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

Produced by the Atlantic Sturgeon Bycatch Working Group
Compiled by Spencer Talmage

NOAA National Marine Fisheries Service
Greater Atlantic Regional Fisheries Office, 55 Great Republic Drive, Gloucester, MA 01930-2276

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 large mesh gillnet fisheries. This Action Plan does not prescribe the measures that must be used, but provides recommendations based on the information considered on Atlantic sturgeon bycatch. These recommendations are: 1) Requirements to use bycatch mitigating low-profile gillnet gear; 2) implementation of closure or gear restricted areas in regions where Atlantic sturgeon bycatch is more common; and 3) limitations on soak time for gillnet gear. 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.

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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 (defined here as $\geq$ 7 inches stretched) fisheries and to develop an action plan by May 27, 2022, to reduce Atlantic sturgeon bycatch in these fisheries by 2024. Additionally, the Opinion requires that the 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.

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

- Spencer Talmage, Greater Atlantic Regional Fisheries Office
- Cynthia Ferrio, Greater Atlantic Regional Fisheries Office
- Lynn Lankshear, Greater Atlantic Regional Fisheries Office
- Henry Milliken, Northeast Fisheries Science Center
- Jason Boucher, Northeast Fisheries Science Center
- Kim McKown, New York State Department of Environmental Conservation, Bureau of Marine Resources
- Heather Corbett, New Jersey Department of Environmental Protection, Marine Fisheries
- Ian Park, Delaware Division of Fish and Wildlife
- Rebecca Peters, Maine Department of Marine Resources
- Eric Schneider, Rhode Island Department of Environmental Management, Division of Marine Fisheries
- Jacque Benway, Connecticut Department of Energy and Environmental Protection, Marine Fisheries Program

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) describes regulatory measures that the New England and Mid-Atlantic Fishery Management Councils and NMFS should consider to reduce bycatch of Atlantic sturgeon by 2024; and (3) establishes a timeline for scoping and development of regulatory measures and completing or initiating work necessary to close information gaps.

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

The following is a summary of the Fishery Management Plans which 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 which 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. 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 Atlantic States Marine Fisheries Commission 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 which 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 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).

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 permit, which have a minimum mesh size of 7.5 inches diamond and 8.0 inches square in the Mid-Atlantic Regulated Mesh Area and 8.5 inches diamond and square in the Gulf of Maine, Georges Bank, and Southern New England Regulated Mesh Areas. Limits are in place regarding the number and type of nets which can be deployed, based on the area being fished.

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 Atlantic States Marine Fisheries Commission 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 regulated mesh area 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 Atlantic States Marine Fisheries Commission 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 Atlantic States Marine Fisheries Commission. 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.

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

Exemption Area	Regulated Mesh Area	Gear Requirements	Target Species	Other allowable catch	Season	Other Restrictions
Gulf of Maine (GOM)/Georges Bank (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	
Southern New England (SNE) Monkfish and Skate Gillnet Exemption	SNE	10 inch minimum diamond mesh size	Monkfish, Dogfish, Skate	Incidental species allowed in SNE Regulated Mesh Area*	Year-Round	
SNE Dogfish Gillnet Exemption	SNE	6 inch minimum diamond mesh size	Dogfish	Incidental species allowed in SNE Regulated Mesh Area*	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 Regulated Mesh Area*	Year-Round	Participating Vessels must be on a Monkfish Day-At-Sea

Existing Closure Areas and Gear Restricted Areas in Regions Used by Atlantic Sturgeon

Seasonal and year-round closures for the use of gillnet gear with ≥ 7 inches stretched mesh exist 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 and the Large-Mesh Gillnet regulations include seasonal closure areas for the use of ≥ 7 inches stretched mesh gillnet gear in 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 for additional information). 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.

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, and the 2017 Atlantic States Marine Fisheries Commission stock assessment, which is the most recent benchmark stock assessment available.

Table 1. 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

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, and available observer program data ranges from 1989 to 2020.

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

NEFOP data are fishery dependent and was 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 the Atlantic sturgeon bycatch in the study region

What fisheries and gear types most commonly interact with Atlantic sturgeon?

Fisheries which 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.

The minimum mesh size for most vessels fishing with gillnets in the Northeast multispecies fishery is 6.5 inches, though Large-mesh Individual DAS permitted vessels, which have a minimum mesh size of 8.5 inches in the Gulf of Maine, Georges Bank, and Southern New England Regulated Mesh Areas and a minimum mesh size of 8.0 inches square, 7.5 inches diamond in the Mid-Atlantic Regulated Mesh Area, also operate in the fishery. The minimum mesh size for gillnets used by vessels fishing under a monkfish DAS is 10-inch diamond mesh, unless the vessel is also fishing on a Northeast multispecies DAS or participating in certain exemption programs. There are no specific gear requirements in the Spiny Dogfish FMP, but vessels targeting spiny dogfish must abide by the requirements of the Northeast Multispecies Fishery Management Plan.

Two types of sink gillnets are used in these 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 flatfish (i.e. flounder species and tie-down gillnets for targeting roundfish (i.e. cod) species. 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).

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 to 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 and, perhaps, through a baiting effect.

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. These studies have largely focused on comparisons between stand-up and tie-down gillnets, as well as modifications to net height and tie-down length. Generally, catch rate of sturgeon did not differ between stand-up gillnets and standard 12-mesh deep tie-down gillnets; stand-up nets tend to reduce monkfish catch (He, 2006).

Fox et al. completed a series of studies (2011, 2012, 2013) 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. In these trials, the low-profile nets ranged between 6 and 8 meshes in height with 24-inch tie-downs, while commercial fishery standard nets were 12 meshes in height with 48-inch tie-downs.

Fox et al. found that the stand-up gillnet configuration reduced monkfish catch, made no difference in catch of Atlantic sturgeon, and greatly increased marine mammal catch. Levesque et al. (2016) conducted a comparison between 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.

Of the low-profile nets, Fox et al. found that the 6-mesh net reduced catch rates of both sturgeon and monkfish significantly. The 8-mesh net caught less sturgeon than the standard nets, but this difference was not significant. Sturgeon that were caught, however, were present in the upper half of nets, and so Fox et al. concluded that low profile nets were still potentially effective at reducing sturgeon bycatch.

He and Jones (2013) conducted their own comparison of the standard tie-down net to the low-profile 8-mesh net with 24-inch tie-downs. This study supported the concept that the low-profile experimental net reduced 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. There were no reductions in winter skate catch.

Fox et al. (2019) ran comparative trials of a low-profile sink-gillnet with 13-inch mesh size, 8-foot high net with 24-inch tie-downs spaced every 12 feet against an industry standard net with 12-inch mesh, 12-foot net height, with 48-inch tie-downs spaced at 24 foot intervals. The low-profile 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; catch rates by the vessel 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.

Lastly, 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 monkfish catch, an undesirable outcome for any gear measure intended to reduce sturgeon bycatch.

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 coast wide 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 Mid-Atlantic, from waters south of Cape May to the Virginia-North Carolina state line, 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. In the Mid-Atlantic, 67.2 percent of 519 individuals were considered alive, with 32.2 percent recorded as dead or dead, damaged. In the waters off of New Jersey, New York, and south of Martha's Vineyard, however, this dynamic is flipped; 53.8 percent of sturgeon were considered dead, dead, damaged, or dead, head only, while only 43.2 percent were considered alive.

It is important to note that 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. A total of 20 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 utilized 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 utilizes 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.

- Federal gillnet fisheries targeting monkfish, spiny dogfish, and Northeast multispecies with sink gillnet gear ranging from 5.5 to 10 inches in minimum mesh size requirements are primary contributors to Atlantic sturgeon bycatch. These fisheries use a mix of stand-up and tie-down gear depending on primary target species.

- 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.

- Soak time is a likely driver of Atlantic sturgeon bycatch rates and mortality, based on available research and the simple concept that time spent by fishing gear in the water strongly correlates with the chances that the gear interacts with sturgeon.

- 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. Modifications to fishing practices, and
3. Consideration of areas of focus in regions of Atlantic sturgeon bycatch.

These approaches are not mutually exclusive; some combination of these could be implemented to achieve desired 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 completely prohibits fishing from that same area or a blanket requirement for all vessels to use a low-profile gillnet in the entire region.

Additionally, 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, Atlantic States Marine Fisheries Commission, 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 a low-profile gillnet by federally-permitted commercial fishing vessels using gillnet gear while on monkfish DAS, participating in a large-mesh exemption area with a 10-inch minimum mesh size requirement, or fishing under a Northeast Multispecies DAS in the Large-Mesh DAS Program.

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; and

- Primary hanging ratio of 0.50.

The low-profile net which showed the greatest success in reducing Atlantic sturgeon bycatch while not significantly reducing monkfish catch was the one used off New Jersey 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 for a total length of 1,200 ft. This study, however, included two participants, one fishing in New York state waters, and another fishing in New Jersey waters. Though the results for the New Jersey trials were that monkfish landings in the low-profile net were not significantly different from those from the control net, the New York trials did show a statistically significant reduction in monkfish landings in the low-profile net. Landings of skate and spiny dogfish in both trials in the low-profile net were not significantly different from those in the control nets.

Continued collaborative experimentation by scientific experts and the fishing industry to identify net designs which optimize catchability of target species while retaining reduced bycatch of Atlantic sturgeon is encouraged. However, the ASBWG notes that this must be balanced by the need to implement meaningful bycatch reductions as soon as possible.

Modifications to Fishing Practices

The Councils should consider restricting the amount of soak time that nets can be deployed by federally permitted commercial fishing vessels using gillnet gear while on monkfish DAS, participating in a large-mesh exemption area with a 10-inch minimum mesh size requirement, or fishing under a Northeast Multispecies DAS in the Large-Mesh DAS Program.

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 regional differences in fishing practices and conditions. Additional work is necessary to fully characterize current practices related to soak time in order to identify opportunities to reduce soak time in areas and at times during which doing so would provide the most conservation benefit. Reductions in soak time in areas known to likely hold aggregations of Atlantic sturgeon, or areas that are migratory corridors at certain times, might be most effective.

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 utilize Bluetooth communications to easily transfer data from the systems. Additional regulatory changes which might be considered also include restricting gillnet vessels from leaving gear in the water between trips, as is currently allowed, for example, in portions of the Northeast multispecies fishery.

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 used observer data to identify areas that might be important for reducing bycatch, and 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 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. These might, for example, apply the recommended gear modifications, or soak time restrictions in locations and times which they might be most impactful.

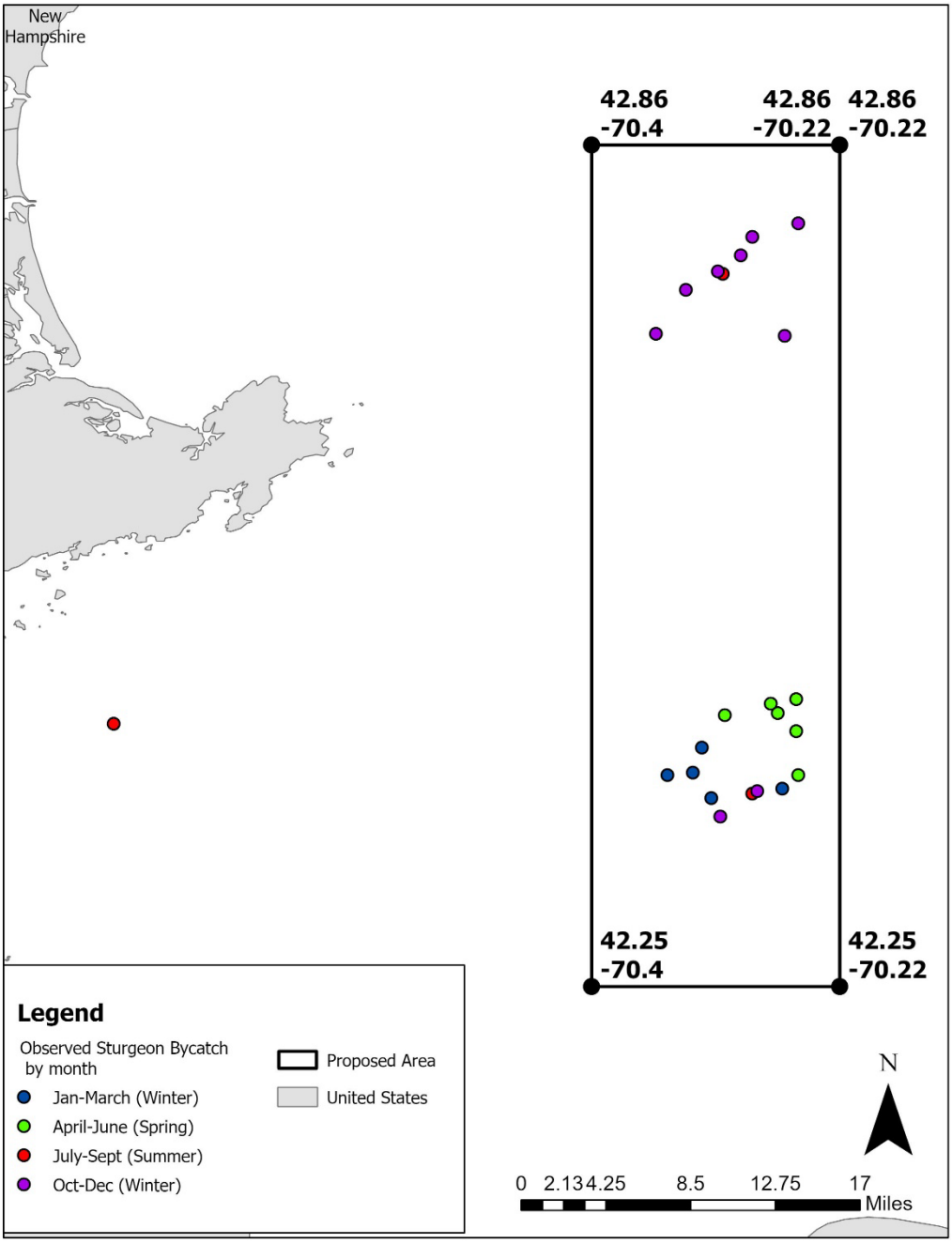
The areas of high incidence of Atlantic sturgeon bycatch, along with the observer data used to identify them, are shown in maps below. The Councils should prioritize these areas when developing measures to reduce Atlantic sturgeon bycatch in federal gillnet fisheries.

Particular areas which should be considered include:

Gulf of Maine

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.

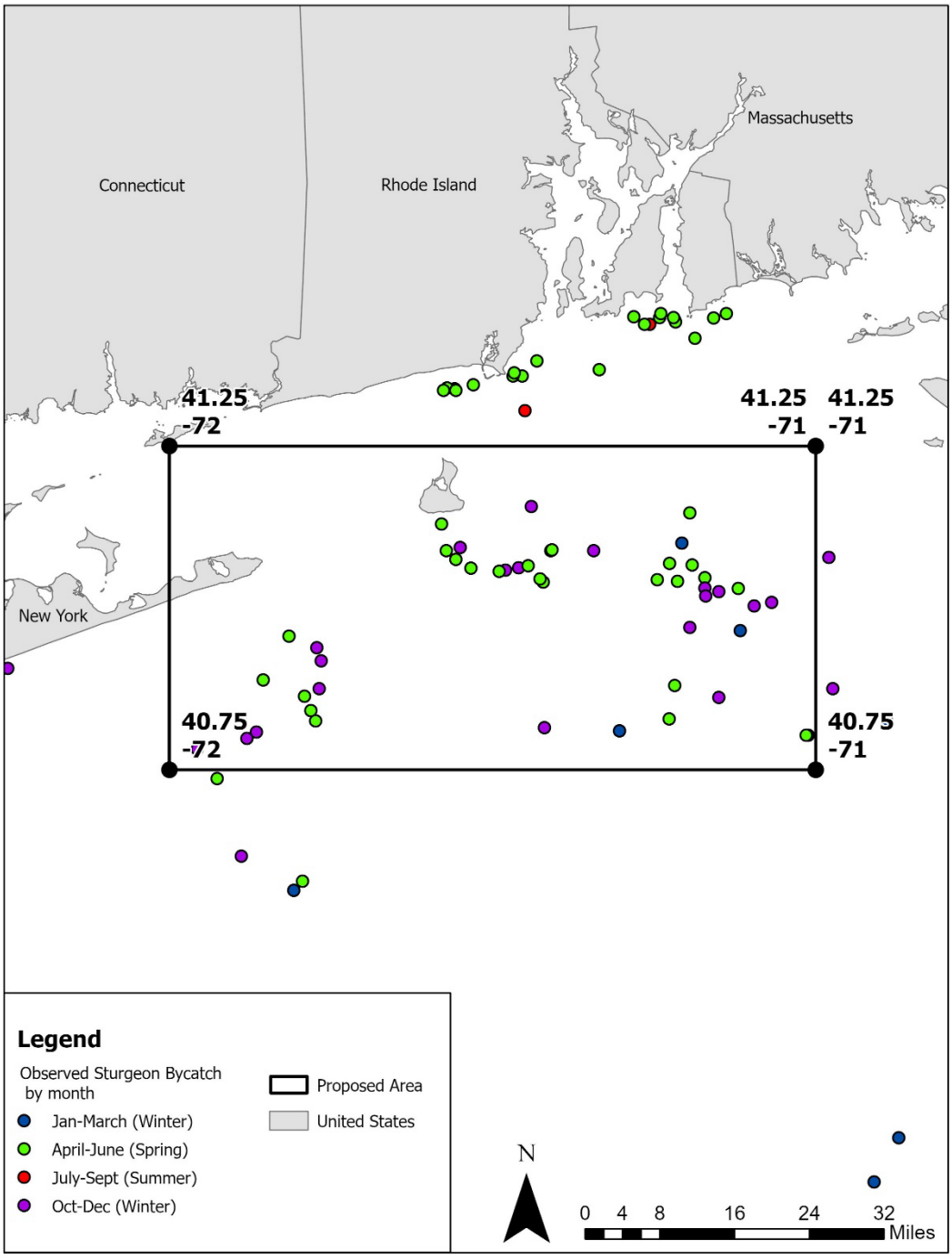
Figure 1. Area of Focus for the Gulf of Maine



Southern New England/Rhode Island/Cox's Ledge

Available observer data shows scattered interactions between Atlantic sturgeon and the gillnet fishery southwest of Martha's Vineyard, with no discernible seasonal pattern, except for interactions which occur within state waters directly off of the coast of Rhode Island, which all occurred in the month of May.

Figure 2. Area of Focus for Southern New England/Rhode Island/Cox's Ledge

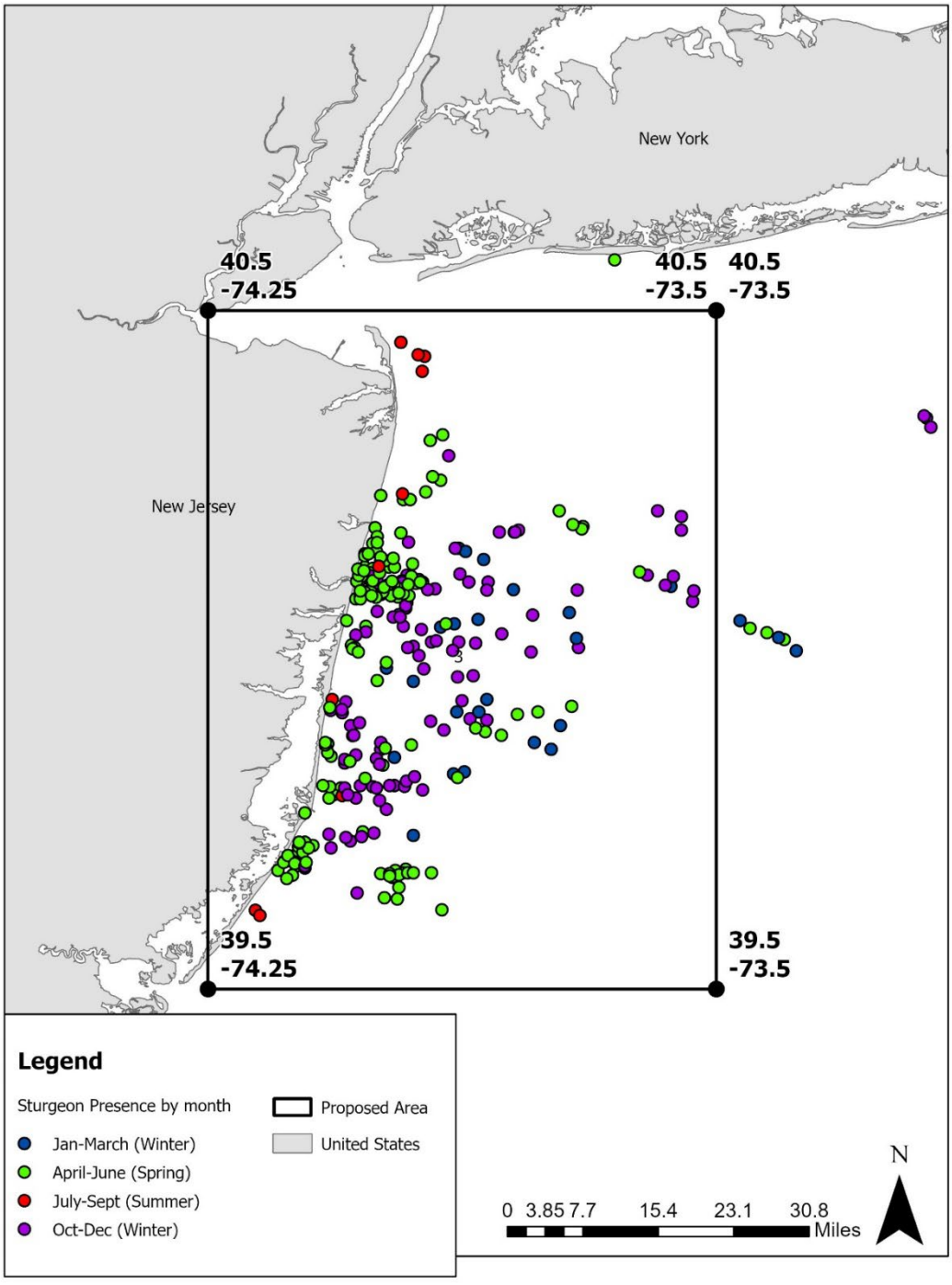


New Jersey Bight

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.

This area also includes a small (85.47 km^2) area just off of Sandy Hook, which was recommended, among others, by Dunton et al. (2010) to protect habitat and juvenile sturgeon from fishing mortality. 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 area included in this recommendation likely acts as a migratory corridor for the aggregation areas to the south.

Figure 3. Area of Focus for New Jersey Bight

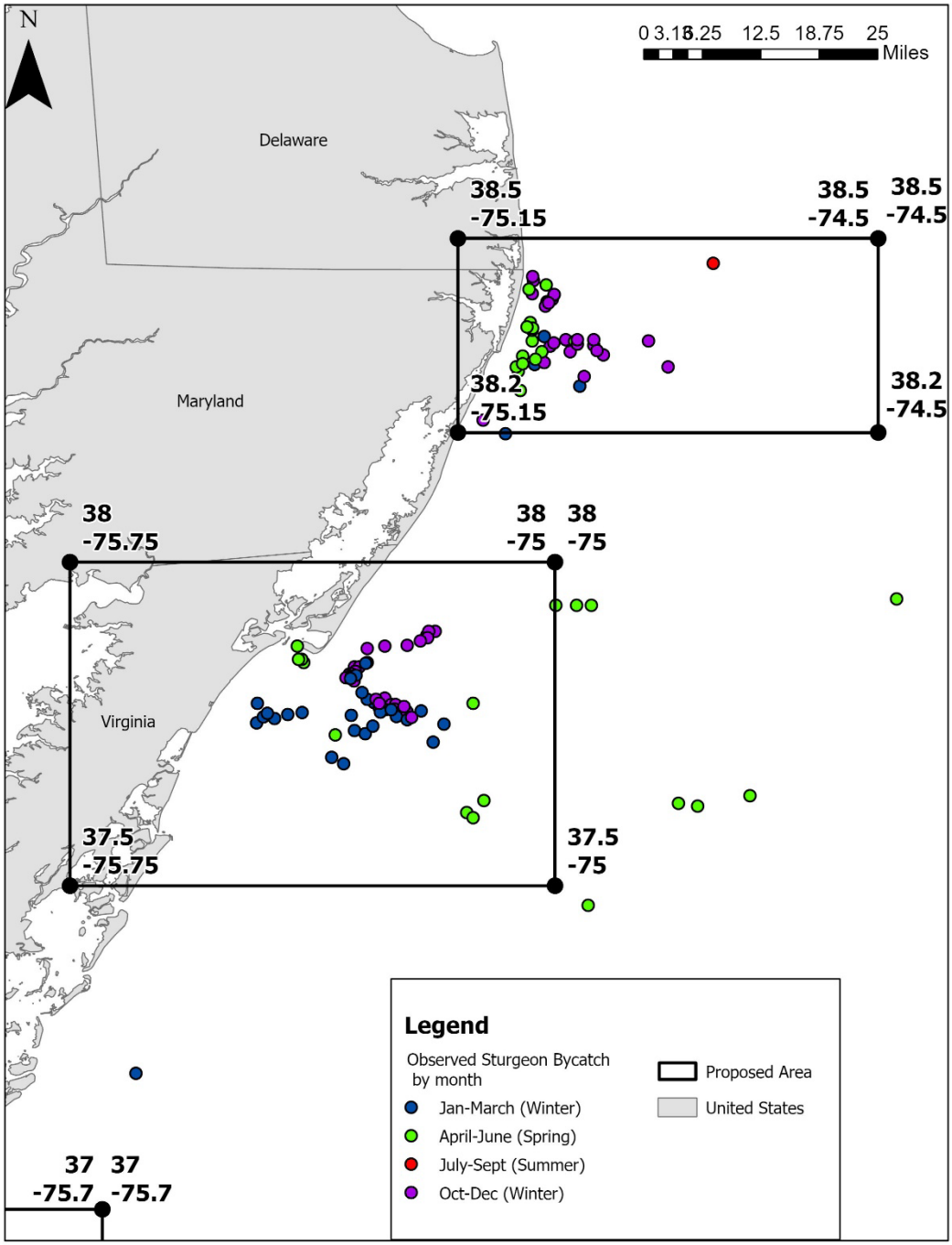


Maryland and Virginia Areas

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 of April and May and an area of interactions in farther offshore in federal waters primarily in December and January.

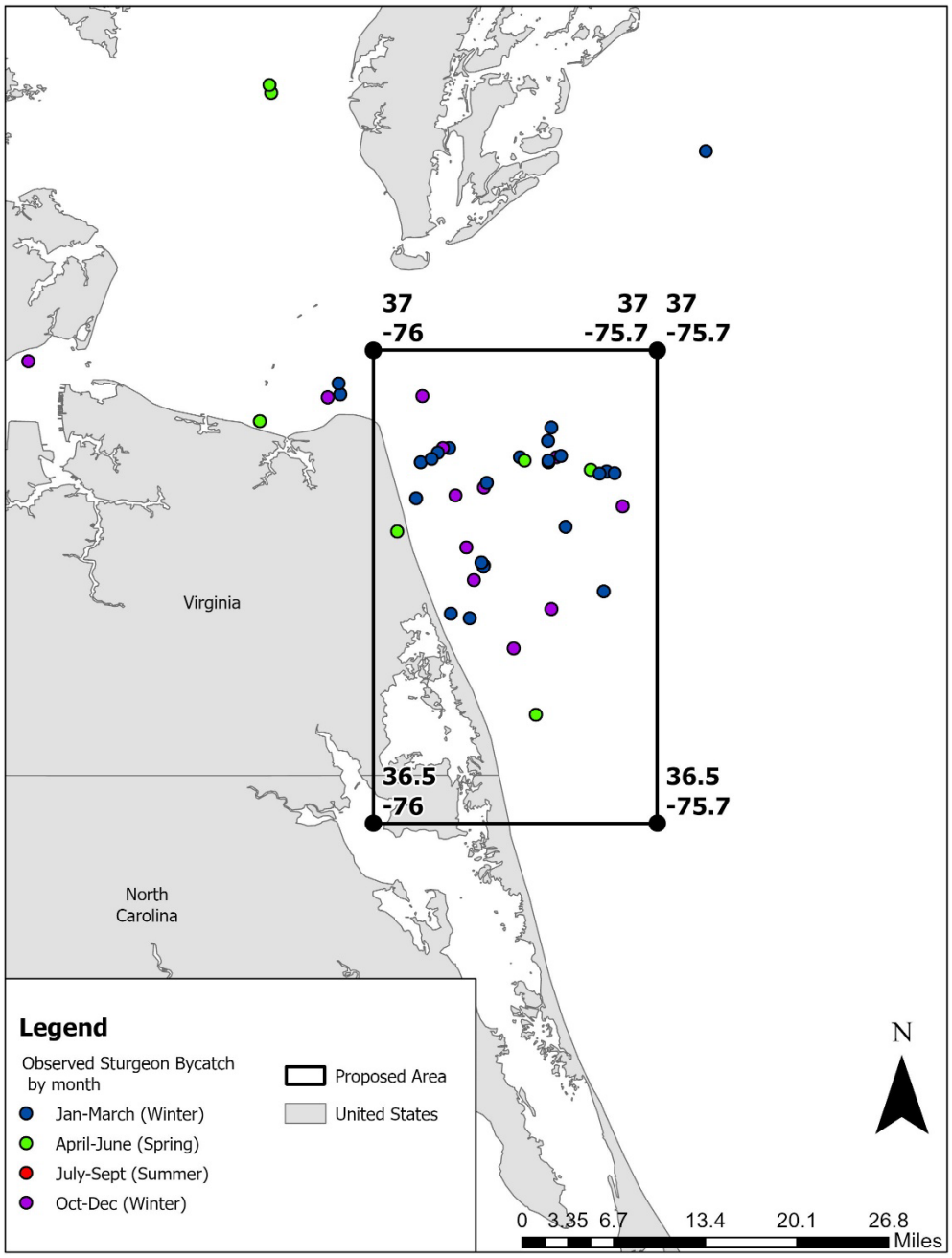
Farther south, there is a concentration of interactions east and southeast of Chincoteague, VA. The seasonal patterns in this area are less clear than those in the northernmost hotspot in this area. Though bycatch occurs most frequently in the months of April, May, January, and December, instances of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

Figure 4. Areas of Focus for Maryland and Virginia



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 5 Area of Focus South of Chesapeake Bay



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 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 just off Cape May might be appropriate; observed interactions between the gillnet fishery and Atlantic sturgeon, however, were not prevalent in this area.

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, Atlantic States Marine Fisheries Commission, 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 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 for gillnet fishermen 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 fishermen 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 work with the Councils, the Atlantic States Marine Fisheries Commission, and others, as needed, to identify steps needed to acquire additional information to inform post-release mortality and to fulfill the above objectives. 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. These steps could include a workshop, but other steps are likely required to achieve the three objectives. 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

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 – May 2024	NMFS Develops Final Rule
January – February 2024	NMFS Review and Publication of Proposed Rule	May 2024	NMFS publishes Final Rule and Implementation
March – May 2024	NMFS publishes Final Rule and Implementation		

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 using all opportunities within 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.

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:

- Requirements for vessels fishing with gillnet to used low-profile gear shown to reduce catch of Atlantic sturgeon;
- Consideration of small time/area closures in areas where observer data has shown greater bycatch of Atlantic sturgeon; and
- Restrictions on 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 as a base to begin further development and specification of

measures which address Atlantic sturgeon bycatch by 2024 while accommodating the needs of the federal gillnet fisheries.

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