Hatchery in South Carolina. These fish were collected from 2008-2010 from the Altamaha River. Fertilized eggs have been produced from at least one tank of Atlantic sturgeon at Bears Bluff every year since 2011. One female produced 2,647 eggs during the 2016 effort, but Bears Bluff gave the 2,591 high quality eggs produced to a partner who had requested them and kept only the 56 low quality eggs to hatch themselves (approximately 8,394 fry were hatched from the 2015 effort). This year's spawning effort likely produced lower fertilization rates and egg quality because the spawning female had spawned for three consecutive years, a behavior that is highly unusual in the wild. Lastly, the U.S. FWS Welaka National Fish Hatchery in Florida maintains 125 Atlantic sturgeon from three year classes. These fish were obtained from the Bears Bluff National Fish Hatchery for future research, and as a refugium for endangered species.

Maryland's Department of Natural Resources Sturgeon Conservation Partnership is currently rearing Atlantic sturgeon for captive brood research at Maryland-based research laboratories in cooperation with NRG Energy and the University of Maryland. NRG Energy's Chalk Point Generating Station houses 9 adult wild Atlantic sturgeon and approximately 382 Canadian hatchery origin Atlantic sturgeon. The University of Maryland's Restoration Ecology Laboratory houses 18 adults and sub-adults and 29 juveniles, and the Cooperative Oxford Laboratory houses 52 individuals. All research and restoration activities using wild origin stock were

suspended due to the ESA listing. Maryland DNR filed a full application for an ESA Section 10 scientific research permit to continue research activities, and the application was approved in January 2015 (NMFS culture permit #17364).

In 2005, LaPaz LLC of Lenoir, North Carolina, received approval from the ASMFC and North Carolina Department of Marine Fisheries to commercially rear Atlantic sturgeon for the purpose of sale of meat and caviar (Addendum II and Addendum III to Amendment 1). From 2006-2008, LaPaz imported 5,883 fertilized Atlantic sturgeon eggs from Supreme Sturgeon in Canada. All eggs, fry, and fingerlings were imported from Canadian sources. From 2010-2012, LaPaz reduced the number of Atlantic sturgeon being held. Nearly all of the 2006 fish had been culled and 435 fish from 2008 were transported from LaPaz to the West Virginia University (WVU) to be involved in a research study evaluating aquaculture potential of reclaimed water from coal mining. The fish were accompanied by proper tracking and documentation and WVU received permission from the West Virginia Fish and Game Division to possess the fish at their facility. However, the PRT expressed concerns regarding the transfer of fish to facilities outside of ASMFC jurisdiction and regarding the ability for facilities under import exemption to transfer live Atlantic sturgeon to research facilities that may not be held to the same Best Management Practices as the exempt facility. Since West Virginia is not an ASMFC member state, the disposition of these fish is not well documented.

LaPaz recently shifted their focus away from the species and no longer has Atlantic sturgeon in their possession. During 2013-2014, 937 Atlantic sturgeon were culled from the facility. Later in 2014, La Paz accepted an offer from Horse Creek Aquafarm (a commercial food farm in Arcadia, Florida) to purchase the remaining 679 fish; Horse Creek Aquafarm received 600 Atlantic sturgeon in February 2015. Unfortunately, several power outages resulted in mortalities and only 117 Atlantic sturgeon remain on the farm. The Horse Creek received a Division of Aquaculture certificate from the Florida Department of Agriculture and Consumer Services under the provisions of Addendum I to Amendment 1.

ESA Section 10 Incidental Take Permits

It is recommended that states and jurisdictions coordinate with the ASMFC regarding the progress of ESA Section 10(a)(1)(b) Incidental Take Permit (ITP) applications. As of 2016, North Carolina and Georgia have acquired ESA Section 10 ITPs for Atlantic sturgeon for their commercial gill net fisheries. Virginia's and South Carolina's applications for Section 10 ITPs are currently pending. Rhode Island, New York, New Jersey, and Delaware are currently developing Section 10 ITP applications. Rhode Island intends to use a modeling approach similar to that used in the 2017 benchmark stock assessment. Also, New York is currently funding two years of increased NMFS observer coverage to develop better estimates of Atlantic sturgeon bycatch for its Section 10 ITP permit application. Virginia is similarly implementing an observer program to improve Atlantic sturgeon bycatch estimates. Connecticut's work on the Section 10 ITP is currently on hold due to staffing and budgetary considerations. Maine, New Hampshire, Massachusetts, Pennsylvania, D.C., the Potomac River Fisheries Commission, and Florida are not pursuing Section 10 ITPs due to low number of interactions with Atlantic sturgeon in their

waters. Maryland is also not pursuing a Section 10 ITP at this time due to insufficient data and resources.

IV. Status of Management Measures and Issues

Mandatory management measures include:

1. Complete closure, through prohibiting possession of Atlantic sturgeon, and any and all parts thereof including eggs, of any directed fishery for and landings of Atlantic sturgeon until the fishery management plan is modified to reopen fishing in that jurisdiction. In February 1999, NMFS imposed a harvest and possession moratorium on Atlantic sturgeon in the EEZ.
2. In addition, states shall implement any restrictions in other fisheries as outlined in bycatch reduction sections of the FMP.
3. States may grant limited specific exceptions to prohibitions on possession for imports of non-U.S. Atlantic sturgeon and/or cultured Atlantic sturgeon upon adoption of FMP addenda that specify the terms, limitations, and enforcement requirements for each such exception. It is intended that each such addenda shall be developed by the Atlantic Sturgeon Plan Development Team (PDT), in consultation with representatives of the ASMFC federal partners, applicable state aquaculture authorities, the ASMFC Law Enforcement Committee, the state(s) for which shipments are intended, and the party(ies) requesting the exception.

In addition to these mandatory regulations, states are implementing several recommendations in the FMP including development of a coast-wide tagging database and culture techniques, incorporation of shortnose sturgeon issues in Atlantic sturgeon research (and vice versa), stock identification, and habitat restoration.

V. Current State-by-State Implementation of FMP Compliance Requirements

As described in *Sections 3.4* and *5.1.2* of Amendment 1, states and jurisdictions must report on monitoring programs and provide estimates of bycatch of Atlantic sturgeon in other fisheries under their jurisdiction. Reports on compliance are submitted by each jurisdiction, annually, by October 1, and are reviewed by the PRT. Compliance reports must cover the previous calendar year at a minimum and should include significant findings of the current year. Based on 2017 compliance reports, all states and jurisdictions met the requirements of Amendment 1 (and its four addenda) to the Atlantic sturgeon FMP in 2016. See Table 4 for a state-by-state summary of compliance in 2016.

VI. Research Needs

The following research priorities and recommendations were identified to support stock assessment and interjurisdictional fisheries management for Atlantic sturgeon in state and federal waters (ASMFC 2017).

Future Research Priorities

High

- Identify spawning units along the Atlantic coast at the river or tributary and coast-wide level.
- Expand and improve the genetic stock definitions of Atlantic sturgeon, including developing an updated genetic baseline sample collection at the coast-wide, DPS, and river-specific level for Atlantic sturgeon, with the consideration of spawning season-specific data collection.
- Determine habitat use by life history stage including adult staging, spawning, and early juvenile residency.
- Expand the understanding of migratory ingress of spawning adults and egress of adults and juveniles along the coast.
- Identify Atlantic sturgeon spawning habit through the collection of eggs or larvae.
- Investigate the influence of warming water temperatures on Atlantic sturgeon, including the effects on movement, spawning, and survival.

Moderate

- Evaluate the effects of predation on Atlantic sturgeon by invasive species (e.g., blue and flathead catfishes).

Data Collection

High

- Establish regional (river or DPS-specific) fishery-independent surveys to monitor Atlantic sturgeon abundance or expand existing regional surveys to include annual Atlantic sturgeon monitoring. Estimates of abundance should be for both spawning adults and early juveniles at age.
- Establish coast-wide fishery-independent surveys to monitor Atlantic sturgeon mixed stock abundance or expand existing surveys to include annual Atlantic sturgeon monitoring.
- Continue to collect biological data, PIT tag information, and genetic samples from Atlantic sturgeon encountered on surveys that require it (e.g., NEAMAP). Consider including this level of data collection from surveys that do not require it.
- Encourage data sharing of acoustic tagged fish, particularly in underrepresented DPSs, and support programs that provide a data sharing platform such as The Atlantic Cooperative Telemetry Network. Data sharing would be accelerated if it was required or encouraged by funding agencies.
- Maintain and support current networks of acoustic receivers and acoustic tagging programs to improve the estimates of total mortality. Expand these programs in underrepresented DPSs.
- Collect DPS-specific age, growth, fecundity, and maturity information.
- Collect more information on regional vessel strike occurrences, including mortality estimates.

- Identify hot spots for vessel strikes and develop strategies to minimize impacts on Atlantic sturgeon.
- Monitor bycatch and bycatch mortality at the coast-wide level, including international fisheries where appropriate (i.e., the Canadian weir fishery). Include data on fish size, health condition at capture, and number of fish captured.

Assessment Methodology

High

- Establish recovery goals for Atlantic sturgeon to measure progress of and improvement in the population since the moratorium and ESA listing.
- Expand the acoustic tagging model to obtain abundance estimates and incorporate movement.

Moderate

- Evaluate methods of imputation to extend time series with missing values. ARIMA models were applied only to the contiguous years of surveys due to the sensitivity of model results to missing years observed during exploratory analyses.

VII. Ongoing Research and Notable Comments Highlighted in 2017 Compliance Reports

Amendment 1 does not require any research in participating states and jurisdictions. Nonetheless, several state and federal agencies, and academic institutions, are conducting research projects to further understand Atlantic sturgeon life history, genetics, behavior, and aquaculture. States and jurisdictions are encouraged to include such information in annual compliance reports. Accordingly, please see the 2017 state-specific compliance report for details regarding ongoing research and other notable comments (ASMFC 2017a).

VIII. Recommendations of Plan Review Team

The PRT recommends that states:

1. Continue to coordinate with the ASMFC regarding the progress of incidental take permits under Section 10(a)(1)(b) of the ESA.
2. The PRT stresses the importance of mandatory reporting and/or observer coverage requirements to effectively monitor Atlantic sturgeon bycatch in state fisheries.
3. Regarding the transfer of live Atlantic sturgeon to facilities for scientific research and/or educational display, the PRT recommends states review and consider the management practices of the receiving facility prior to transfer. Additionally, states are reminded that it is difficult to monitor the disposition of fish that are moved to a state or jurisdiction that is not a member of the ASMFC.

IX. Work Cited

- American Fisheries Society Symposium 56. 2007. Anadromous Sturgeons: Habitats, Threats, and Management. 420 pp. ISBN-13: 978-1-888569-91-9
- Atlantic States Marine Fisheries Commission (ASMFC). 1998. Atlantic Sturgeon Stock Assessment Peer Review. Washington D.C. National Oceanic and Atmospheric Administration Award No. NA87FGO 025. p. 33
- Atlantic States Marine Fisheries Commission (ASMFC). 2013. Research Priorities and Recommendations to Support Interjurisdictional Fisheries Management. Special Report #89. Arlington, VA. p. 58
- Atlantic States Marine Fisheries Commission (ASMFC). 2017. Atlantic Sturgeon Benchmark Stock Assessment and Peer Review Report. Arlington, VA. National Oceanic and Atmospheric Administration Award No. NA15NMF4740069. p. 456
- Atlantic States Marine Fisheries Commission (ASMFC). 2017a. Atlantic Sturgeon State Compliance Reports.
- Environmental Research and Consulting, Inc. 2016. Report of Sturgeon Monitoring and Protection During Rock Removal for the Delaware River Main Channel Deepening Project, December 2015 – March 2015. Prepared for Great Lakes Dredge and Dock Co., LLC. April 26, 2016. p.56
- Melnychuk, M.C., K.J. Dunton, A.J. Jordaan, K.A. McKown, and M.G. Frisk. 2016. Informing conservation strategies for the endangered Atlantic sturgeon using acoustic telemetry and multi-state mark-recapture models. *Journal of Applied Ecology* doi:10.1111/1365-2664.12799.
- National Marine Fisheries Service: Status review of the Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*). p.133.
- National Oceanic and Atmospheric Administration. 2007. National Marine Fisheries Service: Status review of the Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*). p.188

Table 1. Stock status determination for the coast-wide stock and DPSs based on mortality estimates and biomass/abundance status relative to historic levels, and the terminal year (i.e., the last year of available data) of indices relative to the start of the moratorium as determined by the ARIMA analysis. *For indices that started after 1998, the first year of the index was used as the reference value. Source: ASMFC 2017.

Population	Mortality Status	Biomass/Abundance Status	
	Probability that $Z > Z_{50\%EPR}$ 80%	Relative to Historical Levels	Average probability of terminal year of indices > 1998* value
Coastwide	7%	Depleted	95%
Gulf of Maine	74%	Depleted	51%
New York Bight	31%	Depleted	75%
Chesapeake Bay	30%	Depleted	36%
Carolina	75%	Depleted	67%
South Atlantic	40%	Depleted	Unknown (no suitable indices)

Table 2. Atlantic sturgeon bycatch (number of fish) reported from fishery-dependent data sources, 2015-2016. Fishery-dependent bycatch likely underreported due to majority reporting through voluntarily-based programs. Source: 2016 and 2017 ASMFC state compliance reports and NEFOP/ASM. *confidential information

State	Location	Fisheries	Target Species	Data Source	State-Directed Monitoring	2015	2016	Comments
ME	ocean	gillnet, trawl, purse seine	multiple	NEFOP	NO	0	0	Bycatch usually highest in November (1991-2014).
NH	ocean	unspecified	unspecified		NO	0	0	
MA	ocean	pot, trawl, hook, gillnet	multiple	at-sea observers	NO	0	0	Fisheries-Dependent Investigations project via ad hoc at-sea observer program.
RI	ocean	unspecified	unspecified	NEFOP & ASM	NO	1	0	
CT	Connecticut River	drift gillnet	American shad	logbooks	NO	37	58	Includes both Atlantic and shortnose sturgeons, mortality thought to be rare due to actively fished gear. No Long Island Sound bycatch data obtained.
NY	ocean	unspecified	unspecified	mandatory logbooks	NO	0	0	No shad or striped bass gill net fishery on Hudson River since 2010. NY funded additional NEFOP trips for 2016.
NJ	Delaware Bay	gillnet	American shad	Mandatory logbooks	NO	9	*	Although American shad fishers are required to report shad landings, report of Atlantic sturgeon bycatch is on a voluntary basis
PA	No commercial fishing permitted in the PA portion of the Delaware River or Estuary							
DE	Delaware River	gillnet	multiple	voluntary logbook	NO	0	0	Reporting program terminated in 2012
MD	ocean	Trawl	unspecified	DNR Observers	YES	0	0	A reporting reward program was terminated in 2012.
PRFC	Potomac River	*	unspecified	Mandatory Reports	NO	0	*	These confidential fish were released alive

Table 2 continued.

State	Location	Fisheries	Target Species	Data Source	State-Directed Monitoring	2015	2016	Comments
VA	unspecified	gillnet	multiple	observers	YES	N/A	9	Program began in May 2016 as part of VA's Incidental Take Permit application.
NC	NC Estuaries	gillnet	Southern Flounder (primarily)	observers	YES	74	82	Large and small mesh fisheries throughout the state; three mortalities in 2015 and five in 2016.
SC	Winyah River	gillnet	American shad	reporting	YES	10	15	Winyah Bay and Santee System; no mortality data available.
GA	Altamaha River	gillnet	American shad	GA DNR	YES	19	34	Reported and observed. Only one was observed. All released unharmed.
	Savannah River	gillnet	American shad	GA DNR		2	0	
FL	Atlantic coast	unspecified	unspecified	FL FWC	NO	0	0	Small sub-adult captured and released by rec. angler from the Jacksonville Beach Pier in 2015.
NMFS	Atlantic coast	Trawl and gillnet	Unspecified	NEFOP/ASM	N/A	110 (14)	310 (22)	Observations coded as "sturgeon, Atlantic" (Observations coded as "unknown sturgeon")

Table 3. Atlantic sturgeon takes (number of fish) reported from fishery-independent data sources, 2015-2016. Source: 2016-2017 ASMFC state compliance reports.

State	Location	Method	Type of Survey or Research	Data Source	2015	2016	Comments
ME	ocean	trawl	Groundfish	ME/NH joint survey	5	1	61 captured from 2000-2016
NH	Estuarine	NA	-	USGS	0	0	No known reproducing populations within NH waters.
MA	ocean	trawl	-	DMF	0	0	No known reproducing populations within MA waters.
RI	RI Sound	trawl	Coastal Trawl Survey	RI DFW	0	0	Only 3 Atlantic Sturgeon since 1979 (1997, 2005, and 2014).
CT	Connecticut River	unspecified	Research	CT DEP	175	133	Directed research; efforts and methods highly variable over time and should not be used as an index of abundance
	Long Island Sound	trawl	Survey	CT DEP	1	12	Multi-species survey; unreliable for abundance trends
NY	Hudson R. Estuary	anchored gillnet	Survey	NYSDEC-USFWS	554	362	Juveniles and sub-adults; juvenile abundance sampling
NJ	Coastal ocean	trawl	-	NJ DEP-DFW	32	13	Sandy Hook to Cape May; 0.17 mean tow per haul
	Delaware Bay	gillnet	Striped Bass & American Shad	NJ DEP-DFW	4	2	Striped bass tagging program
	State waters	unspecified	Voluntary reporting	NJ DEP-DFW	7	21	Online volunteer reporting for sturgeon interactions
NJ/PA/DE	Delaware River	Trawl	DRMCD Project.	ERC/USACE	482	575	All sturgeon were relocated upriver of blasting area; two mortalities (ERC 2016).
DE	Delaware River	ship strike	-	DE DFW-Reporting	12	12	Collaboration with DSU. Includes fish reported in PA's portion of Delaware Estuary.
	Delaware River	trawl	Juvenile abundance	DE DFW	6	3	Two otter trawl surveys; large (30') and small (16')
	Delaware River and Bay	gill and trammel nets	Juvenile abundance	DE DFW	61	7	2"-3" mesh monofilament gillnets used; targeting early stage juveniles (age 0-2)
MD	Chesapeake Bay	gill net	Striped Bass spawning stock survey	MD DNR	0	1	
	Nanticoke River System	gill net	Adult Atlantic Sturgeon Tagging	MD DNR	7	5	

Table 3 continued.

State	Location	Method	Type of Survey or Research	Data Source	2015	2016	Comments
VA	Chesapeake Bay	trawl	Juvenile fish and Blue Crab survey	VIMS	0	1	
	James River	gillnet	Adult Atlantic Sturgeon Tagging	VCU	81	52	
	James, York & Rapp. Rivers	anchored gillnet	American Shad monitoring	VIMS	10	2	
NC	Albemarle Sound	gillnet	Survey	NCDMF	86	124	Mortalities: 15 in 2015, nine in 2016.
	Pamlico Sound and River, Pungo, Neuse Rivers	gillnet	Survey	NCDMF	24	10	Mortalities: five mortalities in 2015, two in 2016.
	Cape Fear and New Rivers	gillnet	Survey	NCDMF	1	5	Mortalities: no mortalities in 2015 or 2016.
SC	Edisto River System	unspecified	Juvenile Atlantic Sturgeon	SCDNR	64	133	2016: 13 recaptures, 24 nominal age-1 fish.
	Freshwater and estuarine rivers	gillnet	Shortnose Sturgeon	SCDNR	53	117	Freshwater Fisheries Section; designed for Shortnose.
GA	Altamaha River	drift gillnet	Adult shad	GADNR-WRD	0	0	All measured and released alive.
	ocean	trawl	Commercial crustaceans	GADNR-CRD	5	10	Released alive.
	Altamaha & Wassaw Sound	trammel & gill nets	Spotted Sea Trout & Red Drum	GADNR-CRD	0	0	Entanglement gear surveys.
	Ogeechee, Satilla, and Altamaha	trammel & gill nets	Research	UGA	364	580	
	Savannah River St Marys	trammel & gill nets	Juvenile Sturgeon	UGA	434	501 5	May-August, fresh/saltwater interface.
FL	St. John's River	gill net	-	FL FWC	1	0	2015; UGA scientific collection permit. Released alive.

Table 4. State-by-State compliance, 2016. Note: C = In Compliance, P = Partial, N = Not in Compliance/No Report Submitted, NA = Not Applicable

State	Bycatch Monitoring ¹	Monitoring Results ²	Habitat Status ³	Aquaculture Operations ⁴	Moratorium on Harvest and Possession ⁵
ME	C	C	NA	NA	C
NH	C	NA	C	NA	C
MA	C	C	C	NA	C
RI	C	C	C	NA	C
CT	C	C	C	NA	C
NY	C	C	C	NA	C
NJ	C	C	NA	NA	C
PA	C	C	NA	NA	C
DE	C	C	C	NA	C
MD	C	C	C	C	C
PRFC	C	NA	C	NA	C
DC	NA	NA	NA	NA	C
VA	C	C	NA	NA	C
NC	C	C	C	NA	C
SC	C	C	C	NA	C
GA	C	C	C	C	C
FL	C	C	NA	C	C

¹**REQUIRED** Bycatch Monitoring may be implemented via law enforcement observations, FI surveys, ACCSP and/or at-sea observer programs.

²**RECOMMENDED** Monitoring Results should include: (a) details of how juvenile abundance survey will be performed (recommended every 5 years), (b) calculated CPUE estimates of juveniles, (c) reports on tag and release programs, and (d) assessment of spawning stock status including examination of sex ratio, size, and age structure by sex of the larger sub-adults and adults.

³**RECOMMENDED** Habitat Monitoring reports should include: (a) assessment of sturgeon habitats of particular concern, (b) restoration programs, and (c) FERC relicensing evaluations.

⁴**RECOMMENDED** Aquaculture monitoring reports should include: (a) aquaculture research and development, (b) collection of brood stock and release of cultured progeny, (c) translocation of sturgeons and inadvertent spread of diseases, (d) introduction of non-native sturgeons for commercial aquaculture, (e) collection and archiving tissue samples for genetic analysis, and (f) monitoring effectiveness of restoration programs.

REQUIRED for states with private aquaculture exemptions to the harvest and possession moratorium.

⁵**REQUIRED** State moratorium on the harvest and possession of Atlantic sturgeon currently applies throughout ASMFC jurisdiction.