Action Plan to Reduce Atlantic Sturgeon Bycatch in Federal Large Mesh Gillnet Fisheries

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Executive Summary

Bycatch of Atlantic sturgeon, an endangered species, in large mesh gillnet gear deployed in federal fisheries is a major concern for the recovery of the species. NOAA'S National Marine Fisheries Service convened the Atlantic Sturgeon Bycatch Working Group in response to the requirements of the May 27, 2021, Biological Opinion that considered the effects of the authorization of ten fishery management plans and the New England Fishery Management Council's Omnibus Essential Fish Habitat Amendment 2, on species listed under the Endangered Species Act, including all five distinct population segments of Atlantic Sturgeon, and designated critical habitat. The Working Group conducted a review of available information regarding Atlantic sturgeon distribution, bycatch in gillnet gear, bycatch mitigation, and post-release mortality. From this review, the working group produced this Action Plan, which recommends that the New England and Mid-Atlantic Fishery Management Councils, in coordination with the National Marine Fisheries Service and the Atlantic States Marine Fisheries Commission, consider a range of potential measures to reduce Atlantic sturgeon bycatch in federal gillnet fisheries using large mesh gear, defined as greater than or equal to 7 inches. This Action Plan does not prescribe the measures that must be used, but provides recommendations based on the information available and considered on Atlantic sturgeon bycatch. These recommendations are: 1) Requirements to use bycatch mitigating low-profile gillnet gear; 2) reductions in soak time for gillnet gear; and 3) implementation of time/area measures, particularly gear restricted areas, in regions where Atlantic sturgeon bycatch is most common. In addition, the Working Group recommends that the National Marine Fisheries Service lead work to identify and carry out steps needed to acquire more information regarding post-release mortality of Atlantic sturgeon captured by gillnet gear. A draft version of this Action Plan was released on May 26, 2022. This final version reflects changes made in response to public comment and feedback, though not all requests could be accommodated in the time available.

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Introduction: Biological Opinion, RPMs, and T&C

All five Atlantic sturgeon distinct population segments (DPS) in the United States are listed as endangered or threatened under the Endangered Species Act (ESA). The primary threats to these DPSs are entanglement in fishing gears, habitat degradation, habitat impediments, and vessel strikes.

On May 27, 2021, NOAA's National Marine Fisheries Service (NMFS) issued a Biological Opinion (Opinion) on the authorization of eight federal fishery management plans (FMPs), two Interstate Fishery Management Plans (ISFMPs) and the New England Fishery Management Council's Omnibus Essential Fish Habitat Amendment 2. The eight FMPs considered are the: Atlantic Bluefish; Atlantic Deep-sea Red Crab; Mackerel, Squid, and Butterfish; Monkfish; Northeast Multispecies; Northeast Skate Complex; Spiny Dogfish; and Summer Flounder, Scup, and Black Sea Bass FMPs. The two ISFMPs which were considered were the American Lobster and Jonah Crab ISFMPs. The North Atlantic Right Whale Conservation Framework for Federal Fisheries in the Greater Atlantic Region was considered in the proposed action. The Opinion evaluated the effects of the action on ESA-listed species, including all five DPS of Atlantic sturgeon, and designated critical habitat.

Section 9 of the Endangered Species Act of the ESA prohibits the take, including the incidental take, of endangered species. Pursuant to section 4(d) of the ESA, NMFS has issued regulations extending the prohibition of take, with exceptions, to certain threatened species. NMFS may grant exceptions to the take prohibitions with an incidental take statement or an incidental take permit issued pursuant to ESA section 7 and 10, respectively. Take is defined as "to harass, harm, pursue, hunt, shoot, capture, or collect, or to attempt to engage in any such conduct."

The ESA defines incidental take as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of sections 7(b)(4) and 7(o)(2), incidental take is not considered to be prohibited under the ESA provided that it is in compliance with the terms and conditions of an Incidental Take Statement (ITS). The 2021 Opinion includes an ITS which specifies the level of incidental take of Atlantic sturgeon anticipated in the federal fisheries and defines reasonable and prudent measures (RPMs) and implementing terms and conditions (T&C), which are necessary or appropriate to minimize impacts of the incidental take. The RPMs and T&Cs are non-discretionary and must be undertaken in order for the exemption to the take prohibitions to apply.

The RPMs/T&Cs of the Opinion include that NMFS convene a working group to review all the available information on Atlantic sturgeon bycatch in the federal large mesh gillnet fisheries and to develop this

Action Plan by May 27, 2022, to reduce Atlantic sturgeon bycatch in these fisheries by 2024. Additionally, the Opinion requires that this Action Plan include an evaluation of information available on post-release mortality, identification of data needed to better assess impacts, and a plan, including timeframes, for obtaining and using this information to evaluate impacts.

The Opinion does not specify the extent of bycatch reduction that must occur as a result of this Action Plan. However, RPMs are those actions that are necessary or appropriate to minimize impacts (i.e. amount or extent) of incidental takes. As a result, measures must be developed that minimize impacts. However, ESA regulations specify that measures involve only a minor change and be consistent with the basic design, location, scope, duration, or timing of the action. This should be considered in developing alternatives derived from this Action Plan that will minimize impacts to Atlantic sturgeon from the federal large mesh gillnet fishery.

On July 30, 2021, NMFS initiated work to establish the Atlantic Sturgeon Bycatch Working Group (ASBWG) to meet the requirements of the Opinion. Originally convened with NMFS staff in November 2021, the working group was expanded in January 2022 to include representatives from state fisheries agencies with expertise in Atlantic sturgeon and/or large mesh gillnet fisheries.

Atlantic Sturgeon Bycatch Working Group Members

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Purpose of Document

This Action Plan: (1) Communicates the results of the review of all available information regarding Atlantic sturgeon bycatch and highlight gaps in the available information; (2) recommends measures that the New England and Mid-Atlantic Fishery Management Councils and NMFS should consider to reduce bycatch of Atlantic sturgeon in the federal large mesh fishery by 2024; and (3) establishes a timeline for scoping and development of regulatory measures and completing or initiating work necessary to close information gaps.

Large mesh gillnet is defined in this action plan as having a mesh size greater than or equal to 7 inches stretched, which was derived from the Opinion. Thus, any federal gillnet fishery program where the minimum mesh size is 7 inches or greater is included in this definition. This definition functionally excludes vessels participating in several gillnet fisheries programs in which the minimum mesh is 6.5 inches and smaller (e.g. the Mid-Atlantic Exemption Area, vessels on a Northeast Multispecies DAS or Sector trip only.). Though the recommendations in this Action Plan do not technically include these vessels based on the definition of large mesh established in the Biological Opinion, fisheries managers may find it appropriate and necessary to include them in actions taken to reduce Atlantic sturgeon bycatch.

Description of Fishery Management Plans Considered in the May 27, 2021, Biological Opinion

The following is a summary of the Fishery Management Plans that were considered in the May 27, 2021, Biological Opinion for their impact on ESA-listed species and habitat (NMFS 2021). Comprehensive descriptions of each fishery, including those that do not have gillnet components, can be found in the Biological Opinion.

American Lobster Interstate Fishery Management Plan

The American lobster fishery is cooperatively managed by the states and NMFS under the framework of the Atlantic States Marine Fisheries Commission (ASMFC). Vessels fishing for American lobster in the American lobster fishery primarily use trap gear. Though the American Lobster Interstate Fishery Management Plan includes a limited access non-trap permit that allows landing of lobster caught in other gear types, including gillnet, this is incidental to effort in other fisheries. There are no components of the targeted American lobster fishery which use gillnet gear that would be directly affected by the eventual outcomes of this Action Plan.

Atlantic Bluefish Fishery Management Plan

The Atlantic bluefish fishery is managed jointly by the ASMFC and the Mid-Atlantic Fishery Management Council in state and federal waters. Management measures for the fishery include annual catch limits, catch targets, and total allowable landings for both the recreational and commercial sectors. The Atlantic bluefish fishery is primarily a recreational fishery, with 86 percent of the overall annual total allowable landings allocated to the recreational fishery quota and 14 percent allocated to the commercial fishery.

Gillnets are the primary gear type used in the commercial bluefish fishery. Hook and line gear (i.e. longline, handline, rod and reel, etc.), pound nets, seines, pots/traps, and trawls are also authorized gears. In the past five years, gillnets have accounted for around 65 percent of the commercial directed bluefish catch, with the next most common gear used various types of trawls (bottom, beam, midwater, etc.) (23 percent), and handline (8 percent). The combination of all other gear types, including traps, seines, and cast nets, comprised the remaining 4 percent.

There are no gear-specific requirements or area closures identified in the Bluefish FMP. Other federal FMPs have implemented these types of regulations which apply to vessels fishing with gillnet for bluefish and other species.

Atlantic Deep-Sea Red Crab Fishery Management Plan

The Atlantic deep-sea red crab fishery is managed by the New England Fishery Management Council. Vessels fishing for Atlantic deep-sea red crab in the Atlantic deep-sea red crab fishery primarily use trap gear. Vessels that have been issued a limited access red crab permit may not harvest red crab from any fishing gear other than red crab traps or pots which comply with marking requirements. An open-access incidental permit exists that allows landing of red crab caught in other gear types, including gillnet, but this is incidental to effort in other fisheries. There are no components of the targeted red crab fishery which use gillnet gear that would be directly affected by the eventual outcomes of this Action Plan.

Mackerel, Squid, and Butterfish Fishery Management Plan

The Mid-Atlantic Council manages Atlantic mackerel, chub mackerel, longfin squid, Illex squid, and butterfish through a single FMP called the Mackerel, Squid, and Butterfish (MSB) FMP. The FMP uses quotas and accountability measures for all species. Various permitting systems, mesh requirements, time-area closures, and trip limits are used in these fisheries to help achieve optimum yield. Species managed by the MSB FMP are typically harvested with bottom-tending otter trawl gear, jigging gear, single midwater trawls, and paired midwater trawls. There are no components of the mackerel, squid, or butterfish fisheries that use gillnet gear that would be directly affected by the outcomes of this Action Plan.

Monkfish Fishery Management Plan

The New England and Mid-Atlantic Fishery Management Councils jointly manage the monkfish fishery, which occurs year-round from Maine to North Carolina. A days-at-sea (DAS) system with trip limits per DAS is used to manage the fishery, along with a total allowable landings limit within an annual catch limit and accountability measures framework. There are two separate management areas: the Northern (NFMA) and Southern (SFMA). Landings in the SFMA peak in the late spring/early summer months when fish are migrating from deeper water, while landings in the NFMA peak in January through March.

In the commercial fishery, bottom trawl, gillnet, longline, dredge, and trap/pot gear are authorized, though bottom trawl and gillnet are the primary gear types used in the fishery. In 2018, bottom trawl accounted for 46 percent of landings, gillnet accounted for 45 percent of landings, and dredge and other gear types accounted for the remaining 9 percent.

The gear types and style of fishing used in the monkfish fishery differ between the NFMA and SFMA. In the NFMA, the monkfish fishery overlaps significantly with the Northeast multispecies fishery and landings are primarily made by vessels using bottom trawl gear. Landings from gillnet gear in the NFMA make up a small proportion of total landings during winter months and a larger proportion in the summer months. In the SFMA, the monkfish fishery is prosecuted more independently of other fisheries, and gillnet gear accounts for the majority of landings.

Vessels issued limited access monkfish permits are issued 45.2 DAS per fishing year, of which 37 may be used in the SFMA. An additional four DAS may be carried over if unused in the previous year, and can be applied in either area.

A substantial proportion of monkfish-permitted vessels additionally possess Northeast multispecies or scallop permits. Vessels with both a Northeast multispecies permit and a monkfish permit are subject to additional DAS measures which affect where and how they may fish, including gear configurations which may be used. Among these measures is a requirement for such a vessel to use a Northeast multispecies DAS whenever using a monkfish DAS. If a vessel's initial allocation of Northeast multispecies DAS is less than its monkfish DAS allocation, it receives an allocation of monkfish-only DAS equal to the difference. Monkfish-only DAS must be used in an exempted fishery program (Table 1), which are defined by the regulations of the Northeast Multispecies FMP.

Gear requirements in the Monkfish FMP currently establish a 10-inch minimum mesh size for gillnets, unless the vessel is fishing subject to gear requirements under a Northeast multispecies DAS or other exemption areas (Table 1). As of the release of this Action Plan, the New England Fishery Management Council is considering increasing the minimum mesh size for gillnets in this fishery to 11 or 12 inches.

Northeast Multispecies Fishery Management Plan

The New England Fishery Management Council manages the Northeast multispecies fishery through the Northeast Multispecies FMP. Sixteen species of groundfish are managed under the Northeast Multispecies FMP. Groundfish are found throughout New England waters, from the Gulf of Maine to southern New England. The Northeast multispecies fishery operates year-round. For management purposes, the fishing year runs from May 1 through April 30.

Thirteen species (20 stocks) are managed as part of the large mesh complex, based on fish size and the type of gear used to harvest the fish, both as target species (Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, American plaice, Atlantic halibut, redfish, and white hake) and as non-target species (windowpane flounder, ocean pout, and Atlantic wolffish).

The commercial Northeast multispecies fishery is divided between the sector program and the common pool. Vessels voluntarily choose to enter into the sector program as part of a groundfish sector, each of which are allocated a quota of Northeast Multispecies stocks based on the collective fishing history of the sector's members. Each sector may determine how participating vessels fish that quota, also known as an Annual Catch Entitlement. Vessels that do not choose to participate in the sector program are placed in the common pool fishery. Common pool vessels are subject to possession limits and DAS requirements, as well as quotas managed in 4-month trimesters. Annual catch limits are in place for all participants in the fishery.

A variety of gears are used in the large mesh multispecies fishery. Groundfish vessels fish for target species with trawl, gillnet, and hook and line gear (including jigs, handline, and non-automated demersal longlines). For gillnet, minimum mesh sizes are 6.5 inches in all areas, except for vessels with the Large Mesh Individual DAS category permit, which have a minimum mesh size of 7.5 inches diamond and 8.0

inches square in the Mid-Atlantic Regulated Mesh Area (RMA) and 8.5 inches diamond and square in the Gulf of Maine, Georges Bank, and Southern New England RMAs. Limits are in place regarding the number and type of nets which can be deployed, based on the area being fished. The Northeast Multispecies FMP specifies 300 ft as the maximum net length for vessels fishing with gillnet in any of the RMAs

Three species (silver hake/whiting, red hake, and offshore hake) are included in the FMP as the small-mesh complex, but are managed under a separate program through a series of exemptions to the Northeast Multispecies FMP. The small-mesh fishery operates under exemptions that allow vessels to fish for these species in designated areas, called exemption areas (Table 1), using mesh sizes smaller than the minimum mesh sizes otherwise allowed under the Northeast multispecies regulations.

Northeast Skate Complex Fishery Management Plan

The New England Fishery Management Council manages the skate fishery under the Northeast Skate Complex FMP. The fishery operates from Maine to Cape Hatteras, North Carolina. Skates are mostly harvested incidentally in trawl and gillnet fisheries targeting groundfish, monkfish, and sometimes scallops. The FMP manages a complex of seven different skate species: Barndoor; clearnose; little; rosette; smooth; thorny; and winter skates. Skates are harvested for two different market: skate wings for human consumption and whole skates for use as bait in other fisheries, such as lobster and Jonah crab. The skate wing fishery is allocated 66.5 percent of the federal total allowable landings (TAL) for skates, and the skate bait fishery is allocated 33.5 percent of the federal TAL. There are no closed areas identified with the Northeast Skate Complex FMP. However, area management within the Northeast Multispecies, Scallop, and Monkfish FMPs would impact the harvest of skates.

Otter trawl is the primary gear used in the bait fishery (99 percent of bait-only landings), while more skates in the wing fishery are landed with gillnet gear (81 percent of wing-only landings). Overall, gillnets are responsible for approximately 66 percent of skate catch, and trawls comprise about 32 percent. Skates are also consistently caught with traps, hook gear, and scallop dredges, although landings from these gears are relatively insignificant (about 2 percent of all catch combined). Vessels participating in the skate fishery must abide by the minimum mesh sizes and gear limits for gillnet and trawl gear required by the Northeast multispecies regulations. All vessels fishing for skates using a DAS are subject to the gear regulations of whichever limited access fishery it has declared into for that DAS. Otherwise, vessels fishing for skates must abide by the gear requirements of the Northeast Multispecies FMP.

An open access permit is required to land skates. Both a permit and a skate bait letter of authorization (LOA) is required to land whole skate for the bait fishery. Vessels fishing for skate wings must be on a Northeast multispecies, scallop, or monkfish DAS to land more than the incidental limit of 500 lb of skate wings. In general, vessels fishing for skate bait under a bait Letter of Authorization must also be on a DAS, unless the vessel is fishing in a DAS exemption area (Table 1).

Spiny Dogfish Fishery Management Plan

The New England and Mid-Atlantic Fishery Management Councils jointly manage the Atlantic spiny dogfish fishery under the federal Spiny Dogfish FMP. The ASMFC also manages the spiny dogfish fishery in state waters from Maine to North Carolina through its Interstate Fishery Management Plan for Spiny Dogfish. The spiny dogfish fishery is managed using a coastwide annual quota and possession limits. There is very limited directed recreational fishing for spiny dogfish, and no Federal recreational management. The commercial fishery is active year-round, although there is some seasonality in the distribution of landings due to the migratory nature of the species. In general, fishing effort follows the north-south seasonal migratory pattern. Spiny dogfish fishing is concentrated in the North Atlantic around Georges Bank, the Gulf of Maine, and Massachusetts state waters from May through October. Effort shifts further south (e.g., to Virginia and North Carolina) in late fall and early winter. Overall, the highest landings of spiny dogfish typically occur between June and October in Massachusetts. There are no closed areas specifically under the Spiny Dogfish FMP. However, permit holders are subject to the regulations and restrictions of the other permits they may be fishing under in conjunction with spiny dogfish (e.g., multispecies, monkfish, etc.).

Gillnets are the primary gear in the commercial fishery, responsible for approximately 66 percent of landings annually. The other most prevalent gears in the spiny dogfish fishery are bottom longline (25 percent of catch), and bottom trawl (4 percent). There are no specific gear requirements in the Spiny Dogfish FMP, but vessels targeting spiny dogfish must abide by the RMA requirements for gillnet and trawl gear specified in the Northeast multispecies regulations.

Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan

The Mid-Atlantic Fishery Management Council and the ASMFC jointly manage the summer flounder, scup, and black sea bass fisheries. These species are managed under a single FMP because these species occupy similar habitat and are often caught at the same time. The vast majority of these fisheries are harvested with bottom otter trawl gear (96 percent for summer flounder, 97 percent for scup, and 72 percent for black sea bass), and 18 percent of black sea bass are caught with pot/trap gear. As gillnets are not a significant gear in this FMP, participants are not likely to be directly affected by the eventual outcomes of this Action Plan.

Jonah Crab Interstate Fishery Management Plan

The Jonah crab fishery is cooperatively managed by the states and NMFS under the framework of the ASMFC. The Jonah Crab Interstate Fishery Management Plan limits participation in the Jonah crab fishery to vessels that possess an American lobster permit. As with the American lobster fishery, Jonah crab is primarily caught and landed using trap gear. A limited access non-trap permit exists that provides for incidental harvest of Jonah crab caught during the prosecution of other fisheries. There are no components of the targeted Jonah crab fishery which use gillnet gear that would be directly affected by the eventual outcomes of this Action Plan.

Exempted Fishery Areas

Exempted fisheries allow vessels to fish for specific species without being subject to certain Northeast multispecies regulations, including DAS, provided that bycatch of regulated Northeast multispecies stocks is minimal. Many gillnet fisheries in the region are conducted at least in part by vessels participating in exempted fishery areas, including the monkfish, spiny dogfish, and skate fisheries. As such, the exempted fishery areas define some of the gear requirements for vessels participating in these fisheries. Of the Exempted Fishery Areas shown in Table 1, only the Gulf of Maine (GOM)/Georges Bank (GB) Monkfish Gillnet Exemption and Southern New England (SNE) Monkfish and Skate Gillnet Exemption meet the definition of large mesh used in this Action Plan.

Table 1. Exempted fishery areas for vessels fishing with gillnet gear

Exemption Area	Regulated Mesh Area	Gear Requirements	Target Species	Other allowable catch	Season
GOM/GB Monkfish Gillnet Exemption	GOM, GB	10 inch minimum diamond mesh size	Monkfish	American Lobster	July 1 - September 14
Eastern Cape Cod Spiny Dogfish Exemption Area	GOM, GB	6.5 inch minimum diamond mesh size	Dogfish	None specified	June 1 - December 31
Nantucket Shoals Dogfish Fishery Exemption Area	GOM, GB	6.5 inch minimum diamond mesh size	Dogfish	Longhorn sculpin, silver hake, monkfish, lobster, skate	June 1 - October 15
GOM/GB Dogfish Gillnet Exemption	GOM, GB	6.5 inch minimum diamond mesh size	Dogfish	American Lobster	July 1 - August 31
SNE Monkfish and Skate Gillnet Exemption	SNE	10 inch minimum diamond mesh size	Monkfish, Dogfish, Skate	Incidental species allowed in SNE RMA*	Year-Round
SNE Dogfish Gillnet Exemption	SNE	6 inch minimum diamond mesh size	Dogfish	Incidental species allowed in SNE RMA*	May 1 - October 31
Mid-Atlantic (MA) Monkfish/Spiny Dogfish Gillnet Exemption*	MA	5 inch minimum mesh size, limited to 50 stand-up gilllnets	Monkfish, Dogfish, Skate	incidental species allowed in SNE RMA*	Year-Round

*Participating Vessels must be on a Monkfish Day-At-Sea

Review of Available Information on Atlantic Sturgeon Bycatch

Metadata

What information was reviewed?

The ASBWG reviewed a mixture of peer-reviewed scientific papers, available data from the Northeast Fisheries Observer Program database, grant program reports, workshop reports, Northeast Fisheries

Science Center model-derived estimates of Atlantic sturgeon bycatch, the management plan for shortnose sturgeon in Canada, and the 2017 ASMFC stock assessment, which is the most recent benchmark stock assessment available (Table 2).

Table 2. Information Reviewed by ASBWG

Topic	Type of Information	Number Reviewed
Distribution and occurrence	Peer-reviewed literature	12
Bycatch analyses	Peer-reviewed literature	2
	NMFS NEFSC document	2
	ASMFC document	2
Bycatch mitigation	Peer-reviewed literature	3
	NOAA-NMFS Grant Report	4
Other	Canadian Management Plan	1

These sources represent the known information available to the ASBWG.

In the literature that was reviewed, what types of data/methods were used?

Studies and other sources of information used data derived from fishery observer programs, tagging and telemetry, DNA sampling, fisheries independent surveys, and remote sensing and modeling.

What was the temporal range of the information which was reviewed?

The publication dates for peer reviewed articles considered by the Working Group ranged from 2004 to 2021. Available observer program data ranges from 1989 to 2020, though specific analyses conducted for the Action Plan use a more recent timeframe, which is noted where relevant.

Was the information reviewed site-specific or region-wide?

Northeast Fishery Observer Program data are fishery dependent and were derived wherever vessels that were assigned observers fished. Seven peer-reviewed articles or workshop reports studied the entire region (Gulf of Maine to Cape Hatteras in most cases, some the entire Atlantic Coast), and seven peer-reviewed articles or workshop reports focused on smaller study areas. These included New York state waters, along the coast of Long Island and the mouth of New York Harbor, the New York Wind Energy Area, Delaware Bay, and the Mid-Atlantic Bight.

Characteristics of Atlantic sturgeon bycatch in the study region

What fisheries and gear types most commonly interact with Atlantic sturgeon, and what are the characteristics of these fisheries?

Fisheries that use gillnet and trawl gear most commonly interact with Atlantic sturgeon (Stein et al. 2004, ASMFC 2007, Dunton et al. 2015, ASMFC 2017). The ASBWG was formed to address bycatch of Atlantic sturgeon in the federal large mesh (≥ 7 inches) gillnet fisheries. In particular, the Biological Opinion notes that the highest levels of bycatch occurred in the dogfish, monkfish, and Northeast multispecies sink gillnet fisheries. Gillnet gear configurations used in these fisheries are dependent on the species that vessels are targeting.

Two types of sink gillnets are used in Federal large mesh gillnet fisheries. Stand-up gillnets are constructed with floats on the float line and have no tie-down twine between the float line and the lead line. Stand-up gillnets extend vertically from top to bottom generally as a flat plane in the water column. Tie-down gillnets are either constructed with no floats on the float line or are constructed with floats on the float line and tie-down twine between the float line and the lead line. The float line on tie-down gillnets drop or is pulled towards the lead line such that the net forms a curved surface in the water column.

Vessels targeting Northeast multispecies typically use a mix of stand-up gillnets for targeting roundfish (i.e. cod) species and tie-down gillnets for targeting flatfish (i.e. flounder) species. Vessels targeting dogfish similarly use a mixture of stand-up and tie-down gillnets. Vessels targeting monkfish typically use a 12-inch mesh size with large twine sizes, 12 meshes deep, with 48-inch tie-down line 24 feet apart. A string of monkfish gillnets is made up of 10 to 20 nets (He and Jones 2013). In the skate fishery, gillnets are primarily used by vessels targeting skate for wings; these gillnet vessels often target skate in conjunction with monkfish, using tie-down gillnets with the same 10 – 12 inch mesh that is used in that fishery.

The ASMFC special report (2007) estimated Atlantic sturgeon bycatch in coastal Atlantic commercial fisheries and discussed factors associated with Atlantic sturgeon bycatch mortality in sink gillnets. Among these, ASMFC found a significant positive association between soak time and Atlantic sturgeon mortality when monkfish were targeted with tie-down nets, and when groundfish and striped bass were targeted with standup gillnets. The report stated "a clear relationship was apparent between increasing mortality and soak times, with soak times greater than 24 hours resulting in a 40-percent incidence of death and those less than 24 hours resulting in a 14-percent incidence of death." Additionally, the report notes that longer soak times may increase Atlantic sturgeon bycatch and related deaths simply by increasing the likelihood of an interaction.

The ASBWG used data from the observer program database to examine soak time across seasons, fisheries, and area fished from 2015 to 2020. The ABSWG first grouped any instances of caught sturgeon recorded as "Dead, Damaged" with sturgeon simply recorded as "Dead" into a "Combined Dead" category. The resulting instances of "Alive", "Dead", and "Unknown" were split by season ("Fall", "Spring", "Summer", "Winter") and the mean, median, minimum, and maximum soak times were calculated for each (Table 3). Data entries where soak time were listed as less than 30 minutes were removed, as it seemed unlikely that such soaks would be representative of normal fishing activity.

To examine trends in soak time on a fishery basis, the ASBWG used target species (as reported by observers that generated the entries in the Northeast Fisheries Observer Program database) to identify the fishery for each data point. Hauls that were positive for interaction with Atlantic sturgeon were then grouped by target species and counted. Hauls categorized by target species which had less than 10 interactions were removed in order to focus entirely on the primary fisheries which interact with Atlantic sturgeon. As with the previous breakdown, the mean, median, minimum, and maximum soak times were calculated by each (Table 4).

Table 31: Soak time duration by season and sturgeon status for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Only uses hauls that were positive for sturgeon. Asterisks indicate data hidden to comply with confidentiality rules.

SEASON	STATUS	STURGEON	Mean Time	Median Time	Min Time	Max Time
Fall	Alive	160	33.02	24.00	0.5	168.0
	Dead	104	65.46	48.00	0.9	168.0
	Unknown	6	56.00	60.00	24.0	96.0
Spring	Alive	307	27.59	24.00	0.5	192.0
	Dead	99	61.21	48.00	4.2	264.0
	Unknown	13	58.15	24.00	12.0	120.0
Summer	Alive	14	18.65	7.95	1.0	120.0
	Dead	4	55.23	48.00	4.9	120.0
	Unknown	*	*	*	*	*
Winter	Alive	118	42.34	24.00	0.5	288.0
	Dead	37	97.03	72.00	18.0	288.0
	Unknown	*	*	*	*	*

Table 4. Soak time duration by target species for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Only uses hauls that were positive for sturgeon. Only includes targeted species that encountered sturgeon on 10 or more hauls.

TARGET1	STURGEON	Mean Time	Median Time	Min Time	Max Time
BASS, STRIPED	30	23.07	24.0	0.9	24
BLUEFISH	74	23.19	24.0	0.9	36
DOGFISH, SMOOTH	150	16.97	15.7	0.5	72
DOGFISH, SPINY	263	28.67	24.0	0.5	192
FLOUNDER, SUMMER (FLUKE)	14	23.23	24.0	18.3	24
MONKFISH (GOOSEFISH)	227	79.90	72.0	24.0	288
SKATE, WINTER (BIG)	65	76.12	72.0	12.0	168

To examine area fished, hauls that were positive for Atlantic sturgeon interaction were broken down by target species and further by statistical area. Hauls categorized by target species that had less than 10 interactions and hauls with striped bass as a target were removed (Table 5).

Table 25. Soak time duration by target species and area for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Only uses hauls that were positive for sturgeon. Focuses on targeted species that encountered sturgeon on 10 or more hauls, not areas with 10 or more sturgeon hauls.

TARGET1	AREA	STURGEON	Mean Time	Median Time	Min Time	Max Time
BASS, STRIPED	613	*	0.90	0.90	0.9	0.9
	625	29	23.84	24.00	19.3	24.0
BLUEFISH	539	*	13.00	13.00	2.0	24.0
	612	59	24.92	24.00	18.0	36.0
	614	*	8.60	0.90	0.9	24.0
	615	4	18.23	24.00	0.9	24.0
	625	*	24.00	24.00	24.0	24.0
	635	5	19.40	18.00	13.0	24.0
DOGFISH, SMOOTH	612	72	26.68	24.00	3.6	72.0
	614	43	2.01	1.60	0.5	6.5
	615	*	5.80	5.80	5.8	5.8
	621	27	17.82	21.90	1.0	24.0
	635	7	7.36	1.40	0.7	15.7
DOGFISH, SPINY	612	49	24.00	24.00	8.3	48.0
	614	18	2.40	1.65	0.5	16.0
	615	*	9.50	2.70	1.8	24.0
	621	39	30.97	24.00	1.1	78.0
	625	108	32.86	24.00	3.2	192.0
	631	41	37.27	48.00	18.0	72.0
	635	5	1.30	1.30	0.5	2.8
FLOUNDER, SUMMER (FLUKE)	538	*	24.00	24.00	24.0	24.0
	539	13	23.17	24.00	18.3	24.0

TARGET1	AREA	STURGEON	Mean Time	Median Time	Min Time	Max Time
MONKFISH (GOOSEFISH)	513	*	120.00	120.00	120.0	120.0
	514	19	93.47	96.00	24.0	240.0
	521	*	84.00	84.00	48.0	120.0
	526	*	168.00	168.00	168.0	168.0
	537	22	129.76	108.00	48.0	288.0
	539	10	91.20	96.00	48.0	120.0
	612	66	73.27	48.00	24.0	264.0
	613	34	87.18	76.00	36.0	144.0
	614	5	57.60	48.00	48.0	72.0
	615	51	51.18	48.00	24.0	170.0
	616	*	288.00	288.00	288.0	288.0
	621	*	108.00	108.00	72.0	144.0
	622	*	96.00	96.00	96.0	96.0
	625	*	72.00	72.00	72.0	72.0
	626	9	69.33	48.00	48.0	192.0
SKATE, WINTER (BIG)	521	*	24.00	24.00	24.0	24.0
	537	8	119.50	120.00	72.0	168.0
	539	*	96.00	72.00	48.0	168.0
	612	25	95.04	96.00	48.0	168.0
	614	7	44.57	48.00	24.0	72.0
	615	20	44.80	48.00	12.0	96.0
	621	*	96.00	96.00	96.0	96.0

The ASBWG created different variations of the above tables, available in Appendix I, but these three were determined to be the most useful from which to draw conclusions and make recommendations.

Finally, there is a small Canadian gillnet fishery that explicitly targets Atlantic sturgeon in Saint John River (Fisheries and Oceans Canada, 2016, see https://publications.gc.ca/collections/collection_2016/mpo-dfo/En3-5-68-2015-eng.pdf). This fishery includes just four licensed fishermen, whose permits are non-transferable and, without regulatory intervention, will expire when these fishermen retire. This fishery also incidentally captures shortnose sturgeon (*Acipenser brevirostrum*), for which a management plan has been prepared under the Species at

Risk Act by Fisheries and Oceans Canada. The management plan acknowledges the threat that gillnet fisheries in the river pose to shortnose sturgeon, but there are no measures to address this threat other than a 13-inch minimum mesh size requirement, which is expected to reduce the chances that shortnose sturgeon and juvenile Atlantic sturgeon are caught. This gear is presumed to effectively catch adult Atlantic sturgeon, given that these are the target species of the fishery.

What gear modifications have been explored to reduce sturgeon bycatch?

A number of studies were reviewed which considered modifications to gillnet gear that could be used to reduce bycatch of Atlantic sturgeon.

In 2006, Gessner and Arndt demonstrated in experimental conditions in freshwater ponds that the use of spacers to lift stand-up gillnets off the bottom by 0.3 meters (11.81 inches) "substantially" reduced catch of Siberian sturgeon. This concept was discussed at a NMFS and ASMFC gear workshop in 2013 as potentially applicable to Atlantic sturgeon, but it was noted that this type of modification would likely also reduce or eliminate monkfish catch, an undesirable outcome for any gear measure intended to reduce sturgeon bycatch in the monkfish fishery.

The ASBWG also examined work by He (2006) that compared stand-up and tie-down gillnet designs to examine the selectivity of each to investigate whether a particular design could effectively reduce bycatch of cod. This study did not examine or make conclusions on Atlantic sturgeon bycatch for any of the designs, but did support the group's understanding that standard stand-up gillnet designs generally are effective at targeting roundfish, while tie-down gillnet designs are particularly effective in targeting flounders, monkfish, and skate.

Fox et al. completed a series of studies (2011, 2012, 2013, 2019) which progressively tested different configurations of gillnet, including comparisons between stand-up and tie-down gillnets, and comparisons of "low-profile" tie-down nets with commercial fishery standard nets (Table 6). Results of these studies were available to the ASBWG in the form of final grant reports (of which Fox et al. 2011, 2012, and 2013 are available to the public at https://www.fisheries.noaa.gov/resource/publication-database/protected-species-gear-research-contract-reports). Fox et al. 2019 is available upon request by email to Spencer.Talmage@noaa.gov). The 2011 through 2013 studies occurred in November and December of the preceding year off the coast of New Jersey.

Fox et al.'s 2011 study compared a stand-up gillnet design with a tie-down design, and found that the stand-up gillnet configuration reduced monkfish catch, had no significant difference in encounter rate of Atlantic sturgeon, and greatly increased marine mammal catch compared to the tie-down gillnet. The authors do not provide any explanations for the differences in marine mammal and Atlantic sturgeon bycatch between the two designs. Regardless, tie-down designs are the preferred configuration for targeting monkfish, and so this study at least provides some confirmation that removal of tie-downs is unlikely to provide a solution to Atlantic sturgeon bycatch.

Table 6. Gillnet Configurations used in Fox et al 2011, 2012, 2013, and 2019

Fox et al 2011						
	Mesh Size (in.)	Net Height (# mesh)	Tie Down Length (ft)	Tie Down Spacing (ft)	Hanging Ratio	Net Length (ft)
Control	12	12	4	24	0.5	300
Experimental	12	12	N/A	N/A	0.5	300
Fox et al 2012						
	Mesh Size (in.)	Net Height (# Mesh)	Tie Down Length (ft)	Tie Down Spacing (ft)	Hanging Ratio	Net Length (ft)
Control	12	12	4	24	0.5	300
Experimental	12	6	2	12	0.5	300
Fox et al 2013						
	Mesh Size (in.)	Net Height (# Mesh)	Tie Down Length (ft)	Tie Down Spacing (ft)	Hanging Ratio	Net Length (ft)
Control	12	12	4	24	0.5	300
Experimental	12	8	2	12	0.5	300
Fox et al 2019						
	Mesh Size (in.)	Net Height (# Mesh)	Tie Down Length (ft)	Tie Down Spacing (ft)	Hanging Ratio	Net Length (ft)
Control	12	12	4	24	0.5	300
Experimental	13	8	2	12	0.5	300

The 2012 study compared the tie-down design from 2011 with an experimental low-profile net which had a shorter net height, shorter tie-down length, and shorter tie-down spacing. During this study, 37 Atlantic sturgeon were caught, of which 28 came from the control net and 9 from the low-profile net, which was found to be a statistically significant difference. Some reduction in monkfish catch was found for the experimental net when compared to the control, but this was not found to be statistically significant. No significant reduction was found for skate. Fox et al. theorized that increases to the “bag” size of a low-profile net design might alleviate reductions in monkfish catch.

Fox et al.’s 2013 study compared the same control net to an experimental low-profile net which was 8 meshes tall (as opposed to 6 in the 2012 study). Thirty five Atlantic sturgeon were captured during the course of this experiment, with 21 from the control net and 14 from the experimental net. This difference was not statistically significant. Likewise, no statistically significant reduction in monkfish or skate catch was observed for the experimental net when compared to the control.

Finally, in 2019, Fox et al compared the same control net used in previous studies to a new experimental low-profile net with the same parameters as the net used in 2013 except for a 13-inch mesh size. The experimental gillnet reduced Atlantic sturgeon bycatch by a ratio of 4.2:1, which the authors noted as promising for overall bycatch reduction in the future. Results regarding monkfish catch were somewhat mixed; the vessel based out of New York caught significantly fewer monkfish, while there was no significant difference between monkfish catch by the vessel fishing out of New Jersey. Winter skate and dogfish catch was similar across fishing locations and did not differ by gear.

Fox et al. note that overall landings of monkfish by the commercial fishery during the study period were generally higher in New York, and thus the New York based vessel was fishing under a period of higher catch rates than the New Jersey based vessel (i.e. the amount of monkfish available to be caught by the New York vessel was greater than that of the New Jersey vessel). Under such conditions, it may be that a gillnet with shorter, more frequent tie-downs might load up with fish and fold in on itself more rapidly than the industry standard net. In addition, the New York based vessel deployed its nets on an average soak time of 48.0 hours, which is greater than the average soak time of 32.1 hours used by the New Jersey based vessel. If the experimental nets used by the New York based vessel were reaching their capacity for monkfish catch more quickly than the standard control net, then a greater soak time might mean that the period of time in which the experimental nets were less effective than the standard net would be greater in length. The New Jersey based vessel, in comparison, was fishing under more modest catch rates of monkfish and tending net more frequently; as such it may have better optimized the effectiveness of the experimental net and thus the difference in overall catch between the experimental and standard nets was not significant.

He and Jones (2013) (see https://www.fisheries.noaa.gov/resource/publication-database/protected-species-gear-research-contract-reports) conducted their own comparison of the standard tie-down net to an experimental low-profile net (Table 7). Only seven Atlantic sturgeon were captured during this trial, though all came from control nets, and the reduction in catch rates for sturgeon by the experimental net was found to be statistically significant. He and Jones noted that this sample size was simply too small to draw firm conclusions, but the ASBWG finds that this study does add to the evidence that low-profile net designs generally reduces bycatch of Atlantic sturgeon. However, in sets where monkfish catch rates were high (i.e., a large amount of monkfish were potentially available), there was a reduction in overall monkfish catch for the low-profile net when compared to industry standard nets. He and Jones suggest future study to include short tie-downs with greater numbers of vertical mesh. There were no reductions in winter skate catch.

Table 7. Gillnet Configurations used in He and Jones (2013)

He and Jones 2013						
	Mesh Size (in)	Net Height (# Mesh)	Tie Down Length (ft)	Tie Down Spacing (ft)	Hanging Ratio	Net Length (ft)
Control	12	12	4	24	0.5	300
Experimental	12	8	2	12	0.5	300

Finally, the group examined a study by Levesque et al. (2016) that compared the stand-up gillnet design typically used in the inshore southern flounder fishery in North Carolina and a heavily modified version with a 75-percent reduction in net profile from the standard design. This work demonstrated a reduction in incidental encounters of Atlantic sturgeon only relative to the gear used in the inshore southern flounder fishery in North Carolina, though it supports the general conclusions by the other studies examined by the ASBWG that reductions in net height are promising to reduce Atlantic sturgeon bycatch in large mesh gillnet gear.

When and where does this interaction occur?

The Atlantic sturgeon's distribution in the marine environment has been described in a number of documents including the ASMFC's 1998 and 2017 Atlantic Sturgeon Stock Assessments, NMFS background information for the 2012 ESA-listing rules and the 2017 critical habitat designations, and in comprehensive literature reviews (e.g., Hilton et al. 2016). Based on incidental capture of Atlantic sturgeon in fishery-dependent and fishery-independent surveys as well as directed captures for research, and a variety of scientific methods (e.g., tagging and recapture, telemetry, genetic analyses), we know that, generally, Atlantic sturgeon in the marine environment:

- Are adult sturgeon as well as sexually immature sturgeon that have reached a certain stage of development to emigrate from the natal estuary;
- Typically occur within the 50-meter depth contour but may primarily occur within the 25-meter depth contour in some areas and at certain times of the year;
- Have the same overall marine range from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida regardless of DPS; and,
- Make seasonal coastal movements from marine waters to river estuaries in the spring and from river estuaries to marine waters in the fall.

Erickson et al. (2011) provided some of the most detailed information for Atlantic sturgeon in the marine environment based on data from pop-up satellite archival tags of 15 adult Atlantic sturgeon that were captured in the freshwater reach of the Hudson River. Upon leaving the Hudson River, all of the fish used a similar depth range in summer and fall, and 13 of the 15 continued to have a similar depth pattern in the winter through spring. Mean-daily depths typically ranged from 5 to 35 m and never exceeded 40 m. The sturgeons occupied the deepest waters during winter and early spring (December–March) and shallowest waters during late spring to early fall (May– September). Mean-monthly water temperatures ranged from 8.3°C in February to 21.6°C in August for the 13 fish that exhibited similar depth distributions. Of the remaining two fish, during December and January, one sturgeon occurred at shallower depths (5-15 m) and in warmer waters, while the second fish occurred at deeper depths (35-70 m) and in colder waters. Nearly all of the sturgeon stayed within the Mid-Atlantic Bight before their tags were released. However, the sturgeon did not appear to move to a specific marine area where the fish reside throughout the winter. Instead, the sturgeon occurred within different areas of the Mid-Atlantic Bight and at different depths, occupying deeper and more southern waters in the winter months and more northern and shallow waters in the summer months with spring and fall being transition periods. Three subsequent studies, Breece et al. (2018), Ingram et al. (2019), and Rothermel et al. (2020), using thousands of detections of acoustically-tagged Atlantic sturgeon within receiver arrays off of Long Island

and New Jersey, Delaware, and Maryland demonstrated that depth and water temperature are key variables associated with sturgeon presence and distribution in Mid-Atlantic marine waters. All three studies provided further evidence of seasonal inshore and offshore movements with sturgeon occupying shallower waters closer to the coast in the spring and more offshore waters in the late fall-winter. Finally, similar to Erickson et al., both the Ingram et al. study and the Rothermel et al. study found very low residency time for individual Atlantic sturgeon within the receiver arrays for the respective studies. This suggests that sturgeon aggregation areas in the marine environment are not areas where individual sturgeon reside for extended periods of time but are used by many sturgeon for what they provide in terms of the most suitable environmental conditions as the sturgeon move through the marine environment.

Available information suggests a similar pattern for Atlantic sturgeon distribution and occurrence within the Gulf of Maine. Altenritter et al. (2017), Novak et al. (2017), and Wippelhauser et al. (2017) provide the most recent, published literature describing Atlantic sturgeon movements within and beyond the Gulf of Maine. Each of the studies used telemetry detections of acoustically-tagged Atlantic sturgeon, many of which were initially captured in a Gulf of Maine river, suggesting that they were more likely to belong to the Gulf of Maine DPS. Collectively, the studies encompassed the time period of 2006-2014. Their results demonstrate that the sturgeon primarily occurred in the Gulf of Maine, use more offshore waters in the fall and winter, and make seasonal coastal movements between estuaries. Some of the estuaries are known aggregation areas where sturgeon forage, and one (i.e., the Kennebec River Estuary) is the only known spawning river for the Gulf of Maine DPS.

In addition to the studies cited above, a new, comprehensive analysis of Atlantic sturgeon stock composition coastwide provides further evidence that the sturgeon's natal origin influences the distribution of Atlantic sturgeon in the marine environment. While Atlantic sturgeon that originate from each of the five DPSs and from the Canadian rivers were represented in the 1,704 samples analyzed for the study, there were statistically significant differences in the spatial distribution of each DPS, and individuals were most likely to be assigned to a DPS in the same general region where they were collected (Kazyak et al. 2021). The results support the findings of previous genetic analyses that Atlantic sturgeon of a particular DPS can occur throughout its marine range but are most prevalent in the broad region of marine waters closest to the DPSs natal river(s). In comparison to its total marine range, Atlantic sturgeon belonging to: the Gulf of Maine DPS are most prevalent in the Gulf of Maine; the New York Bight DPS are most prevalent in the Mid-Atlantic Bight and are the most prevalent of all of the DPSs in the Mid-Atlantic Bight; and, the Chesapeake Bay DPS are most prevalent in the Mid-Atlantic Bight, particularly from around Delaware to Cape Hatteras.

What are the characteristics of bycaught Atlantic sturgeon?

Available information related to characteristics of Atlantic sturgeon which are caught as bycatch is primarily derived from fisheries dependent sources, particularly the observer database. Observers collect catch, gear, fishing effort, and biological data in fisheries in the Greater Atlantic Region. The observer dataset includes information on weight, length, and status of bycaught sturgeon. External sex determination by fisheries observers is not possible, and so it cannot be inferred whether sturgeon of one sex are more likely to be caught than another.

Status data recorded by observers is categorical and not detailed; bycaught sturgeon are recorded as "alive", "dead", "dead, damaged", "dead, head only" or "unknown". Out of a total 2,991 individual sturgeon recorded by observers in the past 10 years, 52.6 percent of Atlantic sturgeon were considered alive, while 45.2 percent were dead; dead, damaged; or dead, head only. In both the Gulf of Maine and an area from the Virginia-North Carolina state line to Cape May, numbers of sturgeon released alive during this time period are greater than those released dead. In the Gulf of Maine, 61.7 percent of 480 individuals were considered alive, while 36.7 percent were considered dead or dead, damaged. From the Virginia-North Carolina state line to Cape May, 67.2 percent of 519 individuals were considered alive, with 32.2 percent recorded as dead or dead, damaged. From Cape May to Martha's Vineyard, , however, 53.8 percent of sturgeon observed were considered dead, dead, damaged, or dead, head only, while only 43.2 percent were considered alive.

The number and proportion of sturgeon considered to have been released alive on observed trips is not the same as the number of sturgeon that ultimately survive interaction with fishing gear on observer trips. Not all sturgeon that are entangled in gillnet gear will remain in nets when they are hauled, and so the number of sturgeon of any status that actually interacted with gillnet gear on observed trips may be larger than what has been recorded. In addition, observers are recording status at time of capture; the data thus do not provide information regarding post-release mortality.

There is limited information available to characterize post-release mortality for sturgeon caught in gillnet gear. Fox et al. (2019) conducted field trials of an experimental low-profile gillnet design in conjunction with an examination of Atlantic sturgeon behavior in the presence of sink gillnets and an examination of post release mortality of incidentally landed Atlantic sturgeon. Twenty fishing trips were taken under the project by participating vessels, during which paired gillnets were deployed. Two to three strings each of a control industry standard gillnet and experimental low profile gillnet were deployed at each location. A total of 31 Atlantic sturgeon were incidentally caught over the course of this project, 18 of which were dead upon the net being hauled. The 13 remaining sturgeon were fitted with a p-sat transmitter and released alive. Of these, only four transmitters were recovered, and Fox et al. speculated that one (25 percent) of these individuals suffered a mortality post-release. A greater sample size is needed to make any strong conclusions about post-release mortality experienced by Atlantic sturgeon caught in gillnet gear.

Have any recently produced studies established new tools for management?

A few studies reviewed by the working group used remote sensing, biotelemetry, and other techniques to produce dynamic spatial models which may be used by managers and stakeholders as decision-making tools to reduce overlap of fishing activity and sturgeon presence.

Breece et al. in 2016 translated the concept of landscapes, environmental partitions that index complex biogeochemical processes that drive terrestrial species distributions, into a seascape approach to understanding Atlantic sturgeon occurrence during their spring migration in the mid-Atlantic region, along the coast of New Jersey and in and around Delaware Bay. They used a global, publicly available seascape product which uses satellite-derived measurements of remote sensing reflectance and daytime sea surface temperatures (SST) in conjunction with acoustic telemetry data for Atlantic sturgeon locations to determine whether Atlantic sturgeon were selecting for certain seascapes. Of six seascapes that dominated the study area (labeled A - F), Seascape class E was the most preferred by sturgeon and the only seascape to be significantly preferred. Seascape E was defined by an association with the coastline of Delaware Bay and Atlantic Ocean, with a mean SST of 19.8 °C and the second highest reflectance at 443 nm and 555 nm. This work confirms previous findings that mouths of estuaries and inlets concentrate Atlantic sturgeon in the coastal ocean, and that Atlantic sturgeon migrate along these locations using relatively narrow corridors along the coast. Additionally, the established preference of Atlantic sturgeon for Seascape E during the spring migration could be used to estimate spatial occurrence without direct observation of individuals, and thus a seascape product could be applied to inform reduction of Atlantic sturgeon bycatch in coastal fisheries.

In addition to this work, Breece et al. (2018) utilized biotelemetry observations of Atlantic sturgeon in concert with daily satellite observations to construct a spatial distribution model for the species which could determine the relationship between Atlantic sturgeon occurrence and environmental predictors on a daily basis throughout the year. Model estimations showed Atlantic sturgeon association with shallower waters in the spring, deeper waters relative to those used for model development in the fall, and containment to isolated patches at the mouths of estuaries in the summer. This supports previously established patterns of Atlantic sturgeon migration. The model also showed higher abundance of Atlantic sturgeon within water temperatures between 12°C and 25°C, day-of-year patterns consistent with known migratory patterns, and dimorphic migratory patterns in which male sturgeon arrive upon spawning grounds days to weeks prior to the arrival of females. Breece et al. contend that a projection of their base model onto dynamic SST and ocean color data could create a daily map of Atlantic sturgeon abundance over the coastal mid-Atlantic, which could be used as a dynamic management tool.

Actionable Conclusions

The ASBWG makes the following conclusions based on its review of the data and information available about Atlantic sturgeon bycatch in the federal large mesh gillnet fisheries.

- Literature indicates that the Federal gillnet fisheries targeting monkfish, spiny dogfish, and Northeast multispecies with sink gillnet gear ranging from 5.5 to 12 inches in mesh size are primary contributors to Atlantic sturgeon bycatch. These fisheries use a mix of stand-up and tie-down gear depending on primary target species. It is notable, however, that when the ASBWG examined observer data, no haul with sturgeon interaction was recorded with Atlantic cod as the target species and only three other hauls with sturgeon interaction were recorded with another species in the Northeast Multispecies complex as a target.

- Recent gillnet gear research has shown that low-profile gillnet designs with reduced net height, shorter tie-down length, and shorter tie-down spacing reduce Atlantic sturgeon bycatch, potentially without reduction in catch of target species. In particular, a gillnet configuration tested by Fox et al. (2019) with 13-inch mesh size, height of 8 meshes, and 24-inch tie-downs spaced every 12 feet was shown to reduce Atlantic sturgeon bycatch in New Jersey without significant reductions in monkfish catch.

- Available research and the ASBWG's analysis of observer data indicate that soak time is a likely driver of Atlantic sturgeon bycatch rates and mortality. When examining the observer data in Table 3, it is clear that both mean and median soak times for Atlantic sturgeon recorded as "Alive" upon capture are less than soak times for sturgeon recorded as "Dead" upon capture, across all seasons.

- Soak time is not equal among fisheries, and this can have an impact on the rates of Atlantic sturgeon mortality in different fisheries. For example, when spiny dogfish is identified as a target, the mean soak time for hauls positive for interaction with Atlantic sturgeon is 28.67 hours and median is 24 hours. Meanwhile, when monkfish is identified as a target, mean soak time for hauls positive for interaction with Atlantic sturgeon is 79.9 hours, while the median is 72 hours. Of the sturgeon captured on trips where spiny dogfish were targeted, 229 were recorded as "Alive," and 30 were recorded as "Dead" or "Dead, damaged." On the other hand, of the 227 sturgeon captured when monkfish were the target, 73 were recorded as "Alive" and 145 were "Dead" or "Dead, damaged".

- Available research indicates that temperature and depth are primary drivers of Atlantic sturgeon movement and abundance. In particular, sturgeon tend to occur in waters shallower than 50 m in depth and shallower than 25 m during seasonal coastal movements from marine waters to river estuaries in the spring and from river estuaries to marine waters in the fall. Migratory pathways along the coast used by many sturgeon represent key areas of high abundance.

- Post-release mortality for Atlantic sturgeon is not well understood; only a small amount of information on the topic is currently available, and research that does exist is hampered by small sample sizes.

Actions to Reduce Atlantic Sturgeon Bycatch in Federal Large Mesh Gillnet Fisheries

Given the ASBWG's conclusions and review of available information, the ASBWG recommends that fisheries managers consider three primary approaches to achieve bycatch reductions by 2024. These are:

1. Modifications to gear;
2. Reductions in soak time; and
3. Consideration of areas of focus in regions of Atlantic sturgeon bycatch.

These approaches, and the recommendations within them, should apply to federally-permitted commercial fishing vessels fishing with large mesh (greater than or equal to seven inches stretched) gillnet gear in the Greater Atlantic Region to target Northeast multispecies, skate, monkfish, and/or spiny dogfish.

The definition of large mesh used in this Action Plan is derived from the requirements laid out in the 2021 Biological Opinion and excludes vessels participating in several gillnet fisheries programs in which the minimum mesh is 6.5 inches and smaller (e.g. the Mid-Atlantic Exemption Area, vessels on a Northeast

Multispecies DAS or Sector trip only, Southern New England Dogfish Gillnet Exemption Area, etc.). Significant interaction between these vessels and Atlantic sturgeon was observed in the data considered by the working group, and so fisheries managers may find it appropriate and necessary to include them in any actions taken to reduce Atlantic sturgeon bycatch. The technical exclusion of these vessels in the recommendations of this effort is related primarily to the language of the 2021 Biological Opinion and its requirements rather than a belief that interactions between them and Atlantic sturgeon should not be considered now or in the future. Reductions in these interactions would have a positive impact on Atlantic sturgeon in the region.

Practices in the fisheries covered by these recommendations are diverse; it may not necessarily be appropriate to apply these recommendations to the fisheries being considered in a wholesale fashion. Fisheries managers should take care to apply these recommendations such that they balance reduction in Atlantic sturgeon bycatch with the continued successful operation of the fisheries under consideration.

Additionally, these approaches are not mutually exclusive; the ASBWG recommends that some combination of these could be considered together to achieve bycatch reduction while balancing the needs of affected fisheries. For example, a restricted gear area which allows fishing in areas where Atlantic sturgeon bycatch is a possibility, but requires the use of low-profile gillnet gear may be preferred over a time/area closure which prohibits fishing from that same area or a blanket requirement for all vessels to use a low-profile gillnet in the entire region.

Finally, the lack of available information regarding post-release mortality severely inhibits the ability of managers and scientists to understand and respond to the degree of mortality occurring as a result of bycatch. The Councils, ASMFC, and NMFS should collaborate to establish a greater understanding of post-release mortality of Atlantic sturgeon entangled in gillnet gear.

Modifications to Gear

The ASBWG recommends that the Councils consider requiring the use of low-profile gillnet gear by federally permitted commercial fishing vessels participating in the fisheries noted previously.

A low-profile net design, as defined by successful gear studies from Fox et al. 2011, 2012, 2013, 2019 and He and Jones (2013), possesses the following characteristics:

- Mesh size ranging from 12 to 13 inches;
- Net height ranging from 6 to 8 meshes tall;
- Tie-down length of 24 inches;
- Tie-down spacing of 12 feet;
- Net length of 300 feet; and
- Primary hanging ratio of 0.50.

Of the net designs tested in the gear modification studies that the ASBWG examined, the low-profile net which showed the greatest success in reducing Atlantic sturgeon bycatch while not significantly reducing monkfish catch was the one used by Fox et al. 2019. This net had a 13-inch mesh size, an 8-mesh net height, tie-down length of 24 inches, tie-down spacing of 12 feet, and had 12 panels, each 300 feet long,for a total length of 1,200 ft. However, as noted, this success was only true for the New Jersey based participant of the study, and not for the participating vessel based in New York.

The mixed nature of these results signal the need for continued industry engagement and collaboration with scientific experts to further develop and perfect net designs that optimize catchability of target species while retaining reduced bycatch of Atlantic sturgeon. Changes in net design may require adaptation in fishing behavior in order to optimize their use. Reduced soak times and/or more active tending of low-profile gillnets, for instance, may be necessary to ensure that catchability of the net remains high. However, the ASBWG notes that the need to identify the most effective net design must be balanced by the need to implement meaningful bycatch reductions as soon as possible.

Reductions in Soak Time

The Councils should consider restricting the amount of soak time that nets can be deployed by federally permitted commercial fishing vessels participating in the fisheries noted previously.

Soak time is strongly related to the likelihood of bycatch and bycatch mortality. Reductions in the amount of time in which a given piece of gear is in the water will reduce both the likelihood that that gear will interact with an Atlantic sturgeon and that any interaction will result in mortality.

Soak time in the federal large mesh gillnet fishery varies greatly across the relevant fisheries due to differences in fishing practices and conditions. The simple analysis of observer data conducted by the ASBWG indicated that the mean and median soak times of hauls targeting monkfish or skates tended to be greater than those hauls targeting other species like spiny dogfish and bluefish. Additionally, of the observed Atlantic sturgeon captured on hauls in the monkfish fishery, a greater number were dead upon removing gear from the water. As such, efforts to reduce soak time in the monkfish fishery may be most effective to reduce mortality of Atlantic sturgeon. Additional work to fully characterize current practices related to soak time in order may further identify opportunities to reduce soak time in areas and at times during which doing so would provide the most conservation benefit.

Implementation and enforcement of regulations which restrict soak time have been particularly challenging in the past, given a lack of mechanism to do so. NMFS in recent years has explored the development of data loggers which could be used to enforce soak time regulations, and has acquired funding to procure and test data loggers to ensure new technology and systems can record data effectively, indicate when an exceedance has occurred, withstand fishing conditions, and be reviewed and utilized by the Office of Law Enforcement to enforce any tow/soak duration limitations. These data loggers build on work described in Matzen et. Al., (2015) and use Bluetooth communications to easily transfer data from the systems.

Fisheries managers might additionally explore regulatory changes that might indirectly result in reductions in soak time, without requiring direct enforcement of soak time limits. For example, vessels in the Northeast Multispecies fishery classified as “day gillnet vessels” and vessels fishing in the monkfish fishery on a Monkfish-Only DAS to are currently allowed to leave gear in the water when returning to the dock. Restricting or eliminating these practices could reduce soak times by requiring vessels to actively tend or be at-sea while gear is deployed.

Additionally, regulatory adjustments that improve the overall efficiency of subject fisheries may be effective at reducing soak times by reducing the amount of time needed to harvest relevant quotas or by allowing vessels to be more selective about the times during which they fish. If improved efficiency reduces the incentive for vessels to fish at all times of year, vessels might be more likely to voluntarily avoid fishing in times and areas that they expect to encounter Atlantic sturgeon. Increases to possession limits to reduce regulatory discards and improved flexibility regarding the use of DAS might achieve some of these improvements in efficiency.

Areas of Focus

Available observer data suggests high incidence of Atlantic sturgeon bycatch in gillnet fisheries in several distinct regions along the Atlantic coast, which roughly correspond to available examples from the literature review.

The ASBWG mapped observer data from 2015 to 2020 (Figures 1 and 2) to identify areas that might be important for reducing bycatch. The group considered whether it would be possible to make recommendations for large closure areas which would effectively address Atlantic sturgeon bycatch. However, it did not evaluate the socio-economic impacts of these potential areas, or the relative importance of these areas to gillnet vessels. Because Atlantic sturgeon bycatch in the observer data is strongly related to fishing effort, it is likely that broad closure areas for this purpose would encompass the majority of fishing activity in the region and result in extensive closure and disruption to the fishing industry. This idea of broad closure areas was discarded, as it was presumed to have a high negative impact on the fisheries involved.

The ASBWG recommends work to evaluate the trade-offs and potential impacts of smaller, more focused, and potentially seasonal closure or restricted areas where incidence of Atlantic sturgeon interaction are noted to be high. These might, for example, apply the recommended gear modifications, or soak time restrictions in locations and times which they might be most impactful.

Seasonal and year-round closures for the use of gillnet gear with ≥ 7 inches stretched mesh do exist in these areas for the protection of other species (e.g., harbor porpoise, sea turtles) as well as for fisheries management (e.g., Gulf of Maine Cod Protection Closures). Such closures may afford some protection to the Atlantic sturgeon DPSs if they reduce large mesh gillnet fishing effort at times and in areas where sturgeon also occur. For example, the Harbor Porpoise Take Reduction Plan (HPTRP) and the Large-Mesh Gillnet regulations include seasonal closure areas for the use of ≥ 7 inches stretched mesh gillnet gear in New England and mid-Atlantic waters see https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-protection/harbor-porpoise-take-reduction-plan and https://www.fisheries.noaa.gov/resource/map/large-mesh-gillnet-restricted-area-map-gis-data exact coordinates and measures). The prohibitions on the use of ≥ 7 inches stretched mesh gillnet gear in these areas may benefit Atlantic sturgeon, particularly those belonging to the Chesapeake Bay and New York Bight DPSs, when the sturgeon are moving through marine waters to and from coastal estuaries.

Similarly, measures such as the Gulf of Maine Cod Protection Closures (see https://www.fisheries.noaa.gov/new-england-mid-atlantic/rules-and-regulations/northeast-multispecies-closed-area-regulations for additional information) may also benefit Atlantic sturgeon, particularly the Gulf of Maine DPS, when sturgeon are moving through marine waters to and from coastal estuaries.

These existing closures, where relevant, will be noted for each area highlighted by this Action Plan.

The ASBWG did not consider ongoing wind energy projects in the region, which are in various stages of development. It is possible that the eventual construction of wind energy projects affects fishing effort in the region, and thus patterns of Atlantic sturgeon bycatch. This is, however, difficult to project. At the least, fisheries managers should take care not to implement restrictive measures that combine with wind energy activities to severely restrict fishing activity in a given area (e.g. a full closure area that encompasses what would be the remainder of available fishing ground outside of a wind energy lease area for a given geographic region). A map of current wind energy development in the Greater Atlantic region is available in Appendix II.

Finally, the ASBWG notes that these maps have changed from the versions which were present in the draft Action Plan to ensure data confidentiality. The prior maps used point data to display the locations of Atlantic sturgeon interactions, and this revised Action Plan uses heat maps to visualize the observer data. Seasonal trends were originally shown using differently colored symbols for point data; the transition to using heat maps removed this option, given that heat maps rely on a color gradient to identify point density. Creating multiple maps using only data from certain months could not be done to show these trends, as the data became so limited as to violate confidentiality rules even as heat maps. In addition, the draft Action Plan defined explicit boundaries for areas in which spatial measures could be considered. However, these boundaries were removed in this revised Action Plan, considering that the Plan is not intended to prescribe a specific action managers must take, but rather measures that managers could consider. The intention of this section is to highlight areas where higher levels of interaction between gillnet fisheries and Atlantic sturgeon are known to occur, and suggest focus on these areas.

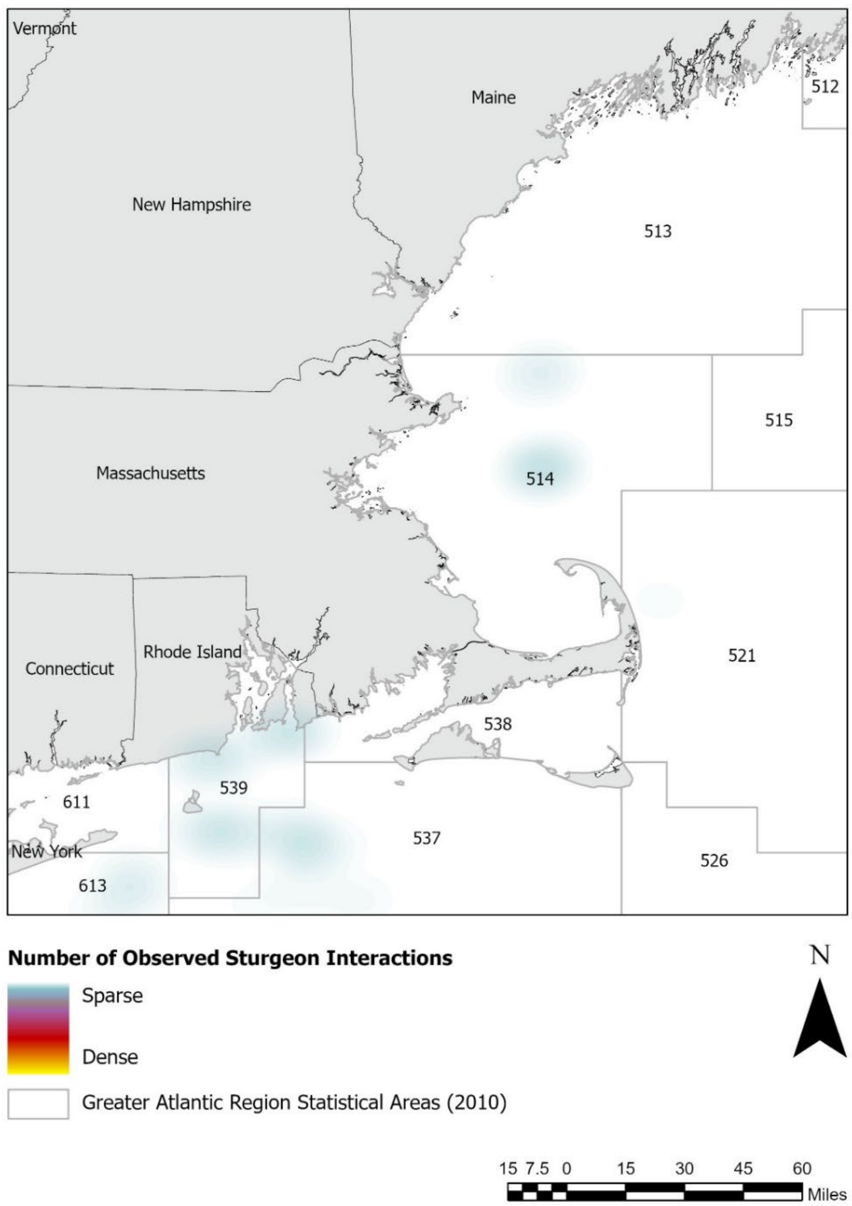
Gulf of Maine through Southern New England

Available observer data shows a cluster of interaction between the large mesh gillnet fishery and Atlantic sturgeon on Stellwagen Bank within the Gulf of Maine, with no discernible seasonal pattern. Notably, several instances of observed sturgeon interaction occurred along the border of the Western Gulf of Maine Closure Area on the 70˚ 15’ W. longitude line. Given the relative importance of Stellwagen Bank to a variety of fisheries in the Gulf of Maine, these interactions could potentially be driven by fishing effort, rather than a particularly large abundance or presence of Sturgeon. There are a series of closures in the Gulf of Maine near this cluster of interactions, both for the HPTRP and the Northeast Multispecies FMP. The Massachusetts Bay Management Area is closed to gillnets from March 1 through March 31 of each year, though this does not cover Stellwagen Bank. The Gulf of Maine Cod Protection Closures (See https://www.fisheries.noaa.gov/new-england-mid-atlantic/commercial-fishing/northeast-multispecies-closed-area-regulations-gulf#gulf-of-maine-cod-protection-closures) are closed to fishing vessels with a few exceptions, but sink gillnet gear is included in the closure. These areas change monthly, and as a result, portions of Stellwagen bank are closed from May to June, October, and November through January.

Farther south, available observer data shows scattered interactions between Atlantic sturgeon and the gillnet fishery southwest of Martha's Vineyard. The interactions in this region have a seasonality that matches with the established literature that was reviewed; most occur from April through June and October through December, with limited interaction during the summer months.

The Cape Cod South Closure Area, part of the HPTRP Plan, bounds most of the interactions shown in this area on the map, but is closed to gillnet gear only from March 1 through March 31.

Figure 1. Areas of Focus for the Gulf of Maine and Southern New England



New Jersey through Virginia

When mapped, NEFOP data indicates that interaction with Atlantic sturgeon by gillnet gear in the last 10 years is concentrated off of the coast of New Jersey in two groups split temporally. The first is a spring concentration largely within and close to state waters in the months of April, May, and June, which coincides with coastal migratory patterns. The second grouping is less concentrated and occurs farther offshore in the New Jersey Bight during the late fall and early winter months of November and December.

In the literature, Dunton et al. (2010) recommended the closure of a small (85.47 km^2) area just off of Sandy Hook to protect habitat and juvenile sturgeon from fishing mortality. Interactions in this area were not seen in the observer data, so it is likely that this recommendation might be more pertinent for state fisheries for New Jersey and New York. Additionally, Erickson et al. (2011) tagged 15 Atlantic sturgeon in the Hudson River, of which 13 remained in, and traveled throughout the Mid-Atlantic Bight. Erickson et al. also conducted a Kernal density analysis to identify oceanic aggregation areas and migratory corridors for adult Atlantic sturgeon tagged in the Hudson River. The areas of greatest aggregation identified by this analysis actually occurred on the northern side of Hudson Bay, the southern end of New Jersey, and southeast of the mouth of Chesapeake Bay. This information suggests that the areas shown in this map likely act as a migratory corridor for the aggregation areas to the south.

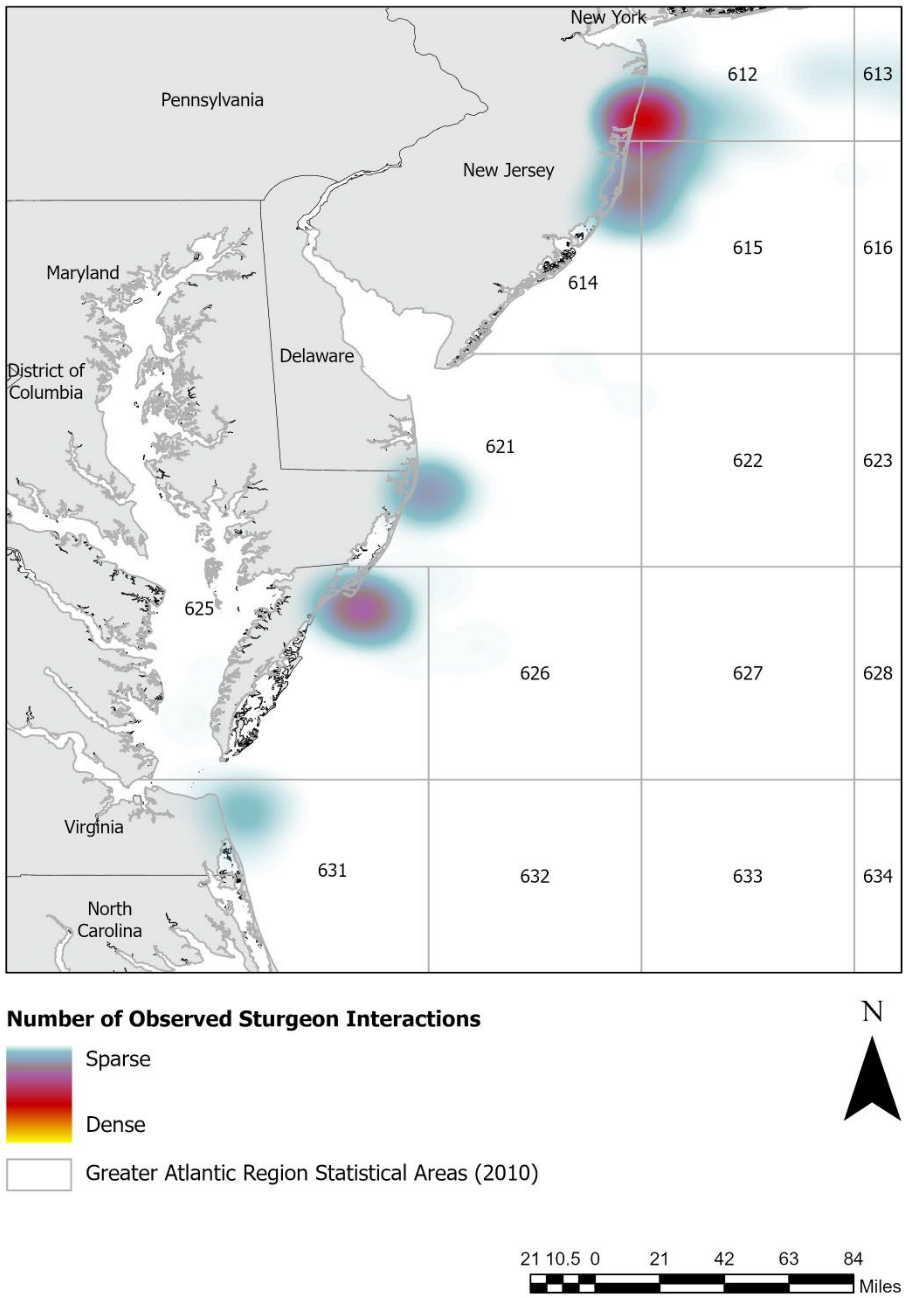
There are several HPTRP closures in the area where these clusters of interaction with Atlantic sturgeon are present in the observer data. The Waters off New Jersey Management Area covers a square-shaped area with a northeast corner on the eastern extent of Long Island to and a southwest corner at Cape Henlopen, Delaware. It is closed to gillnet gear from April 1 through April 20, and requires tie-downs spaced no more than 24 ft apart along the floatline, and not more than 48 inches in length from January 1 through April 30th. The Mudhole North Management and Mudhole South Management Areas are also near this cluster of interaction with Atlantic sturgeon, and both closed from February 15 through March 15 and April 1 through April 20.

Observer data indicates three general areas of interaction between Atlantic sturgeon and gillnet gear in the Mid-Atlantic Bight off Maryland and Virginia. The northernmost area, off of Ocean City, MD, is split seasonally and spatially, with some interactions within state waters during April and May and an area of interactions more offshore in federal waters primarily in December and January.

Farther south, there is a concentration of interactions east and southeast of Chincoteague, VA. The seasonal patterns in this area are less clear than those in the northernmost hotspot in this area. Though bycatch occurs most frequently in the months of April, May, January, and December, instances of observed bycatch of Atlantic sturgeon are spatially dispersed.

Finally, the area in and just south of the mouth of Chesapeake Bay, interactions between Atlantic sturgeon and gillnet gear are heavily concentrated along the boundary between state and federal waters, with no seasonal patterns evident.

Figure 2. Areas of Focus from New Jersey to Virginia



In the literature, evidence from both Breece et al. (2016) and Erickson et al. (2011) support measures from the mouth of Delaware Bay to Chesapeake Bay. From Breece et al. 2016, the seascape feature in which Atlantic sturgeon are most commonly associated was most prevalent along the coast of Delaware, Maryland, and Virginia in the months of April and May from 2009 - 2012. The kernel analysis from Erickson et al. (2011) resulted in a heavy concentration of Atlantic sturgeon just outside the mouth of the

Chesapeake and surrounding coastline. It should be noted that both of these sources may indicate that closures or area-based measures just off Cape May might be appropriate; observed interactions between the gillnet fishery and Atlantic sturgeon, however, were not prevalent in this area.

The HPTRP includes the Southern Mid-Atlantic Management Area, which spatially encompasses all of the Atlantic sturgeon interactions in this area in the observer data, which is closed from February 15 through March 15, and requires tie-down gear from February 1 through April 30.

Post-Release Mortality and Assessment of Bycaught Sturgeon

In order to improve our understanding of post-release mortality of Atlantic sturgeon caught in gillnet gear, the Councils, ASMFC, and NMFS should explore ways to prioritize focused research.

There are two subordinate research topics that should be explored:

- Quantitative estimates of post-release mortality rates for sturgeon entangled in gillnet gear; and
- Injury assessment for sturgeon entangled in gillnet gear.

Available research by Fox et al. (2019) has shown that tagging and telemetry is a feasible approach to developing post-release mortality estimates for sturgeon. Traditional methods by which the Councils, ASMFC, and NMFS support research development, such as grant issuance, is a recommended approach to encouraging research into post-release mortality estimation.

For injury assessment, the ASBWG studied the workshop-style approach which was used to develop technical guidelines for assessing injury of sea turtles from 2003 to 2011 would be feasible for assessing post-release mortality of Atlantic sturgeon. NMFS conducted an initial assessment of the magnitude of injuries from sea turtle interactions with Atlantic sea scallop dredge gear via the issuance of a detailed questionnaire sent to various experts in sea turtle veterinary medicine and rehabilitation. The results of this assessment were used to generate working guidance for serious injury determinations for hard-shelled sea turtles taken in the scallop dredge fishery and further used to help determine during Section 7 consultations to differentiate between non-lethal and lethal interactions. These determinations were specific to the scallop dredge fishery; to extend injury assessment guidance to other relevant fisheries, NMFS in 2009 held a Sea Turtle injury workshop. This workshop gathered various experts in sea turtle veterinary medicine, health, assessment, anatomy, and/or rehabilitation to: (1) discuss case studies of sea turtles caught in fishing gear with varying levels of injuries; (2) critique NMFS' working guidance and approach for evaluating post-release survival; and (3) comment on the level of information collected by observers. The results of this workshop were used to revise working guidance and produce a 2011 document titled *Technical Working Guidelines for Assessing Injuries of Sea Turtles Observed in Northeast Fishing Gear* (Upite 2011). This work was extended and updated following a workshop held in 2015 to provide national consistency to assessment of post-interaction mortality of sea turtles captured in trawl, net, and pot/trap gear (Stacy et al. 2016).

The approach used in the sea turtle example cannot necessarily be used as a 1:1 template to develop a means to assess injury to Atlantic sturgeon entangled in gillnet gear. The network of experts in topics such as veterinary medicine and rescue/rehabilitation for sea turtles is fairly well developed. It is unlikely that such a network for Atlantic sturgeon exists to the same extent, which would make, for example, an initial assessment for Atlantic sturgeon similar to the one conducted for sea turtles in 2003 difficult, if not impossible.

As such, the timeline recommended by the ASBWG to improve understanding of post-release mortality of Atlantic sturgeon captured by gillnet gear places will occur in two phases and seek to achieve three objectives:

1. Develop protocols and standard criteria for the rapid visual assessment of live Atlantic sturgeon captured in gillnet gear and, based on the best available information, identify the risk (e.g., expressed as a percentage likelihood) of post-release mortality given the results of the visual assessments;
2. Facilitate the acquisition of new data suitable for scientific publication that quantifies the post-release mortality of Atlantic sturgeon captured in gillnet gear; and
3. Explore options for a citizen science program to increase voluntary reporting of Atlantic sturgeon captures in gillnet gear and to increase data collection for long-term assessments of Atlantic sturgeon post-release mortality (e.g., training gillnet vessels how to implant and/or check each captured sturgeon for a Passive Integrated Transponder (PIT) tag).

There is an immediate need for information on post-release mortality of Atlantic sturgeon in gillnet gear. However, acquiring new data will take some time. Objective 1 will provide information in the short-term and will be based on the currently available scientific information, the expertise and knowledge of sturgeon researchers, and the coordination of managers with other essential parties (e.g., the NEFSC, Northeast Fisheries Observer Program). Objective 2 will provide scientific data which, after being properly vetted and peer-reviewed, can be used to modify and improve upon the results of Objective 1 or to replace the product of Objective 1. Objective 3 would provide the necessary long-term data to better inform post-release mortality of Atlantic sturgeon captured in gillnet gear, including trends and any changes over time, and which cannot reasonably be replicated by any other method.

The ASWBG recommends NMFS lead the first phase to identify steps needed to acquire additional information to inform post-release mortality and to fulfill the above objectives, working the Councils, ASFMC, and others, as needed and appropriate. These steps should include:

- Outreach to develop a network of researchers and other subject matter experts regarding Atlantic sturgeon biology and related fields;
- Scoping within that network to identify research needs pertaining to injury assessment;
- Identification of funding sources which might provide opportunity for research, such as tagging and telemetry studies, regarding post-release mortality rates of Atlantic sturgeon; and
- Identification of necessary permitting.

Once steps have been identified, NMFS, the Councils, and the ASMFC should work collaboratively to carry them out to achieve the three objectives listed above. Fulfillment of these steps need not involve each of these entities, but should include them where appropriate based on the role of each. For example, the Councils maintain a network of fishing industry stakeholders and experts, which may prove useful for outreach and other efforts to gather local ecological knowledge on Atlantic sturgeon. Additionally, ASMFC has a Fisheries Science Program, which may make it an ideal collaborating partner to address research priorities and opportunities.

Once these steps are complete, NMFS should produce technical guidelines for NEFOP observers to make and record visual assessments of each Atlantic sturgeon captured in gillnet gear and released alive, and which will provide NMFS approach for assigning the likelihood of post-release mortality to each sturgeon based on the NEFOP observers visual assessment.

Timelines

Timeline for Action Plan and Development of Measures to Reduce Atlantic Sturgeon Bycatch in Gillnet Gear (Completed Milestones Marked in Gray)

May 26, 2022	Draft Action Plan is published online		
June 7 – 9, 2022	Presentation at MAFMC Meeting		
June 28 – 30, 2022	Presentation at NEFMC		
August 1 – 4, 2022	Presentation at ASMFC Summer Meeting		
September 2022	Finalized Action Plan is published online		
September 27 – 29, 2022	NEFMC 2023 Priorities Setting Process Begins		
October 4 – 6, 2022	Initial MAFMC Discussion of 2023 Implementation Plan		
December 6 – 8, 2022	NEFMC 2023 Priorities Set		
December 12 – 15, 2022	MAFMC 2023 Implementation Plan Finalized		
If Councils develop action under MSA		**If NMFS develops action under ESA**	
January – April 2023	Council Action Development - Background Work	January – November 2023	NMFS Develops Proposed Rule*
April – September 2023	Council Action Development and Final Action	November 2023	Proposed Rule Published; 30-day public comment period
December 2023	Council Submission of Action	January – March 2024	NMFS Develops Final Rule
January – February 2024	NMFS Review and Publication of Proposed Rule	March – May 2024	NMFS publishes Final Rule and Implementation
March – May 2024	NMFS publishes Final Rule and Implementation		

*Proposed rule development would include consultation with the Council, with a comment period that overlaps with December Council meetings.

Actions to Address Post Release Mortality from Gillnet Gear

December 31, 2023	NMFS-led identification of the specific steps needed to acquire additional information to inform post-release mortality. Identify the steps and the participants needed to achieve each objective as well as the organization lead for each step (e.g., NMFS, NEFMC, MAFMC, ASMFC).
January 1, 2024 – December 31, 2025	Councils, ASMFC, and NMFS carry out steps to meet the three objectives appropriate to their authorities with regard to funding, permitting, and information gathering. NMFS will produce technical guidelines for NEFOP observers to make and record visual assessments of each Atlantic sturgeon captured in gillnet gear and released alive, and which will provide NMFS approach for assigning the likelihood of post-release mortality to each sturgeon based on the NEFOP observers' visual assessment. Other: NMFS will provide an update on the progress made for each objective to the public as appropriate via normally scheduled meetings of the Councils and the ASMFC and other available means.
December 31, 2026	Other steps deemed necessary to meet Objective 2 and Objective 3 are completed by this time even if the research conducted for Objective 2 to better inform post-release mortality is on-going and/or the final results have not yet been published.

Concurrent Initiatives

There are several ongoing initiatives that are likely to result in regulatory changes for Federal large mesh gillnet fisheries. The status and likely impact of these initiatives should be considered during the development of measures intended to reduce Atlantic sturgeon bycatch. At a minimum, the Councils and NMFS should ensure that staff or other representatives are designated to participate in these initiatives, coordinate between them with frequent progress updates, and ensure that proposed regulatory measures from these initiatives are developed with consideration of the progression of measures designed to mitigate Atlantic sturgeon bycatch, and vice versa.

Framework Adjustment 13 to the Monkfish FMP

The New England Fishery Management Council is currently developing Framework Adjustment 13 to the Monkfish FMP, which may include:

- Specifications for fishing years 2023 through 2025;
- Revisions to effort controls, including DAS allocations, possession limits, and the DAS overage provision; and
- Increase of the minimum mesh size for monkfish gillnets from 10 inches to 11 or 12 inches.

Of these, both the revisions to effort controls and the increase in minimum mesh size for monkfish gillnets have the potential to affect fishing behavior and effort, and thus the degree of Atlantic sturgeon bycatch in the monkfish fishery.

The potential revisions to effort controls, particularly increases to possession limits and modifications to the DAS overage provision, allow increased flexibility for vessels to land greater amounts of monkfish on relatively short trips, potentially increasing efficiency in the fleet. If this is the case, it is possible that vessels may be more selective about when, where, and how often they fish, potentially reducing overall fishing effort. However, monkfish vessels remain eligible to leave gillnet gear at sea. As such, reductions in DAS usage and overall trip count affect the amount of time that a vessel is on the water, and do not necessarily result in reductions in soak time that might be necessary to address bycatch of Atlantic sturgeon.

Framework 13 may potentially increase the minimum mesh size for gillnet vessels on a monkfish DAS from 10 inches to 11 or 12 inches. This regulatory change is not expected to affect rates of Atlantic sturgeon bycatch, because much of the monkfish gillnet fleet already uses 12-inch mesh. Rationale put forth by the New England Fishery Management Council in exploring this adjustment recognizes that 12-inch mesh is the norm in the fishery. In addition, the bycatch reduction studies by He and Fox cited extensively in this Action Plan assumed 12 inches was the standard mesh size in the fishery.

Though the ASBWG notes concerns expressed by the Councils and public regarding the potential concurrent development of this minimum mesh size adjustment and any measures that might require the use of a low profile gillnet design, it concludes that these two measures do not necessarily conflict. As currently proposed by the New England Fishery Management Council in its development of Framework 13, implementation of the minimum mesh size adjustment would be delayed two years after the publication of the final rule implementing the action in order to allow the industry time to adapt and come into compliance to changing requirements. This would be to fishing year 2025 (May 1, 2025) under the current schedule. The timeline laid out in this Action Plan, as required by the May 27, 2021, Biological Opinion, would result in measures implemented to reduce bycatch of Atlantic sturgeon in Federal large mesh gillnet fisheries by 2024, the fishing year prior. Any industry member that needs to adjust their net to follow low profile net requirements (if adopted in an action based on the action plan) would need to do so at some point in 2024, before any necessary adjustments to a 12-inch minimum mesh size requirement. Any of the low profile gillnet designs explored in this Action Plan would meet a 12-inch minimum mesh size requirement, so these industry members would not need to further adjust their nets to comply with the 12-inch minimum mesh requirement.

Additionally, the minimum mesh size adjustment included in Framework 13 would be required for all monkfish trips fishing under monkfish DAS regardless of area fished. Portions of the fishery receive exemptions from this baseline requirement which allow smaller mesh; this would not be altered by Framework 13 and these vessels would not need to modify their net due to a final rule for Framework 13. The scope of measures that might eventually be developed to require the use of a low profile gillnet design, may range from the entire fishery to more discrete requirements in certain areas and times. If a spatially or temporally discrete low profile net requirement is pursued by the Council or NMFS, then these requirements would not necessarily negate or conflict with the Council identified need for a baseline 12-inch minimum mesh size requirement across the fishery. It would not be appropriate to assume that the minimum mesh size adjustment in Framework 13 is moot given the recommendations of the Action Plan.

Atlantic Large Whale Take Reduction Team

The Atlantic Large Whale Take Reduction Team (Team) will be meeting this fall to develop recommendations on further risk reduction measures in the gillnet and trap pot fisheries that are regulated under the Atlantic Large Whale Take Reduction Plan (Plan). Some of the measures that may be considered in the next phase of rulemaking include closed areas, weak rope, and changes to gear configurations. A proposed rule is anticipated in 2023.

The membership of the Team and Take Reduction Plan process provide ample opportunities for ensuring that the sturgeon measures are fully considered during development of measures to address large whale interactions. The Team consists of industry representatives, environmental organizations, academics, and fishery and protected species managers. This includes management representatives from every coastal state, primarily from the same agencies with seats on the Councils and Commission, and representatives from the Councils and Commission. Each Team member has the opportunity to review the best available science, request additional information, and actively participate in the development of the recommended management measures. They also each have a vote as the Team works towards consensus on recommendations to NMFS. Additionally, NMFS regularly presents to the Councils and the Commission, particularly during public comment and scoping periods, to ensure the Councils and Commission have the opportunity to provide input. Internally, NMFS staff involved in marine mammal, sturgeon, and sea turtle management meet monthly to discuss potential for collateral benefits or harm caused by management measures under development.

Conclusion

In this Action Plan, the ASBWG presents a review of available information on Atlantic sturgeon bycatch in the federal large mesh gillnet fisheries and several conclusions drawn from that review. Using these conclusions, we recommend consideration of the following measures which could be implemented in the Greater Atlantic Region to comply with the requirements of the Opinion. These include:

- Gear modifications and a requirements for vessels fishing with gillnet to used low-profile gear shown to reduce catch of Atlantic sturgeon;
- Consideration of small time/area measures in areas where observer data has shown greater bycatch of Atlantic sturgeon, in particular restricted gear areas which require previously mentioned gear modifications; and
- Measures that could reduce soak time for gillnet gear.

In addition, the Action Plan identifies research needs and a process to develop technical guidelines for assessing post-release mortality of Atlantic sturgeon captured in gillnet gear.

NMFS and the ASBWG intends that this Action Plan provides the foundation for collaborative work between NMFS, the Councils, and the Commission to reduce the impact of gillnet fisheries on Atlantic sturgeon, an endangered species. The Action Plan does not prescribe the measures that must be used, but provides recommendations based on the information considered by the ASBWG on Atlantic sturgeon bycatch. The New England and/or Mid-Atlantic Fishery Management Councils can use the recommendations in this Action Plan to begin further exploration and development of measures which address Atlantic sturgeon bycatch by 2024 while accommodating the needs of the federal gillnet fisheries.

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Appendix I. Additional Information on Soak Time

The Action Plan describes several tables which were developed to further explore soak time by fishery and area. Only a few tables were included in the main document for brevity, but the remainder are included here to provide more information. Asterisks indicate data hidden to comply with confidentiality rules.

Table 8.3: Soak time duration by season (Fall: October – December, Spring: April – June, Summer: July – September, and Winter: January – March). and sturgeon status for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Only uses hauls that were positive for sturgeon.

SEASON	STATUS	STURGEON	Mean Time	Median Time	Min Time	Max Time
Fall	Alive	160	33.02	24.00	0.5	168.0
	Dead	87	64.32	48.00	0.9	168.0
	Dead, Damaged	17	71.29	72.00	36.0	120.0
	Unknown	6	56.00	60.00	24.0	96.0
Spring	Alive	307	27.59	24.00	0.5	192.0
	Dead	91	61.09	48.00	4.2	264.0
	Dead, Damaged	8	62.50	60.00	24.0	96.0
	Unknown	13	58.15	24.00	12.0	120.0
Summer	Alive	14	18.65	7.95	1.0	120.0
	Dead	4	55.23	48.00	4.9	120.0
	Unknown	*	*	*	*	*
Winter	Alive	118	42.34	24.00	0.5	288.0
	Dead	22	96.64	75.00	18.0	288.0
	Dead, Damaged	15	97.60	72.00	24.0	240.0
	Unknown	*	*	*	*	*

Table 49. Soak time duration by target species and sturgeon status for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Only uses hauls that were positive for sturgeon.

TARGET1	STATUS	STURGEON	Mean Time	Median Time	Min Time	Max Time
BASS, STRIPED	Alive	30	23.07	24.00	0.9	24.0

BLUEFISH	Alive	65	22.52	24.00	0.9	36.0
	Dead	8	28.50	24.00	24.0	36.0
	Unknown	*	24.00	24.00	24.0	24.0
CROAKER, ATLANTIC	Alive	*	18.00	18.00	18.0	18.0
DOGFISH, SMOOTH	Alive	128	15.82	12.00	0.5	72.0
	Dead	20	22.45	22.95	0.9	72.0
	Unknown	*	36.00	36.00	24.0	48.0
DOGFISH, SPINY	Alive	229	27.44	24.00	0.5	192.0
	Dead	30	37.07	24.00	16.0	96.0
	Unknown	4	36.00	24.00	24.0	72.0
DRUM, BLACK	Alive	6	5.67	2.00	2.0	24.0
FLOUNDER, SUMMER (FLUKE)	Alive	10	23.49	24.00	20.0	24.0
	Dead	*	24.00	24.00	24.0	24.0
	Unknown	*	22.10	24.00	18.3	24.0
FLOUNDER, YELLOWTAIL	Alive	*	72.00	72.00	72.0	72.0
	Dead	*	72.00	72.00	72.0	72.0
GROUNDFISH, NK	Dead	*	120.00	120.00	120.0	120.0
KINGFISH, SOUTHERN	Alive	*	2.15	2.15	1.8	2.5
LOBSTER, AMERICAN	Alive	*	48.00	48.00	48.0	48.0
	Dead	*	72.00	72.00	48.0	96.0
MACKEREL, KING	Alive	*	0.60	0.60	0.6	0.6
MENHADEN, ATLANTIC	Alive	*	12.40	12.40	0.8	24.0
MONKFISH (GOOSEFISH)	Alive	73	77.97	72.00	24.0	288.0
	Dead	109	81.03	72.00	24.0	288.0
	Dead, Damaged	36	81.00	72.00	24.0	240.0
	Unknown	9	77.33	72.00	24.0	120.0
SCUP	Alive	8	24.00	24.00	24.0	24.0
SEA BASS, BLACK	Alive	*	24.00	24.00	24.0	24.0
SHAD, HICKORY	Alive	*	12.00	12.00	12.0	12.0

SHARK, SPINNER	Alive	*	3.60	3.60	3.6	3.6
SHARK, THRESHER	Alive	7	2.47	2.40	0.9	3.5
SKATE, NK	Dead	*	48.00	48.00	48.0	48.0
	Unknown	*	120.00	120.00	120.0	120.0
SKATE, WINTER (BIG)	Alive	29	73.52	72.00	20.0	168.0
	Dead	30	80.80	72.00	24.0	168.0
	Dead, Damaged	4	65.00	60.00	48.0	92.0
	Unknown	*	66.00	66.00	12.0	120.0
SPOT	Alive	*	24.00	24.00	24.0	24.0

Table 510. Soak time duration by target species for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Uses all hauls, not just ones that were positive for sturgeon.

TARGET1	STURGEON	Mean Time	Median Time	Min Time	Max Time
BASS, STRIPED	30	11.57	2.50	0.5	72.0
BLUEFISH	74	15.97	23.60	0.5	144.0
BONITO, ATLANTIC		10.24	5.25	0.6	24.0
COD, ATLANTIC		22.10	24.00	1.2	168.0
CROAKER, ATLANTIC	*	4.36	2.30	0.5	72.0
CUTLASSFISH, ATL		1.50	1.30	0.5	5.1
DOGFISH, NK		31.61	24.00	0.5	72.0
DOGFISH, SMOOTH	150	10.94	3.30	0.5	80.0
DOGFISH, SPINY	263	23.08	24.00	0.5	480.0
DRUM, BLACK	6	19.00	24.00	2.0	24.0
FISH, NK		59.51	27.85	2.7	192.0
FLOUNDER, AMERICAN PLAICE		32.00	24.00	24.0	72.0
FLOUNDER, NK		56.79	48.00	6.0	168.0
FLOUNDER, SOUTHERN		12.08	12.00	10.0	14.2
FLOUNDER, SUMMER (FLUKE)	14	22.76	24.00	0.7	72.0

FLOUNDER, WINTER (BLACKBACK)		80.68	72.00	2.0	456.0
FLOUNDER, WITCH (GREY SOLE)		94.07	96.00	34.5	120.0
FLOUNDER, YELLOWTAIL	*	53.68	48.00	1.7	216.0
GROUNDFISH, NK	*	37.36	24.00	0.7	600.0
HADDOCK		44.58	24.00	12.0	120.0
HAKE, MIX RED/WHITE/SPOTD/SOUTHERN		24.00	24.00	24.0	24.0
HAKE, NK		19.22	24.00	11.5	24.0
HAKE, SILVER (WHITING)		65.86	24.00	19.0	134.0
HAKE, WHITE		24.63	24.00	2.3	120.0
HERRING, ATLANTIC		96.00	96.00	96.0	96.0
KINGFISH, GULF		3.87	3.85	2.0	5.6
KINGFISH, NK		6.08	2.30	0.5	24.7
KINGFISH, NORTHERN		8.28	3.50	0.7	22.8
KINGFISH, SOUTHERN	*	8.35	3.10	0.5	48.0
LOBSTER, AMERICAN	*	76.94	72.00	15.0	504.0
MACKEREL, ATLANTIC		2.10	2.10	2.0	2.2
MACKEREL, FRIGATE		0.97	1.10	0.5	1.3
MACKEREL, KING	*	3.08	2.80	0.6	9.2
MACKEREL, SPANISH		2.01	1.60	0.5	24.0
MENHADEN, ATLANTIC	*	14.85	12.00	0.5	72.0
MONKFISH (GOOSEFISH)	227	103.82	96.00	0.5	1,008.0
PERCH, WHITE		1.15	1.15	1.1	1.2
POLLOCK		22.98	21.90	0.5	240.0
RIBBONFISH, NK		0.65	0.65	0.6	0.7
SCUP	8	22.95	24.00	1.0	72.0
SEA BASS, BLACK	*	20.10	24.00	2.5	24.0
SEATROUT (WEAKFISH), SPOTD		20.52	24.00	0.5	24.0
SHAD, HICKORY	*	21.65	24.00	12.0	48.0

SHARK, ATL SHARPNOSE		4.63	2.30	0.5	24.0
SHARK, HAMMERHEAD, SCALLOPED		1.91	1.60	0.5	3.8
SHARK, NK		7.23	3.40	0.7	24.0
SHARK, SPINNER	*	8.02	4.05	0.5	18.0
SHARK, THRESHER	7	2.54	2.40	0.5	5.0
SHRIMP, NK		0.90	0.90	0.9	0.9
SKATE, LITTLE		85.33	96.00	24.0	144.0
SKATE, NK	*	83.99	72.00	12.0	528.0
SKATE, WINTER (BIG)	65	82.14	72.00	0.6	504.0
SPOT	*	17.68	24.00	0.5	72.0
TAUTOG (BLACKFISH)		24.33	24.00	24.0	27.3
TUNA, LITTLE (FALSE ALBACORE)		1.71	1.20	0.5	5.6
WEAKFISH (SQUETEAGUE SEA TROUT)		17.32	18.00	0.6	24.0

Table 611. Soak time duration by target species for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Only uses hauls that were positive for sturgeon.

TARGET1	STURGEON	Mean Time	Median Time	Min Time	Max Time
BASS, STRIPED	30	23.07	24.00	0.9	24.0
BLUEFISH	74	23.19	24.00	0.9	36.0
CROAKER, ATLANTIC	*	18.00	18.00	18.0	18.0
DOGFISH, SMOOTH	150	16.97	15.70	0.5	72.0
DOGFISH, SPINY	263	28.67	24.00	0.5	192.0
DRUM, BLACK	6	5.67	2.00	2.0	24.0
FLOUNDER, SUMMER (FLUKE)	14	23.23	24.00	18.3	24.0
FLOUNDER, YELLOWTAIL	*	72.00	72.00	72.0	72.0
GROUNDFISH, NK	*	120.00	120.00	120.0	120.0
KINGFISH, SOUTHERN	*	2.15	2.15	1.8	2.5
LOBSTER, AMERICAN	*	64.00	48.00	48.0	96.0
MACKEREL, KING	*	0.60	0.60	0.6	0.6
MENHADEN, ATLANTIC	*	12.40	12.40	0.8	24.0
MONKFISH (GOOSEFISH)	227	79.90	72.00	24.0	288.0
SCUP	8	24.00	24.00	24.0	24.0
SEA BASS, BLACK	*	24.00	24.00	24.0	24.0
SHAD, HICKORY	*	12.00	12.00	12.0	12.0
SHARK, SPINNER	*	3.60	3.60	3.6	3.6
SHARK, THRESHER	7	2.47	2.40	0.9	3.5
SKATE, NK	*	72.00	48.00	48.0	120.0
SKATE, WINTER (BIG)	65	76.12	72.00	12.0	168.0
SPOT	*	24.00	24.00	24.0	24.0

Table 12.7 Soak time duration by target species for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Compares Only hauls that were positive for sturgeon to all hauls. Only includes targeted species that encountered sturgeon on 10 or more hauls.

TARGET1	STURGEON	Sturgeon - Mean Time	Sturgeon - Median Time	Sturgeon - Min Time	Sturgeon - Max Time	All - Mean Time	All - Median Time	All - Min Time	All - Max Time
BASS, STRIPED	30	23.07	24.0	0.9	24	11.57	2.5	0.5	72
BLUEFISH	74	23.19	24.0	0.9	36	15.97	23.6	0.5	144
DOGFISH, SMOOTH	150	16.97	15.7	0.5	72	10.94	3.3	0.5	80
DOGFISH, SPINY	263	28.67	24.0	0.5	192	23.08	24.0	0.5	480
FLOUNDER, SUMMER (FLUKE)	14	23.23	24.0	18.3	24	22.76	24.0	0.7	72
MONKFISH (GOOSEFISH)	227	79.90	72.0	24.0	288	103.82	96.0	0.5	1,008
SKATE, WINTER (BIG)	65	76.12	72.0	12.0	168	82.14	72.0	0.6	504

Table 813. Soak time duration by target species and area for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Uses all hauls, not just ones that were positive for sturgeon.

TARGET1	AREA	STURGEON	Mean Time	Median Time	Min Time	Max Time
BASS, STRIPED	611		3.33	3.25	0.6	7.6
	612		0.84	0.50	0.5	2.3
	613	*	3.85	1.00	0.5	24.0
	621		10.02	1.40	0.5	24.0
	625	29	27.99	24.00	19.3	72.0
	631		33.45	24.00	0.9	72.0
BLUEFISH	537		12.00	12.00	12.0	12.0

	539	*	23.85	24.00	2.0	144.0
	611		16.05	13.50	5.2	48.0
	612	59	15.30	17.50	0.5	36.0
	613		8.60	1.20	0.5	24.0
	614	*	2.65	0.85	0.5	24.0
	615	4	3.27	1.00	0.5	24.0
	621		3.54	1.35	0.5	24.0
	625	*	24.00	24.00	24.0	24.0
	631		1.08	0.90	0.5	2.0
	632		1.11	1.10	0.5	2.1
	635	5	10.97	12.90	0.5	24.0
	636		1.39	1.30	0.5	3.7
	701		1.15	1.15	0.9	1.4
BONITO, ATLANTIC	539		12.64	6.50	2.7	24.0
	614		0.75	0.75	0.7	0.8
	615		0.90	0.90	0.6	1.2
	621		1.77	1.60	1.1	2.6
	635		1.50	1.50	1.5	1.5
COD, ATLANTIC	513		27.06	24.00	1.4	168.0
	514		19.90	21.40	1.2	72.0
	515		22.99	20.00	13.0	48.0
	521		23.81	24.00	2.0	120.0
	522		17.96	8.15	5.6	72.0
	537		23.75	24.00	2.1	48.0
	539		27.61	9.00	2.6	168.0
	561		16.11	12.50	5.7	72.0
CROAKER, ATLANTIC	614		0.78	0.80	0.5	1.1
	621		3.23	2.20	0.5	48.0

	625	*	6.14	2.90	0.5	25.3
	631		22.33	24.00	0.5	72.0
	632		3.41	3.25	0.5	8.5
	635		2.45	1.90	0.5	13.0
	636		2.43	1.80	0.5	24.0
	700		4.25	3.05	0.9	10.0
	701		0.50	0.50	0.5	0.5
	708		1.06	0.80	0.7	1.9
CUTLASSFISH, ATL	635		1.54	1.30	0.5	5.1
	636		1.31	1.25	0.5	3.1
DOGFISH, NK	513		27.43	24.00	24.0	48.0
	514		28.90	30.10	7.4	48.0
	521		1.30	0.50	0.5	2.9
	537		3.50	3.50	3.5	3.5
	539		51.50	60.00	4.0	72.0
DOGFISH, SMOOTH	539		38.84	48.00	2.2	48.0
	612	72	20.53	23.20	0.8	80.0
	614	43	1.79	1.50	0.5	24.0
	615	*	3.31	1.50	0.5	24.0
	621	27	15.36	19.80	0.8	24.0
	631		24.75	12.75	1.5	72.0
	632		1.36	1.30	0.5	3.4
	635	7	5.66	2.55	0.5	24.0
	636		1.81	1.70	0.5	3.3
DOGFISH, SPINY	512		21.23	14.25	5.1	44.1
	513		35.88	24.00	5.0	480.0
	514		38.81	24.00	0.5	330.0
	521		11.79	3.00	0.5	216.0

	522		16.83	24.00	2.5	24.0
	537		40.85	18.50	2.5	168.0
	539		23.52	21.50	6.8	72.0
	612	49	26.87	24.00	0.7	72.0
	614	18	2.08	1.40	0.5	24.0
	615	*	3.47	1.70	0.5	72.0
	621	39	26.65	24.00	0.5	168.0
	625	108	30.61	24.00	0.5	192.0
	626		40.67	24.00	0.9	96.0
	631	41	30.02	24.00	0.7	168.0
	635	5	5.06	1.90	0.5	48.0
	636		24.00	24.00	24.0	24.0
	700		16.84	18.20	1.1	24.0
	707		6.02	2.10	0.7	24.0
DRUM, BLACK	625	6	19.00	24.00	2.0	24.0
FISH, NK	513		82.16	51.40	20.0	192.0
	514		65.00	72.00	24.0	100.0
	539		24.00	24.00	24.0	24.0
	621		5.45	5.25	2.7	8.6
	625		24.33	24.00	24.0	25.0
FLOUNDER, AMERICAN PLAICE	513		24.00	24.00	24.0	24.0
	514		48.00	48.00	24.0	72.0
FLOUNDER, NK	513		54.00	60.00	24.0	96.0
	514		57.72	48.00	7.0	168.0
	635		16.29	24.00	6.0	24.0
FLOUNDER, SOUTHERN	635		14.00	14.00	14.0	14.0
	700		12.30	12.00	10.5	14.2
	701		10.00	10.00	10.0	10.0
FLOUNDER, SUMMER (FLUKE)	537		24.00	24.00	24.0	24.0

	538	*	48.00	48.00	24.0	72.0
	539	13	22.46	24.00	2.6	72.0
	611		1.22	1.25	0.7	1.8
	613		24.00	24.00	24.0	24.0
FLOUNDER, WINTER (BLACKBACK)	513		72.00	72.00	72.0	72.0
	514		81.40	72.00	4.8	456.0
	521		2.00	2.00	2.0	2.0
	537		12.00	12.00	12.0	12.0
	539		109.78	110.10	50.9	168.0
FLOUNDER, WITCH (GREY SOLE)	513		34.50	34.50	34.5	34.5
	514		104.00	108.00	72.0	120.0
FLOUNDER, YELLOWTAIL	513		51.43	48.00	24.0	96.0
	514	*	53.74	48.00	1.7	216.0
GROUNDFISH, NK	513		42.03	24.00	3.5	600.0
	514	*	52.59	48.00	2.2	200.0
	515		16.95	15.00	2.0	96.0
	521		28.75	24.00	0.7	360.0
	522		24.89	21.20	12.1	70.4
	561		8.41	9.95	2.7	11.3
HADDOCK	513		43.54	48.00	12.4	96.0
	514		50.00	24.00	12.0	120.0
	521		21.60	24.00	18.0	24.0
HAKE, MIX RED/WHITE/SPOTD/SOUTHERN	513		24.00	24.00	24.0	24.0
HAKE, NK	513		24.00	24.00	24.0	24.0
	515		12.05	12.05	11.5	12.6
HAKE, SILVER (WHITING)	514		22.75	24.00	19.0	24.0
	515		123.33	119.00	117.0	134.0
HAKE, WHITE	464		21.72	18.70	12.6	33.6

	513		27.98	24.00	9.5	120.0
	514		33.37	24.00	11.7	48.0
	515		17.62	16.10	2.3	43.1
	521		20.23	19.05	16.2	28.0
HERRING, ATLANTIC	513		96.00	96.00	96.0	96.0
KINGFISH, GULF	635		3.87	3.85	2.0	5.6
KINGFISH, NK	625		24.00	24.00	24.0	24.0
	631		19.00	19.00	19.0	19.0
	635		4.93	2.20	0.5	24.0
	700		11.78	15.70	0.5	24.7
	701		1.38	1.40	0.5	2.8
	707		3.43	1.40	0.8	16.6
	708		14.80	14.80	14.8	14.8
KINGFISH, NORTHERN	635		8.28	3.50	0.7	22.8
KINGFISH, SOUTHERN	621	*	1.46	1.10	0.5	5.4
	625		21.00	24.00	0.9	48.0
	631		20.75	20.50	18.0	24.0
	635	*	4.55	2.50	0.5	24.0
	700		19.20	20.00	0.9	24.0
	701		3.71	1.55	0.5	15.0
	702		1.10	1.10	0.8	1.4
	707		24.00	24.00	24.0	24.0
	708		24.00	24.00	24.0	24.0
LOBSTER, AMERICAN	513		62.41	48.00	15.0	120.0
	514	*	66.68	72.00	24.0	120.0
	521	*	151.10	120.00	24.0	504.0
MACKEREL, ATLANTIC	635		2.10	2.10	2.0	2.2
MACKEREL, FRIGATE	614		0.50	0.50	0.5	0.5

	615		1.20	1.20	1.1	1.3
MACKEREL, KING	635	*	3.08	2.80	0.6	9.2
MACKEREL, SPANISH	614		0.60	0.60	0.6	0.6
	625		4.10	4.30	1.3	7.9
	631		1.19	0.90	0.5	3.4
	635		2.01	1.70	0.5	24.0
	700		5.03	4.55	0.6	11.6
	701		1.60	1.25	0.5	5.1
	708		1.13	1.05	0.8	1.7
MENHADEN, ATLANTIC	611		72.00	72.00	72.0	72.0
	612	*	4.47	0.65	0.5	40.0
	614		0.70	0.60	0.5	1.9
	621		2.20	1.20	0.5	24.0
	625		25.59	24.00	0.6	72.0
	631	*	26.77	24.00	20.4	48.0
	635		12.74	12.00	0.6	24.0
	702		3.40	3.40	3.4	3.4
MONKFISH (GOOSEFISH)	464		15.80	15.80	15.8	15.8
	512		47.11	47.40	38.0	55.5
	513	*	129.20	120.00	12.0	1,008.0
	514	19	86.19	72.00	3.3	480.0
	515		157.09	120.00	8.4	1,008.0
	521	*	100.79	96.00	4.0	336.0
	522		139.03	144.00	8.6	226.5
	526	*	126.24	132.00	48.0	288.0
	537	22	127.53	120.00	0.5	720.0
	538		120.00	120.00	120.0	120.0
	539	10	87.57	72.00	9.0	240.0
	612	66	79.82	72.00	0.9	264.0

	613	34	86.44	72.00	1.3	336.0
	614	5	57.60	48.00	48.0	72.0
	615	51	69.53	72.00	0.7	216.0
	616	*	91.47	96.00	6.0	288.0
	621	*	73.84	72.00	24.0	168.0
	622	*	78.00	72.00	72.0	96.0
	625	*	52.75	48.00	18.0	72.0
	626	9	63.84	48.00	18.2	192.0
	635		21.00	21.00	21.0	21.0
PERCH, WHITE	621		1.15	1.15	1.1	1.2
POLLOCK	464		19.32	16.70	9.6	47.9
	513		25.62	24.00	0.9	144.0
	514		24.49	24.00	1.9	96.0
	515		19.93	18.00	0.5	240.0
	521		21.93	24.00	4.0	72.0
	522		14.04	14.30	7.0	21.2
	561		16.20	16.60	13.5	18.5
RIBBONFISH, NK	635		0.65	0.65	0.6	0.7
SCUP	538		24.00	24.00	24.0	24.0
	539	8	23.16	24.00	3.0	72.0
	615		1.25	1.25	1.0	1.5
SEA BASS, BLACK	538	*	24.00	24.00	24.0	24.0
	539		19.75	24.00	2.5	24.0
SEATROUT (WEAKFISH), SPOTD	625		24.00	24.00	24.0	24.0
	635		21.04	24.00	0.5	24.0
	700		8.30	8.40	8.1	8.4
SHAD, HICKORY	635	*	21.65	24.00	12.0	48.0
SHARK, ATL SHARPNOSE	614		1.38	1.35	0.5	2.5
	635		4.40	2.30	0.5	18.7

	701		9.32	4.60	1.2	24.0
	702		1.95	1.90	0.7	3.6
SHARK, HAMMERHEAD, SCALLOPED	635		1.91	1.60	0.5	3.8
SHARK, NK	614		1.17	1.00	0.9	1.6
	615		0.80	0.80	0.8	0.8
	625		24.00	24.00	24.0	24.0
	635		6.92	3.30	0.7	24.0
	701		8.50	5.65	2.0	20.4
SHARK, SPINNER	614		2.47	1.00	0.5	18.0
	621	*	2.17	2.10	0.8	3.6
	635		3.52	2.70	1.7	6.7
	700		12.97	15.00	0.8	15.0
	701		14.41	15.00	1.3	17.0
SHARK, THRESHER	635	7	2.54	2.40	0.5	5.0
SHRIMP, NK	635		0.90	0.90	0.9	0.9
SKATE, LITTLE	521		24.00	24.00	24.0	24.0
	537		144.00	144.00	144.0	144.0
	613		96.00	96.00	96.0	96.0
SKATE, NK	514		48.00	48.00	48.0	48.0
	521		53.66	48.00	12.0	264.0
	522		22.20	22.20	22.2	22.2
	526		216.00	168.00	168.0	312.0
	537		125.08	96.00	24.0	528.0
	539	*	80.35	72.00	24.0	168.0
	612		60.00	60.00	48.0	72.0
	613	*	94.00	72.00	48.0	192.0
	615	*	48.00	48.00	48.0	48.0
SKATE, WINTER (BIG)	514		91.64	72.00	72.0	144.0

	521	*	60.25	48.00	0.6	360.0
	526		146.18	144.00	48.0	192.0
	537	8	131.64	120.00	9.0	504.0
	539	*	91.60	86.00	24.0	212.0
	612	25	89.34	72.00	20.0	264.0
	613		122.71	120.00	24.0	360.0
	614	7	39.80	42.00	4.1	80.0
	615	20	51.50	48.00	12.0	168.0
	621	*	96.00	96.00	96.0	96.0
	622		72.00	72.00	72.0	72.0
	625		39.00	48.00	24.0	48.0
	626		45.33	48.00	24.0	48.0
SPOT	621		5.00	2.10	1.0	11.4
	625	*	17.81	24.00	0.5	72.0
	631		22.61	24.00	0.5	25.6
	635		2.43	1.40	0.5	12.0
	700		8.34	6.30	0.5	25.2
	701		1.41	1.30	0.5	4.0
	708		1.90	1.90	1.9	1.9
TAUTOG (BLACKFISH)	539		24.33	24.00	24.0	27.3
TUNA, LITTLE (FALSE ALBACORE)	539		4.58	4.35	4.0	5.6
	612		1.52	1.65	0.8	2.0
	614		0.83	0.70	0.6	1.2
	615		1.00	1.00	0.6	1.4
	635		1.62	1.10	0.5	5.3
WEAKFISH (SQUETEAGUE SEA TROUT)	612		3.50	3.50	3.5	3.5
	625		20.12	18.20	17.3	24.0
	635		16.73	18.00	0.6	24.0

Table 914. Soak time duration by target species and area for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Only uses hauls that were positive for sturgeon.

TARGET1	AREA	STURGEON	Mean Time	Median Time	Min Time	Max Time
BASS, STRIPED	613	*	*	*	*	*
	625	29	23.84	24.00	19.3	24.0
BLUEFISH	539	*	*	*	*	*
	612	59	24.92	24.00	18.0	36.0
	614	*	*	*	*	*
	615	4	18.23	24.00	0.9	24.0
	625	*	*	*	*	*
	635	5	19.40	18.00	13.0	24.0
CROAKER, ATLANTIC	625	*	*	*	*	*
DOGFISH, SMOOTH	612	72	26.68	24.00	3.6	72.0
	614	43	2.01	1.60	0.5	6.5
	615	*	*	*	*	*
	621	27	17.82	21.90	1.0	24.0
	635	7	7.36	1.40	0.7	15.7
DOGFISH, SPINY	612	49	24.00	24.00	8.3	48.0
	614	18	2.40	1.65	0.5	16.0
	615	*	*	*	*	*
	621	39	30.97	24.00	1.1	78.0
	625	108	32.86	24.00	3.2	192.0
	631	41	37.27	48.00	18.0	72.0
	635	5	1.30	1.30	0.5	2.8
DRUM, BLACK	625	6	5.67	2.00	2.0	24.0
FLOUNDER, SUMMER (FLUKE)	538	*	*	*	*	*
	539	13	23.17	24.00	18.3	24.0
FLOUNDER, YELLOWTAIL	514	*	*	*	*	*
GROUNDFISH, NK	514	*	*	*	*	*
KINGFISH, SOUTHERN	621	*	*	*	*	*

	635	*	*	*	*	*
LOBSTER, AMERICAN	514	*	*	*	*	*
	521	*	*	*	*	*
MACKEREL, KING	635	*	*	*	*	*
MENHADEN, ATLANTIC	612	*	*	*	*	*
	631	*	*	*	*	*
MONKFISH (GOOSEFISH)	513	*	*	*	*	*
	514	19	93.47	96.00	24.0	240.0
	521	*	*	*	*	*
	526	*	*	*	*	*
	537	22	129.76	108.00	48.0	288.0
	539	10	91.20	96.00	48.0	120.0
	612	66	73.27	48.00	24.0	264.0
	613	34	87.18	76.00	36.0	144.0
	614	5	57.60	48.00	48.0	72.0
	615	51	51.18	48.00	24.0	170.0
	616	*	*	*	*	*
	621	*	*	*	*	*
	622	*	*	*	*	*
	625	*	*	*	*	*
	626	9	69.33	48.00	48.0	192.0
SCUP	539	8	24.00	24.00	24.0	24.0
SEA BASS, BLACK	538	*	*	*	*	*
SHAD, HICKORY	635	*	*	*	*	*
SHARK, SPINNER	621	*	*	*	*	*
SHARK, THRESHER	635	7	2.47	2.40	0.9	3.5
SKATE, NK	539	*	*	*	*	*
	613	*	*	*	*	*
	615	*	*	*	*	*
SKATE, WINTER (BIG)	521	*	*	*	*	*

	537	8	119.50	120.00	72.0	168.0
	539	*	*	*	*	*
	612	25	95.04	96.00	48.0	168.0
	614	7	44.57	48.00	24.0	72.0
	615	20	44.80	48.00	12.0	96.0
	621	*	*	*	*	*
SPOT	625	*	*	*	*	*

Table 15.10 Soak time duration by target species for Sturgeon caught as bycatch. Hauls have a minimum duration greater than or equal to 30 minutes. Compares Only hauls that were positive for sturgeon to all hauls. Only includes targeted species that encountered sturgeon on 10 or more hauls, not areas with 10 or more sturgeon hauls.

TARGET1	AREA	STURGEON	Sturgeon - Mean Time	Sturgeon - Median Time	Sturgeon - Min Time	Sturgeon - Max Time	All - Mean Time	All - Median Time	All - Min Time	All - Max Time
BASS, STRIPED	613	*	*	*	*	*	3.85	1.00	0.5	24
	625	29	23.84	24.00	19.3	24.0	27.99	24.00	19.3	72
BLUEFISH	539	*	*	*	*	*	23.85	24.00	2.0	144
	612	59	24.92	24.00	18.0	36.0	15.30	17.50	0.5	36
	614	*	*	*	*	*	2.65	0.85	0.5	24
	615	4	18.23	24.00	0.9	24.0	3.27	1.00	0.5	24
	625	*	*	*	*	*	24.00	24.00	24.0	24
	635	5	19.40	18.00	13.0	24.0	10.97	12.90	0.5	24
DOGFISH, SMOOTH	612	72	26.68	24.00	3.6	72.0	20.53	23.20	0.8	80
	614	43	2.01	1.60	0.5	6.5	1.79	1.50	0.5	24
	615	*	*	*	*	*	3.31	1.50	0.5	24
	621	27	17.82	21.90	1.0	24.0	15.36	19.80	0.8	24
	635	7	7.36	1.40	0.7	15.7	5.66	2.55	0.5	24
DOGFISH, SPINY	612	49	24.00	24.00	8.3	48.0	26.87	24.00	0.7	72
	614	18	2.40	1.65	0.5	16.0	2.08	1.40	0.5	24
	615	*	*	*	*	*	3.47	1.70	0.5	72

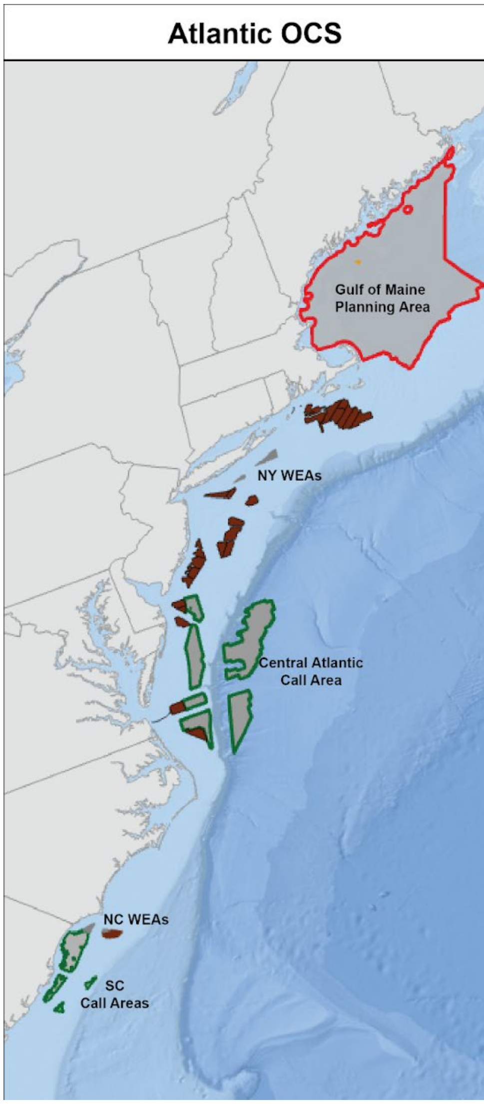
	621	39	30.97	24.00	1.1	78.0	26.65	24.00	0.5	168
	625	108	32.86	24.00	3.2	192.0	30.61	24.00	0.5	192
	631	41	37.27	48.00	18.0	72.0	30.02	24.00	0.7	168
	635	5	1.30	1.30	0.5	2.8	5.06	1.90	0.5	48
FLOUNDER, SUMMER (FLUKE)	538	*	*	*	*	*	48.00	48.00	24.0	72
	539	13	23.17	24.00	18.3	24.0	22.46	24.00	2.6	72
MONKFISH (GOOSEFISH)	513	*	*	*	*	*	129.20	120.00	12.0	1,008
	514	19	93.47	96.00	24.0	240.0	86.19	72.00	3.3	480
	521	*	*	*	*	*	100.79	96.00	4.0	336
	526	*	*	*	*	*	126.24	132.00	48.0	288
	537	22	129.76	108.00	48.0	288.0	127.53	120.00	0.5	720
	539	10	91.20	96.00	48.0	120.0	87.57	72.00	9.0	240
	612	66	73.27	48.00	24.0	264.0	79.82	72.00	0.9	264
	613	34	87.18	76.00	36.0	144.0	86.44	72.00	1.3	336
	614	5	57.60	48.00	48.0	72.0	57.60	48.00	48.0	72
	615	51	51.18	48.00	24.0	170.0	69.53	72.00	0.7	216
	616	*	*	*	*	*	91.47	96.00	6.0	288
	621	*	*	*	*	*	73.84	72.00	24.0	168
	622	*	*	*	*	*	78.00	72.00	72.0	96
	625	*	*	*	*	*	52.75	48.00	18.0	72
	626	9	69.33	48.00	48.0	192.0	63.84	48.00	18.2	192

SKATE, WINTER (BIG)	521	*	*	*	*	*	60.25	48.00	0.6	360
	537	8	119.50	120.00	72.0	168.0	131.64	120.00	9.0	504
	539	*	*	*	*	*	91.60	86.00	24.0	212
	612	25	95.04	96.00	48.0	168.0	89.34	72.00	20.0	264
	614	7	44.57	48.00	24.0	72.0	39.80	42.00	4.1	80
	615	20	44.80	48.00	12.0	96.0	51.50	48.00	12.0	168
	621	*	*	*	*	*	96.00	96.00	96.0	96

Table 1115. Number of positive sturgeon hauls per area by target species. Only includes targeted species that encountered sturgeon on 10 or more hauls.

TARGET1	513	514	521	526	537	538	539	612	613	614	615	616	621	622	625	626	631	635
BASS, STRIPED									*						29			
BLUEFISH							*	59		*	4				*			5
DOGFISH, SMOOTH								72		43	*		27					7
DOGFISH, SPINY								49		18	*		39		108		41	5
FLOUNDER, SUMMER (FLUKE)						*	13											
MONKFISH (GOOSEFISH)	*	19	*	*	22		10	66	34	5	51	*	*	*	*	9		
SKATE, WINTER (BIG)			*		8		*	25		7	20		*					

Appendix II. Wind Energy Development in the Region



Map Legend

Lease Areas
Call Areas
Proposed Lease Sale
Planning Areas

U.S. Wind Development Footprint

Planning Stage	Wind area	Acres
Atlantic OCS		
Projects Approved	Vineyard Wind, South Fork Wind	79,000
Lease Areas	17 Lease Areas	2,349,128
Wind Energy Areas	New York WEA (Fairways) North Carolina WEA	112,000 185,014
Call Areas	Central Atlantic Call Area South Carolina Call Areas	4,027,208 853,769
Planning Areas	Gulf of Maine Planning Area	14,820,000
Total Atlantic OCS Acres		**22,426,119**

Figure 4. Current Wind Energy Development Footprint in the Atlantic.

Several stages of wind energy development are underway in the Greater Atlantic Region. Call and Planning Areas represent the earliest stage of development, wherein preliminary environmental analysis and public calls for information about the areas occur. Lease areas are those which are finalized for auction.

Wind energy infrastructure is either in very early stages of construction or has not been constructed in any of these areas at this point in time, and particular configurations of individual wind projects shift as development occurs, making specific conclusions about their impact on Atlantic sturgeon bycatch difficult to derive.

Appendix III. Public Comment on Draft Action Plan

Opportunities for Public Comment

The draft version of this Action Plan was released on May 26, 2022 and several opportunities for public comment were subsequently provided. A bulletin was issued and an alert was distributed via email to announce the release of the draft, explain its contents, and communicate how the public may comment. Written comments were accepted via email or through a Google Form that was created to allow for anonymous comment. Verbal comments were heard during a series of presentations provided to the following:

- Monkfish Committee Meeting, May 26, 2022;
- Groundfish Advisory Panel, June 2, 2022;
- Mid-Atlantic Fishery Management Council Meeting, June 8, 2022;
- Groundfish Committee Meeting, June 14, 2022;
- New England Fishery Management Council Meeting, June 30, 2022; and
- Atlantic States Marine Fisheries Commission, August 3, 2022.

Description of Comments and Response

Written comments were received via email from members of the public, letters from the New England and Mid-Atlantic Fishery Management Councils. Written comment from the public comprised of:

- A suggestion to explore work by Fox and Delaware State University. The Action Plan makes extensive use of work by Fox et al., so no revisions were explored based on this comment;
- A request for more information on trawl data, which was not directly relevant to efforts to revise the Action Plan;
- An inquiry for the list of sources used in the Action Plan, which was then provided; and
- A discussion about the potential for a "baiting effect" – an attraction of Atlantic sturgeon to an area of repeated discards of dead or dying fish. The commenter noted that the diet of Atlantic sturgeon is typically focused around molluscs and small fish. Clarification on this phenomenon was also sought by the New England Fishery Management Council in their letter (described in greater detail below). We reviewed the ASMFC Special Report from 2007, where information about the baiting effect was derived, to determine if further clarification could be provided. The Special Report only notes that a baiting effect may be occurring, without any significant supporting data, and so mention of the baiting effect was removed from this final Action Plan.

Letters from the New England Fishery Management Council, Mid-Atlantic Fishery Management Council, were received on August 12, and August 16, 2022 respectively. The letter from the Mid-Atlantic Fishery Management Council concurs with the letter from the New England Fishery Management Council, which effectively captures much of the verbal comment received during the presentation delivered to it on June 30, 2022. These comments are summarized in Table 16. below. The ASMFC did not provide written comment via a formal letter, but communicated via email and phone that it reiterated concerns verbally delivered during its summer meeting. These concerns were also captured by the letter from the New England Fishery Management Council and are addressed in Table 16 below.

Table 16. Summary of Council and Commission Comments and Responses

Comment	Response
The Action Plan should clarify the status of the Biological Opinion, given ongoing litigation.	Comment on this matter in this Action Plan would not be appropriate given the likelihood that the details of this situation could change, rendering such comment outdated and/or inaccurate. Given the timeframe in the Biological Opinion, it is prudent to continue making progress towards meeting the RPM for development of the Action Plan and implementation of measures to reduce bycatch of Atlantic sturgeon.
The potential for interaction between the Action Plan and the Phase 2 measures of the Large Whale Take Reduction Team is concerning, and a coordinated approach to managing this is recommended	This was a common concern expressed by the public; the section regarding concurrent initiatives was added in response.
The Action Plan should clarify how how other measures that require gear modification or closures to large mesh gillnets, specifically referencing the Harbor Porpoise Take Reduction Plan were considered.	Existence of these measures was briefly noted in the draft Action Plan, but were not explicitly discussed. The ASBWG did not conduct any extensive analysis to reframe its recommendations in light of this comment, but this final Action Plan includes discussion of Harbor Porpoise Take Reduction Plan measures where relevant.
More information about the data used in the plan should be included, at a minimumto include details on how to acquire some of the information used by the ASBWG.	For technical documents which may be difficult to find, the ASBWG added links or other guidance to allow readers to locate source information. In addition, more information was provided regarding the Observer Database used to draw many of the conclusions in the Action Plan.
Large mesh gillnet should be more clearly defined to eliminate confusion based on other definitions which reference mesh size.	The Action Plan defines large mesh as greater than or equal to 7 inches, and that as part of this, fisheries operating in certain fishery programs using mesh sizes that fit this definition were considered (e.g. the “Large Mesh DAS Program”).
The Action Plan should clarify whether it is recommending that the Councils consider measures to reduce bycatch of sturgeon in gillnets using less than 7 inch mesh	Text was added to confirm that some of the fisheries known to contribute to bycatch of Atlantic sturgeon (e.g. spiny dogfish) sometimes use gillnets with less than 7-inch mesh and could be considered by the Council for action.
Clarification is needed regarding the outcome of Fox et al. 2019	Hypotheses have been added regarding the outcome of this study in the relevant section.
The Action Plan should better identify which gear studies were technical reports and which were peer-reviewed.	Text was added to clearly label studies which were technical grant reports and which were peer reviewed works.
A table should be added to make understanding the different gear configurations used in each study easier.	This table was added to the Action Plan.

Comment	Response
The Action Plan should clarify whether the gear studies cited are applicable across other fisheries and regions, and should include information regarding the use of low-profile gear in the Northeast Multispecies fishery.	The ASBWG agrees that the available research into these gear modifications have largely focused on the gillnet fishery for monkfish and skates in the mid-Atlantic. The Action Plan did note that it was possible that there would be a need for further research that would have to be balanced with a need for swift implementation of bycatch measures. This may be one of those cases.
More information is needed on different gear configurations used in the Northeast Multispecies and other gillnet fisheries. Additionally, an error is present in the draft where stand-up and tie-down gear is described incorrectly.	More information was added where possible to the Action Plan regarding other gillnet fisheries in the Review of Available Information section, and the accidental swap of the stand up and tie-down gillnet usage was corrected.
More quantitative spatial and temporal information is needed, as well as quantitative information on soak time.	Tables containing quantitative information derived from the observer database were added to the Characteristics of Atlantic Sturgeon Bycatch section and an additional appendix to address this comment
A comparison between 12 and 13-inch mesh in the monkfish fishery is needed.	There was not sufficient time to fully explore this potential information gap, but it should be noted that, as described earlier in the Action Plan, 13-inch mesh is the preferred mesh size of the dedicated Atlantic sturgeon gillnet fishery in the Saint John River, New Brunswick. Additionally, the Action Plan is recommending adoption of a low profile gillnet design, which has many characteristics; 13-inch mesh may be among them, but the combination of height reductions brought about by a reduced number of vertical meshes and shorter, more frequent tie downs is what defines the gear. Though 13-inch mesh may show some reduction in bycatch of smaller sturgeon in comparison to 12-inch mesh, simply increasing the minimum mesh size was not the full breadth of the Action Plan's recommendation.
Additional experiments are needed to provide more precision and accuracy in determining factors influencing sturgeon bycatch rates.	It is unclear exactly what aspect of the available research this comment refers to, but the ASBWG does not disagree that further research into Atlantic sturgeon bycatch would be helpful.
The Action Plan should consider the decline in gillnet effort over time.	More information about the temporal range of observer data used was provided, but there was insufficient time to conduct a deep analysis into how declines in gillnet effort may be influencing rates of sturgeon bycatch. Bycatch of Atlantic sturgeon in the federal large mesh gillnet fisheries remains a threat to the species that must be addressed, given its identification as such in the Biological Opinion.
The impact of offshore wind energy development on gillnet effort and rates of Atlantic sturgeon bycatch should be considered.	As with the recommendation to consider the decline in gillnet effort, there was limited time to fully explore this topic. An appendix was added showing the current status of wind development in the region. The development of wind energy is changing rapidly; impacts are thus difficult to predict, and

Comment	Response
	may vary heavily depending on the exact configuration of each wind energy project.
The Action Plan should examine the Canadian gillnet fishery in the Saint John River, New Brunswick, for gear modification ideas.	Corresponding text about this fishery is available in the Characteristics of Atlantic sturgeon Bycatch in the Study Region section. Little in the way of possible gear modification was found, but this did provide context for some other aspects of the Action Plan (e.g. 12 vs 13 inch mesh size).
The Action Plan mischaracterizes the Councils role in research, and it is not clear how the Council can contribute to research objectives of the Action Plan	The Post Release Mortality section of the Action Plan has been modified to clarify that the Council will not be expected to contribute to research in ways that is inappropriate given its structure and role.

Verbal comments received and responses to them, not captured by the Council letters, are shown in Table 17 below.

Table 17. Summary of Verbal Comments Received and Responses

Comment	Response
The Action Plan should provide clearer bycatch goals, and the requirements of the RPM are unclear.	A more clear explanation, derived from the Biological Opinion and the requirementes of the RPM and ESA, was added in the Introduction Section
Why did the Action Plan not consider other sources of mortality (e.g. habitat destruction, etc.)?	The Action Plan was developed as a requirement of the Biological Opinion to specifically address Atlantic sturgeon bycatch and mortality in large mesh gillnet fisheries. Though Atlantic sturgeon are threatened by more than just the federal large mesh gillnet fishery, this Action Plan was therefore specifically written to address Atlantic sturgeon bycatch in federal large mesh gillnet gear, and thus it would be inappropriate to consider and/or make recommendations regarding other sources of mortality for Atlantic sturgeon.
Could Vessel Monitoring System (VMS) data be used in this effort?	It is possible that VMS data might have been useful to examine some aspect of the fisheries under consideration, but this was not pursued, and there was insufficient time to determine how VMS data might be useful.
The low-profile gillnet gear is ineffective or suboptimal and would fold up in bad weather.	The studies reviewed by the ASBWG indicated that the low profile gillnet design is a promising tool to reduce bycatch of Atlantic sturgeon, potentially without major negative impacts to commercial catch. It has been conceded that further work might be necessary to dial in the "optimal" configuration, but any of this work should account for the need to meet bycatch reduction goals.

Comment	Response
The low-profile gillnet gear would effectively shut down specific fisheries, particularly certain gillnet fisheries for groundfish.	This Action Plan was created as a response to an RPM of a Biological Opinion released on May 27, 2021; RPMs are those actions that the Director believes necessary or appropriate to minimize impacts. However, ESA regulations specify that these meausres involve only a minor change and be consistent with the basic design, location, scope, duration, or timing of the action. If the low-profile gillnet design completely eliminates a portion of a specific fishery, then this would likely not constitute a minor change. If considered by the Councils or NMFS, the ASBWG recommendation to use the low profile gillnet design is intended to be implemented where it will most effectively reduce bycatch of Atlantic sturgeon. I would not be intended to eliminate large portions or sectors of the gillnet fishery.