NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
BIOLOGICAL OPINION

Title:	Biological Opinion on Issuing an Incidental Take Permit (File No. 27686) to the Hudson River Sloop Clearwater, Incorporated
Consultation Conducted By:	Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce
Action Agency:	Endangered Species Conservation Division, Office of Protected Resources, National Marine Fisheries Service
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1 INTRODUCTION

The Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.), establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat they depend on. Section 7(a)(2) of the ESA requires Federal agencies to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy designated critical habitat. Federal agencies must do so in consultation with the National Marine Fisheries Service (NMFS) for threatened or endangered species (ESA-listed), or designated critical habitat under NMFS' jurisdiction that may be affected by the action (50 CFR 402.14(a)). If a Federal action agency determines that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS concurs with that determination for species under NMFS' jurisdiction, consultation concludes informally (50 CFR 402.14(b)).

Section 7(b)(3) of the ESA requires that, at the conclusion of consultation, NMFS provide an opinion stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat. If NMFS determines that the action is likely to jeopardize listed species or destroy or adversely modify critical habitat, NMFS provides a reasonable and prudent alternative that allows the action to proceed in compliance with section 7(a)(2) of the ESA. If an incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts and terms and conditions to implement the reasonable and prudent measures.

The action agency for this consultation is the Endangered Species Conservation Division (ESCD) of NMFS' Office of Protected Resources (OPR) in Silver Spring, Maryland. The ESCD proposes the issuance of an Incidental Take Permit (ITP) to the Hudson River Sloop Clearwater, Incorporated (Clearwater), under section 10(a)(1)(B) of the ESA and the regulations governing the incidental taking of ESA-listed species (50 CFR 222.307). The permit would authorize the incidental capture, with some mortality, of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) Gulf of Maine (GOM), New York Bight (NYB), Chesapeake Bay (CB), Carolina (CA), and South Atlantic (SA) distinct population segments (DPS), and shortnose sturgeon (*A. brevirostrum*) associated with the otherwise lawful environmental education program conducted on the Hudson River, New York. The permit would expire 10 years after the date of issuance.

This consultation, biological opinion (opinion), and ITS, were completed per section 7(a)(2) of the statute (16 U.S.C. 1536 (a)(2)), associated implementing regulations (50 CFR 401-16), and agency policy and guidance and was conducted by NMFS OPR Endangered Species Act Interagency Cooperation Division (hereafter referred to as "we"). We prepared this opinion and ITS per section 7(b) of the ESA and implementing regulations at 50 CFR 402.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act (89 Fed. Reg. at 24268; 84 Fed. Reg. at 45015). We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations.

This document represents NMFS' opinion on the effects of these actions on incidental capture, with some mortality, of Atlantic sturgeon GOM, NYB, CB, CA, and SA DPS, and shortnose sturgeon. A complete record of this consultation is on file at the NMFS OPR in Silver Spring, Maryland.

1.1 Background

Clearwater is a privately owned company that owns and operates a 106-foot (ft) historic replica ship, the sloop *Clearwater*. Clearwater uses an otter trawl to sample fish and invertebrates in the Hudson River as part of its environmental educational program, which operates annually from April 1st to November 5th. Clearwater operates similar to a research vessel, and operators will likely be more cautious, particularly in areas where sturgeon are known to occur. The trawl occasionally results in the unintended capture of threatened and endangered Atlantic sturgeon and endangered shortnose sturgeon.

Clearwater conducts educational trawling, reaching thousands of people each year, to educate them about the ecology and history of the Hudson River through hands-on, interactive learning stations. All proposed sample sites occur within the geographic range of the ESA-listed shortnose sturgeon; Atlantic sturgeon from the GOM, NYB, and/or CB DPS; and NYB DPS Atlantic sturgeon critical habitat. The two southernmost sample sites also occur within the geographic range of green, Kemp's ridley, leatherback, and loggerhead sea turtles. Over the past 10 years, Clearwater conducted the educational trawling and captured two Atlantic sturgeon. As Clearwater's ITP expired on December 31, 2023, Clearwater determined it was necessary to apply for a renewal of the ITP per the requirements under section 10(a)(1)(B) of the ESA. The ITP would authorize a total incidental take of 10 sturgeon (any combination of Atlantic and shortnose sturgeon) throughout the 10-year permit. Up to four sturgeon of any combination of Atlantic sturgeon or shortnose sturgeon may be taken in any given year. One of the 10 takes may be lethal throughout the 10-year permit.

1.2 Consultation History

This opinion is based on information provided in the permit application, correspondence, discussions with the ESCD, previous annual reports, biological opinions and annual reports for other similar research activities for which we have conducted ESA section 7 consultations, and the best scientific and commercial data available.

Our communication with the ESCD regarding this consultation is summarized as follows:

- On October 26, 2023, a request for consultation was received.
- On February 7, 2024, consultation was initiated.
- From March 28, 2024 to April 1, 2024, the ESCD and the Endangered Species Act Interagency Cooperation Division corresponded via email to discuss the number of requested takes of sturgeon.
- On April 8, 2024, the Divisions discussed historical take versus requested take with New York State Department of Environmental Conservation (NYSDEC), and ESCD decided to proceed with requested take and reporting actions, as well as areas to avoid during July-September.
- On April 16, 2024, ESCD communicated the size, weight, and photos of the trawl net and doors via email.

2 THE ASSESSMENT FRAMEWORK

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species; or adversely modify or destroy their designated critical habitat.

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02).

"Destruction or adverse modification" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of an ESA-listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 CFR 402.02).

In order to reach our conclusions about whether the ESCD is able to insure that the issuance of this ITP is not likely to jeopardize listed species or destroy or adversely modify critical habitat, we produce a biological opinion that summarizes our risk analysis. The sections of the opinion are as follows:

Description of the Proposed Action (Section 3): We describe the activities being proposed by the action agencies, including conservation measures to reduce the effects to ESA-listed resources.

We also analyze the physical, chemical, and biological changes to land, water, and air that result from those actions.

Action Area (Section 4): We describe the action area with the spatial extent of the physical, chemical, and biological changes to land, water, and air from the action (stressors). Action area means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

Species and Critical Habitat that May Be Affected (Section 5): We identify the ESA-listed species and designated or proposed critical habitat under NMFS' jurisdiction in the action area, and which may be affected but are not likely to be adversely affected by the proposed action.

Status of Species Likely to be Adversely Affected (Section 6): We examine the status of the ESA-listed species that are likely to be adversely affected by the proposed action.

Environmental Baseline (Section 7): We describe the environmental baseline in the action area as the condition of the ESA-listed species and designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process. The impacts to ESA-listed species from Federal agency activities or existing Federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

Effects of the Action (Section 8): Effects of the action are all consequences to listed species that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02). We identify the number, age (or life stage), and gender of ESA-listed individuals that are likely to be exposed to the stressors and the populations or subpopulations to which those individuals belong. This is our exposure analysis. We evaluate the available evidence to determine how individuals of those ESA-listed species are likely to respond given their probable exposure. This is our response analyses.

Cumulative Effects (Section 9): Cumulative effects are the effects to ESA-listed species and designated critical habitat of future state or private activities that are reasonably certain to occur within the action area (50 CFR 402.02). Effects from future Federal actions that are unrelated to the proposed action are not considered because they require separate ESA section 7 compliance.

Integration and Synthesis (Section 10): In this section, we integrate the analyses in the opinion to summarize the consequences to ESA-listed species under NMFS' jurisdiction. With full consideration of the status of the species and the designated critical habitat, we consider the effects of the action within the action area on populations or subpopulations and on essential habitat features when added to the environmental baseline and the cumulative effects to determine whether the action could reasonably be expected to:

- Reduce appreciably the likelihood of survival and recovery of ESA-listed species in the wild by reducing its numbers, reproduction, or distribution, and state our conclusion as to whether the action is likely to jeopardize the continued existence of such species; or
- Appreciably diminish the value of designated critical habitat for the conservation of an ESA-listed species, and state our conclusion as to whether the action is likely to destroy or adversely modify designated critical habitat

Conclusion (Section 11):

Here, we state the conclusions reached in our opinion. If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat, then we must identify reasonable and prudent alternative(s) to the action, if any, or indicate that to the best of our knowledge there are no reasonable and prudent alternatives (See 50 CFR 402.14).

In addition, we include an ITS (Section 12) that specifies the impact of the take that is reasonably certain to occur (50 CFR 402.14(g)(7)), reasonable and prudent measures to minimize the impact of the take, and terms and conditions to implement the reasonable and prudent measures (ESA section 7 (b)(4); 50 CFR 402.14(i)).

We also provide discretionary Conservation Recommendations (Section 13) that may be implemented by the action agencies and their applicant (50 CFR 402.14(j)).

Finally, we identify the circumstances in which the action agency is required to request Reinitiation of Consultation (Section 15; 50 CFR 402.16).

2.1 Evidence Available for the Consultation

To comply with our obligation to use the best scientific and commercial data available, we collected information identified through searches of Google Scholar, American Fisheries Society, Science Direct, BioOne, Conference Papers Index, JSTOR, and Aquatic Sciences and Fisheries Abstracts search engines and literature cited sections of peer-reviewed articles, species listing documentation, and reports published by government and private entities. This opinion is based on our review and analysis of various information sources, including:

- Information submitted by Clearwater and the ESCD;

- Government reports (including NMFS biological opinions and stock assessment reports);
- National Oceanographic and Atmospheric Administration (NOAA) technical memos; and
- Peer-reviewed scientific literature.

These resources were used to identify information relevant to the potential stressors and responses of ESA-listed and proposed species, and designated and proposed critical habitat, under NMFS' jurisdiction that may be affected by the proposed action to draw conclusions on risks the action may pose to the continued existence of these species and the value of designated critical habitat for the conservation of ESA-listed species.

3 DESCRIPTION OF THE PROPOSED ACTION

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies.

The ESCD proposes to issue a permit for incidental take pursuant to section 10(a)(1)(B) of the ESA. The proposed activities involve incidental harassment, harm, wounding, trapping, capture, or collection ("take") of threatened and endangered Atlantic sturgeon and endangered shortnose sturgeon incidental to otherwise lawful activities.

The ESCD is the Federal action agency for this consultation. The proposed action is issuance of an ITP pursuant to ESA section 10(a)(1)(B), to incidentally take shortnose sturgeon and Atlantic sturgeon during the course of an otherwise lawful activity. ESCD is authorizing permitted take of Atlantic and shortnose sturgeon to Clearwater. Clearwater is requesting a permit from ESCD for the incidental take of 10 sturgeon (either Atlantic or shortnose sturgeon or a combination thereof), over the course of the 10-year permit through 2034, that may be incidentally caught in trawls used to collect fish and invertebrate specimens from the Hudson River. Of the total 10 individual sturgeon anticipated to be taken between now and 2034 by educational trawling, Clearwater does not anticipate lethal takes, but has applied for one lethal take for the duration of the permit in the event they encounter conditions that result in sturgeon mortality.

As a condition for issuance of a 10(a)(1)(B) permit, the permit applicant must develop a conservation plan that minimizes negative impacts to the species. Clearwater's "Conservation Plan" is described in Section VII of their incidental take application. Their plan reiterates steps to limit the scope of the educational trawling (e.g., avoiding known sturgeon zones, slow vessel speeds, shortened set times) to continue to maintain sturgeon encounters at near zero and minimize sturgeon injury and mortality if one is caught. No additional avoidance and minimization measures are presented in the plan.

3.1 Vessel Background

The sloop *Clearwater*, a replica vessel modeled after the Dutch vessels that sailed the Hudson River in the 18th and 19th centuries (Figure 1), was launched on May 17, 1969 from Harvey

Gamage Shipyard in South Bristol, Maine. Those early cargo vessels were specially designed for the variable winds, currents and depths of the Hudson. Sailing from town to town today, the *Clearwater* models her course after that of the historic Dutch sloops. The *Clearwater* is a gaff sloop 106 ft (32 meters [m]) in length, with a 25 ft (7.6 m) beam, 8 ft (2.4 m) draft, and 4305 ft^2 (387.5 m^2) total sail area, propelled by sails and an auxiliary engine.

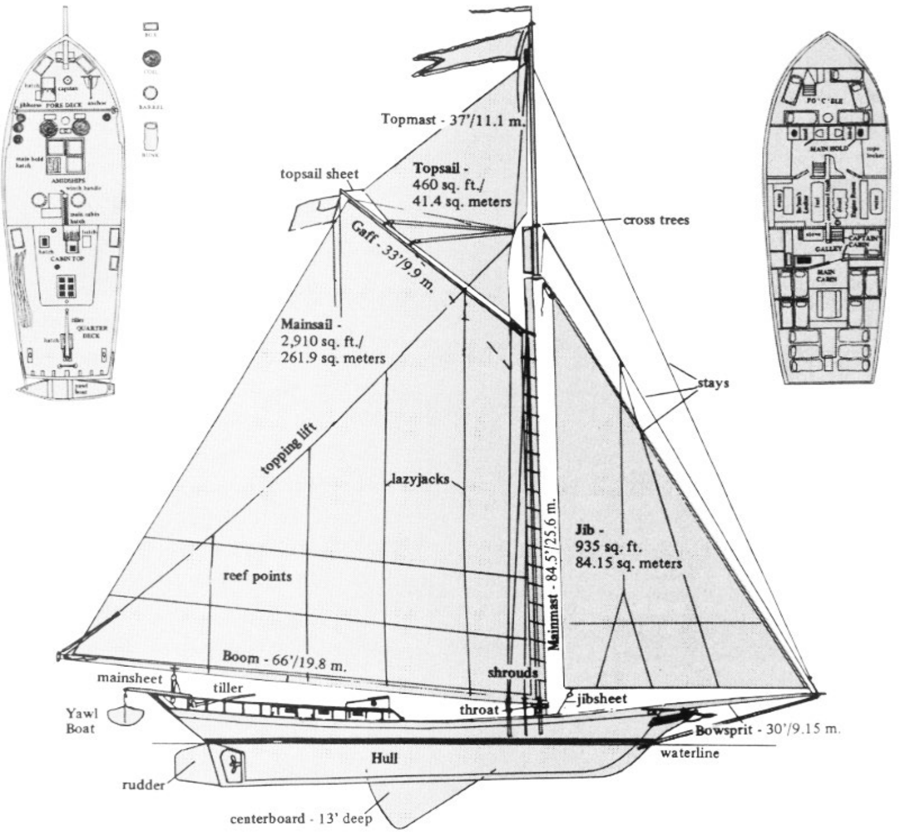

Figure 1. Specifications of the Hudson River Sloop *Clearwater*

Clearwater will sail and run programs throughout the Hudson River estuary from various locations between Albany, NY south to New York Harbor, depending on the demand for programs at specific docks. The specific scheduled locations for trawling sets are based on Clearwater's sailing schedule. Clearwater conducts educational trawling on the Hudson River to educate about the ecology and history of the Hudson River through hands-on, interactive learning stations.

The program reaches thousands of students, as well as members of the general public each year. The trawl is used as an educational experience for students to sample Hudson River fish and invertebrates. The students participate in setting and hauling in the net. Only a few individual fish and invertebrates are kept onboard in an aquarium for the duration of the three-hour program. The rest are immediately returned to the river. The trawl is a useful, participatory tool in exposing students and the public to the diversity of life in the Hudson estuary.

3.2 Trawling

As part of an environmental education program, two sailboats are used as platforms for setting and hauling trawl or beach seine nets to bring fish and invertebrates onboard and into an aquarium for three-hour education sessions.

3.2.1 Otter trawl

The activity involves the use of a small otter trawl net. The trawl used by Clearwater has two otter boards (doors), which are 36 by 18 inches (in) long; each weighs less than 20 pounds (lbs). The net itself includes a soft inner liner at the cod end to help protect the fish.

Otter trawls are a common method of trawling, often called “bottom otter trawl,” “otter trawl,” or “bottom trawl.” The mouth or opening of the net is created by a set of otter boards or trawl doors attached to warp lines. The doors have bridles that then attach to sweep lines on each side of the net. While under tow, these boards will have the force of water acting as drag and therefore warp the net resulting in opening the net to create the mouth (Figure 2).

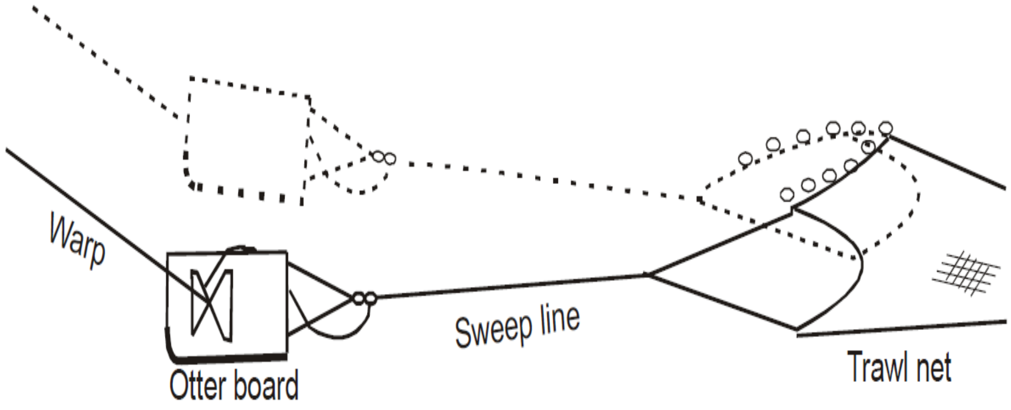

Figure 2. Typical rigging of otter boards in a trawl system

Clearwater uses rectangular curved otter boards similar to those pictured in Figure 3. The main advantage of this board is that greater spread can be achieved at low towing power. These boards work at smaller angle of attack, which results in a lower towing resistance and may also reduce the tendency of the otter board to dig into soft ground. Clearwater trawls a net with 36 x 18 in otter doors with an 8 ft diameter mouth on a 16 ft net.

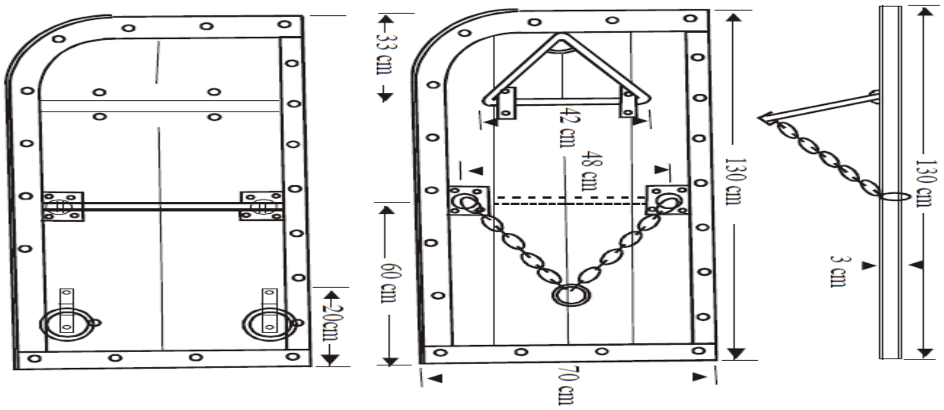

Figure 3. Rectangular curved otter boards

The Vigneron-Dahl system for trawling, in which the otter boards are attached to the wings by means of sweep lines and bridles, was introduced during the 1920s. This helped increase the swept area and thus increased the catch due to the herding effect of sweep lines and otter boards. In larger trawls, in addition to the weight on the foot rope, iron bobbins or rubber discs are attached depending upon the intended target species. The ratio of depth of fishing ground and the warp released is known as scope ratio or, in other words, it is the warp-length ratio.

The length of warp to be released is generally:

- 5-6 times the depth in shallow waters below 50 m
- 4-5 times the depth in off shore waters of 50-100 m
- 3-4 times the depth in deep waters of 100-200 m
- 2-3 times the depth in deep sea of 200 m and more

The speed at which the trawl is towed over the bottom ranges from about 2-2.5 knots (kts) for slow swimming species to 3-4.5 kts for fast swimming fish. Towing a particular trawl too slowly may cause the otter boards to close together, providing insufficient spreading power to the net which tends to sag on the bottom. Towing too fast may result in the net lifting off the bottom and floating which may lead to fouling of gear.

On reaching the ground the warps are attached to the net and the cod end is closed properly. The cod end is the first part to be released, followed by the main body of the net. The vessel moves forward slowly releasing the net and the otter boards. The winch is stopped after releasing few meters of the warp to ensure the proper spreading of the bridles and otter boards. The gear is then lowered to the desired fishing depth by releasing sufficient length of warp.

The net is hauled by heaving in the trawl warps evenly on to the winch drums, until the otter boards reach the gallows. Sweeps and bridles are then hauled up followed by the main body of the net and finally the cod end. In small trawlers, the sweeps and the net are shot and hauled in manually and sweeps may remain connected to the otter boards.

3.2.2 Trawling Protocol

The Clearwater sailing season runs from early April through the beginning of November. The Clearwater anticipates using the otter trawl net between April 1st and November 5th each year of the 10-year ITP (2024-2034).

The trawling activity will include one to two sets per day, depending on conditions. A set is defined as the time when the doors reach the water's surface to the time when they are retrieved. Net sets are limited to five minutes each and less than 2-3 kts vessel speed. Each set will be logged in detail by the captain onboard. No more than a maximum of 10 sets per vessel will be made in any given week during the active sailing season. Most weeks would feature 6-8 sets. Most sets take place between 20 and 40 ft of water depth, while maximum depth of the action area is approximately 200 ft in some areas. Trawling is scheduled to take place onboard the sloop *Clearwater* only. Trawling in general will commence at approximately 9:30 AM and 1:00 PM on a given day, based on Clearwater's sailing operations schedule.

3.2.3 Trawling Minimization Measures

Clearwater has proposed measures to reduce the likelihood of sturgeon capture and to minimize negative impacts to any sturgeon that are incidentally captured, including the following:

1) Trawling will occur between April 1st and November 5th to minimize any encounters with early life stage or juvenile fish.
2) Only trained and qualified Clearwater crew leaders will be allowed to carry out the trawling activities. The Clearwater crew leader will review the ESA-listed species minimization and avoidance procedures at the beginning of each day.
3) Trawling operations will occur for a maximum of five minutes for each bag, once the doors enter into the water and they are retrieved, to reduce the stress put onto a sturgeon if caught in the trawl net. There will be no more than 10 sets completed in a given week.
4) The speed of the trawl will be kept at 2-3 kts in order to allow fish to move out of the way of the bag.
5) If sturgeon are captured in the net, the species will be documented and immediately released back into the river.
6) Clearwater will avoid setting nets in habitat known to be sturgeon gathering areas and spawning grounds. Clearwater will regularly communicate with NYSDEC fisheries officials to coordinate this activity, and make use of information from the states' benthic mapping project to avoid sensitive areas.

7) In order to avoid catching sturgeon, Clearwater will not set the trawl in known spawning areas between Norrie Point and Hyde Park during spawning season (May through June).

More information on NYSDEC data and mapping products can be found online at New York State Department of State Geographic Information Gateway, the Environmental Resource Mapper, and the Hudson Valley Natural Resource Mapper.

4 ACTION AREA

Action area means all areas affected directly, or indirectly, by the Federal action, and not just the immediate area involved in the action (50 CFR 402.02).

The ESCD proposes to permit Clearwater to sail and run programs throughout the Hudson River estuary from various locations between Albany, NY south to New York Harbor, depending on the demand for programs at specific docks. The action area for this particular action includes the Hudson River estuary between Albany, NY (river mile [RM] 125) and south to New York Harbor (RM 0; Figure 4). We anticipate that all effects of the action will occur within this geographic area. The specific scheduled locations for trawling sets (Table 1) are based on Clearwater’s sailing schedule.

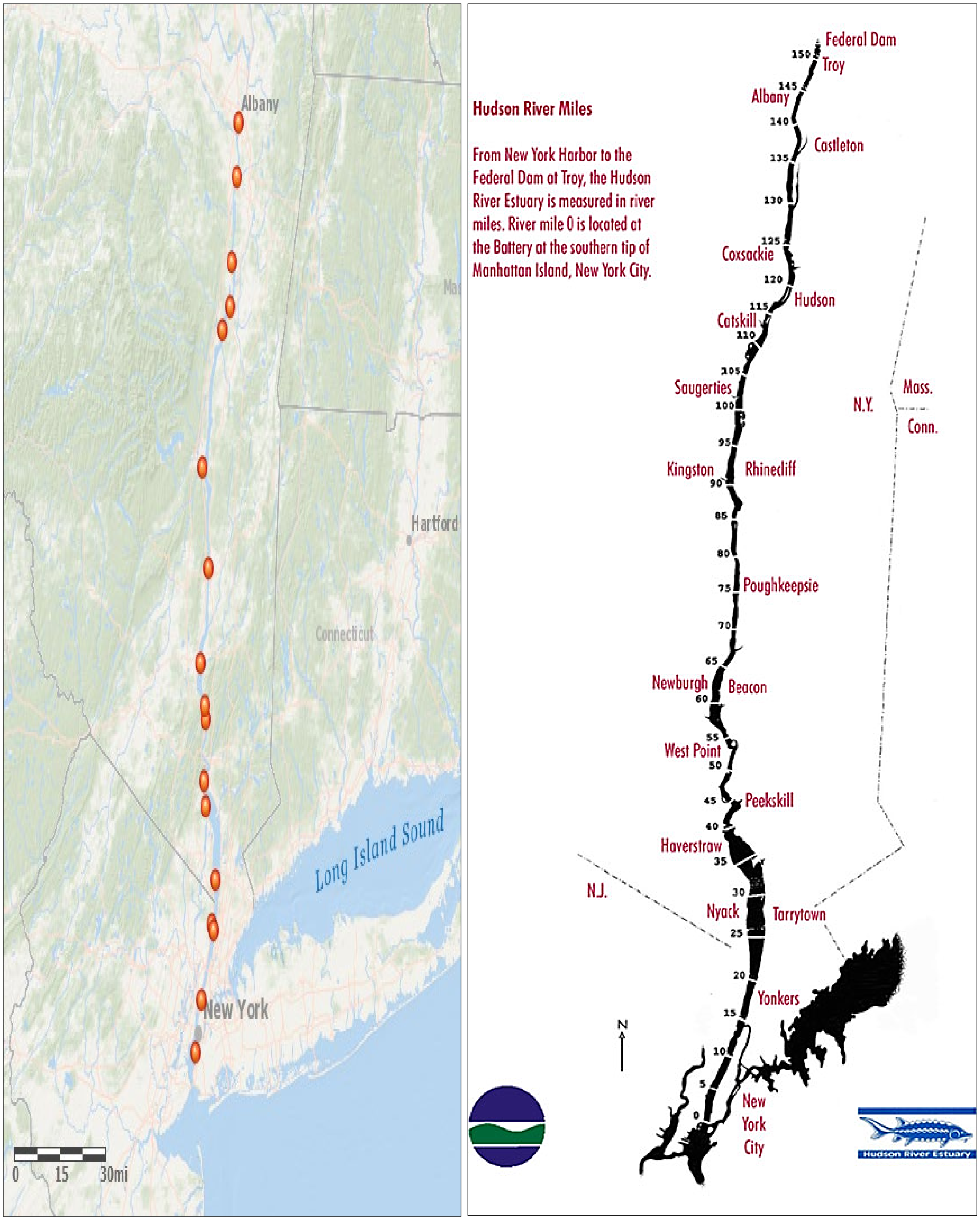

Figure 4. Map of dock locations (left); Towns and RM markers (right)

Table 1. Dock locations and gear type used at each site

Dock Name	**RM**	**Coordinates**	**Gear***	**Dock Authority**
One15 Brooklyn Marina, NY	1	40° 41’ 54.74” N, 74° 0' 16.28” W	Trawl only	One15 Marina Club
Liberty Landing, NJ	1	40° 42' 37.72' N, 74° 2' 38.25" W	Trawl only	Suntex
Dyckman Marina, NY	10	40° 52' 8.04" N, 73° 55' 54.84" W	Trawl only	New York City Office of Parks
Alpine, NJ	15.5	40° 58' 5.34" N, 73° 55' 1.74" W	Trawl & Seine	Ary Bouskila
Piermont, NY	25.4	41° 2′ 26″ N, 73° 55′8″ W	Trawl & Seine	Village of Piermont
Haverstraw, NY	36	41° 12′ 17″ N, 73° 59′ 26″ W	Trawl only	West Haverstraw Marina
Verplanck, NY	42	41° 15′ 11″ N, 73° 57′ 35″ W	Trawl & Seine	King’s Marine
West Point, NY	52	41° 22′ N, 74° 03′ W	Trawl only	United States (US) Military Academy
Cold Spring, NY	55	41° 25′ 8″ N, 73° 57′ 16″ W	Trawl only	Village of Cold Spring
Beacon, NY	61	41° 30′ 15″ N, 73° 57′ 56″ W	Trawl & Seine	Village of Beacon
Poughkeepsie, NY	75	41° 42′ N, 73° 55′ W	Trawl & Seine	City of Poughkeepsie
Kingston, NY	90	41° 55′ 30″ N, 74° 0′ 00″ W	Trawl only	Hudson River Maritime Museum
Rhinecliff, NY	90	41° 55' 5.99" N, 73° 57' 2.39" W	Trawl only	Hudson River Maritime Museum
Catskill, NY	112	42° 13′ 16″ N, 73° 51′ 59″ W	Trawl only	City of Catskill
Hudson, NY	117	42° 15′ 0″ N, 73° 47′ 23″ W	Trawl only	City of Hudson
Coxsackie, NY	125	42° 21′ 27″ N, 73° 48′ 29″ W	Trawl only	Village of Coxsackie
Rensselaer NY	145	42° 38′ 48″ N, 73° 44′ 01″ W	Trawl only	City of Rensselaer

*Seine is a beach seine and used only during low tide conditions at these docks.

The Hudson River is tidal along its entire 246-kilometer (km) length from New York Harbor to the Federal Dam at Troy, NY. The upper two-thirds of the river are freshwater with saltwater intrusion in the lower third. Generally salt water intrusion occurs as far north as West Point (RM 52) in the late spring. During the summer months it can move as far north as Poughkeepsie (RM 75). The river is classified as a 'drowned' river valley, straight and fairly deep in some sections, especially in the Hudson Highlands near West Point, where the river is greater than 60 m in depth. In the lower 45 river miles, the river opens into two large, wide shallow "bays", Haverstraw Bay and the Tappan Zee, before narrowing down to a deep section just above New York Harbor.

From Hudson Falls to Albany, the river is maintained for commercial traffic at a depth of about 12 ft. The lower Hudson River is maintained at a depth of at least 32 ft for commercial traffic from the Port of Albany to New York City, but is 200 ft deep in some places. The lower Hudson River begins at the Federal Dam at Troy, just downstream from the confluence with the Mohawk.

5 SPECIES AND CRITICAL HABITAT THAT MAY BE AFFECTED

This section identifies the ESA-listed species, designated critical habitat that potentially occur within the action area (Table 2) that may be affected by the proposed action. We then describe which species and critical habitat may be affected, but are not likely to be adversely affected, by the proposed action.

All proposed sample sites occur within the geographic range of the ESA-listed shortnose sturgeon, Atlantic sturgeon, and NYB DPS Atlantic sturgeon critical habitat. All DPSs of Atlantic sturgeon may be present in the action area; however, only Atlantic sturgeon from the NYB DPS spawn and rear in the Hudson River. The southernmost two sample sites also occur within the geographic range of green, Kemp's ridley, leatherback, and loggerhead sea turtles.

Table 2. Threatened and endangered species that may be affected by the proposed action

Species	ESA Status	Critical Habitat	Recovery Plan
Marine Reptiles			
Green Turtle (*Chelonia mydas*) – North Atlantic DPS	T – 81 FR 20057	63 FR 46693 88 FR 46572 (Proposed)	10/1991 – U.S. Atlantic
Kemp's Ridley Turtle (*Lepidochelys kempii*)	E – 35 FR 18319	-- --	03/2010 – U.S. Caribbean, Atlantic, and Gulf of Mexico 09/2011
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	44 FR 17710 and 77 FR 4170	10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 63 FR 28359 05/1998 – U.S. Pacific
Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic Ocean DPS	T – 76 FR 58868	79 FR 39855	74 FR 2995 10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 05/1998 – U.S. Pacific 01/2009 – Northwest Atlantic
Fishes			
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus)*			
CA DPS	E - 77 FR 5914	82 FR 39160	2018 Recovery Outline
SA DPS	E - 77 FR 5914		
CB DPS	E - 77 FR 5880		
NYB DPS	E - 77 FR 5880		
GOM DPS	T - 77 FR 5880		
Shortnose sturgeon (*Acipenser brevirostrum)*	E - 32 FR 4001 (39 FR 41370)	-- --	63 FR 69613 12/1998

5.1 Species and Critical Habitat Not Likely to be Adversely Affected

NMFS uses two criteria to identify the ESA-listed species or critical habitat that are not likely to be adversely affected by the Federal agency's proposed action. The first criterion is exposure, or some reasonable expectation of a co-occurrence, between one or more potential stressors associated with the proposed activities and ESA-listed species or designated critical habitat. If we conclude that an ESA-listed species or designated critical habitat is not likely to be exposed to the proposed activities, we must also conclude that the species or critical habitat is not likely to be adversely affected by those activities.

The second criterion is the probability of a response given exposure. ESA-listed species or designated critical habitat that is exposed to a potential stressor but is likely to be unaffected by the exposure is also not likely to be adversely affected by the proposed action. We applied these criteria to the species ESA-listed in the action area and we summarize our results below.

An action warrants a "may affect, not likely to be adversely affected" finding when its effects are completely *beneficial, insignificant* or *discountable*. *Beneficial* effects have an immediate positive effect without any adverse effects to the species or habitat. Beneficial effects are usually discussed when the project has a clear link to the ESA-listed species or its specific habitat needs and consultation is required because the species may be affected.

Insignificant effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. Insignificant is the appropriate effect conclusion when plausible effects are going to happen, but will not rise to the level of constituting an adverse effect. That means the ESA-listed species may be expected to be affected, but not harmed or harassed.

Discountable effects are those that are extremely unlikely to occur. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action and that would be an adverse effect if it did impact an ESA-listed species), but it is very unlikely to occur.

Four ESA-listed sea turtle species, as well as Atlantic sturgeon critical habitat, may occur within the action area, and therefore may be affected by the proposed action; however, as described below, we expect the proposed action will not adversely affect these species or critical habitat.

5.1.1 Sea Turtles

ESA-listed sea turtles may be present in New York Harbor, including green, Kemp's ridley, leatherback, and loggerhead sea turtles. Adult and juveniles of each of the four species may be present in the action area while migrating and foraging. In general, juvenile and adult sea turtles migrate north in the spring as water temperatures warm, arriving in mid-Atlantic waters in May. As the waters cool in the fall, the trend is reversed with most sea turtles leaving the area by the end of November (NMFS 2015a; NMFS 2015b; Shoop 1992). Sea turtles could be subject to trawling and vessel strike from the proposed action.

Turtles are potentially present in the upper bay, but not in the Hudson River Estuary; as such, they would only potentially be present at the southernmost two trawling sites, and thus, a fraction of total trawling. Trawls will be short in duration (maximum of five minutes) and at slow speeds (2-3 kts), minimizing the risk of trawl interaction or vessel strike to turtles. No sea turtles have been caught in the Clearwater trawl or struck by the Clearwater in previous sampling records going back 20 years. Therefore, we expect the risk of sea turtles being adversely impacted via trawling or vessel strike during Clearwater operations to be extremely unlikely and, thus, discountable. We conclude the proposed action may affect, but is not likely to adversely affect ESA-listed green, Kemp's ridley, leatherback, and loggerhead sea turtles.

5.1.2 Atlantic sturgeon – GOM, CB, Carolina, and SA DPSs

Genetic analyses of Atlantic sturgeon captured in the Hudson River have revealed individuals from the Gulf of Maine (Kennebec River), Chesapeake Bay (James River spring and fall spawn populations), Carolina (Albemarle complex), and South Atlantic (Satilla River) DPSs (White et al. 2024). However, those same genetic analyses suggest that when Clearwater encounters an Atlantic sturgeon, it has a 98+% probability of being from the NYB DPS (Waldman et al. 1996; White et al. 2024). Therefore, because only 10 Atlantic sturgeon at most may be encountered during this ITP and the frequency of NYB DPS Atlantic sturgeon in the action area, we anticipate all captured Atlantic sturgeon will be natal to the NYB DPS. It will be extremely unlikely to encounter individuals from the other four DPSs, and therefore the likelihood of effects to the GOM, CB, Carolina, or SA DPSs is discountable. We, therefore, conclude the proposed action may affect, but is not likely to adversely affect the GOM, CB, Carolina, or SA DPSs Atlantic sturgeon.

5.1.3 Atlantic sturgeon NYB DPS critical habitat

NMFS designated critical habitat for each ESA-listed DPS of Atlantic sturgeon in August of 2017 (82 FR 39160). Atlantic sturgeon critical habitat for the NYB DPS is designated in the Hudson River. Critical habitat designated for the other DPSs of Atlantic sturgeon does not occur within the action area. The PBFs of critical habitat essential for the conservation of Atlantic sturgeon are:

1. Hard bottom substrate for spawning;
2. Aquatic habitat for gradual downstream salinity gradient;
3. Water of appropriate depth and free of passage barriers; and
4. Water from river mouths to spawning habitat of sufficient quality (temperature, salinity, and dissolved oxygen [DO]) to support all life stages.

Bottom otter trawls interact physically with the bottom sediment, which could cause turbidity. Turbidity could affect PBFs of Atlantic sturgeon critical habitat. Two PBFs, hard bottom substrate for spawning and water of sufficient quality to support all life stages, could be affected by increases in turbidity. Hard bottom substrate for spawning is indirectly affected by turbidity because the effects to the substrate occur once the suspended sediments settle out downriver. If enough sediment is suspended from a location that the hard bottom substrates downstream would be covered, this would adversely affect the PBF of Atlantic sturgeon critical habitat. Likewise, the PBF supporting water quality is important to the conservation of sturgeon because they are very sensitive to high temperatures and low DO (Campbell 2004; Cech 1984; Jenkins 1993; Secor 1998). Suspension of sediment often releases buried organic matter, which can allow bacteria to flourish, reducing DO. As noted earlier, Atlantic sturgeon are a benthic species adapted to living in turbid conditions (Allen 2007; French 2014; Wildhaber 2007).

The suspended sediment generated when implementing the program will be minimal. Areas where trawling will occur have river bottom habitat that consists mostly of debris-covered mud. East Coast rivers supporting Atlantic sturgeon spawning habitat are naturally turbid and any increases in turbidity caused by these actions are not likely to be detectable beyond a few feet downstream. Furthermore, trawling will not occur in spawning areas. Because of this, we anticipate that the hard bottom substrate and water quality PBFs of Atlantic sturgeon critical habitat will be exposed to increased turbidity but, because of the small amounts of suspended sediment, natural background conditions, and sturgeon adaptations, the response to turbidity at the scale expected from program activities is expected to be insignificant. Therefore, NMFS concludes that turbidity resulting from proposed action activities may affect, but is not likely to adversely affect, Atlantic sturgeon critical habitat.

6 STATUS OF SPECIES LIKELY TO BE ADVERSELY AFFECTED

This section identifies the ESA-listed species that occur within the action area that may be adversely affected by the proposed action—shortnose sturgeon and the NYB DPSs of Atlantic sturgeon—and examines the status of each species. The status includes the existing level of risk that the ESA-listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution," which is part of the jeopardy determination, as described in 50 CFR 402.02. More detailed information on the status and trends of these ESA-listed species, and their biology and ecology can be found in the listing regulations and critical habitat designations published in the Federal Register, status reviews, recovery plans, and on the NMFS Endangered Species Conservation website.

This section also examines the condition of critical habitat throughout the designated area (such as various watersheds and coastal and marine environments that make up the designated area), and discusses the condition and current function of designated critical habitat, including the essential PBFs that contribute to that conservation value of the critical habitat.

6.1 Shortnose Sturgeon, *Acipenser brevirostrum*

6.1.1 Description

Shortnose sturgeon were initially listed as endangered on March 11, 1967 (32 FR 4001) under the Endangered Species Preservation Act of 1966. In 1994 the species was listed as endangered throughout its range under the ESA (38 FR 41370). Critical habitat has not been designated for shortnose sturgeon. The shortnose sturgeon occurs along the Atlantic Coast of North America, from the St. John River in Canada to the St. Johns River in Florida. The shortnose sturgeon is the smallest of the three sturgeon species that occur in eastern North America; they grow up to 4.7 ft (1.4 m) and weigh up to 50.7 lbs (23 kg). It has a short, conical snout with four barbels (fleshy, whisker-like projections) in front of its large underslung mouth. Five rows of bony plates (called scutes) occur along its body: one on the back, two on the belly, and one on each side. The body coloration is generally olive-yellow to gray or bluish on the back, and milky-white to dark yellow on the belly. The peritoneum (body cavity lining) is black. The shortnose sturgeon is a relatively slow growing, late maturing, and long-lived fish species.

During the summer and winter, adult shortnose sturgeon occur in freshwater reaches of rivers or river reaches that are influenced by tides; as a result, they often occupy only a few short reaches of a river's entire length. During the summer, at the southern end of their range, shortnose sturgeon congregate in cool, deep, areas of rivers where adult and juvenile sturgeon can take refuge from high temperatures (Bahr 2017). Juvenile shortnose sturgeon generally move upstream for the spring and summer seasons and downstream for fall and winter; however, these movements usually occur above the salt- and freshwater interface of the rivers they inhabit (Hardy 2021).

Shortnose sturgeon typically live longer in the northern portion of their range compared to the southern portion (Gilbert 1989a). The maximum ages reported of female shortnose sturgeon by river system include 67 years for the St. John River (New Brunswick), 40 years for the Kennebec River, 37 years for the Hudson River, 34 years for the Connecticut River, 20 years for the Pee Dee River, and 10 years for the Altamaha River (Dadswell 1984; Gilbert 1989a). Female shortnose sturgeon generally outlive and outgrow males, which seldom exceed 30 years of age (Dadswell 1984; Gilbert 1989a). Thus, the ratio of females to males among young adults is 1:1, but changes to approximately 4:1 for fish larger than 3 ft (0.90 m). Shortnose sturgeon also exhibit sexually dimorphic growth and maturation patterns across latitudes (Dadswell 1984). In the north, males reach maturity at five to 11 years, while females mature between seven and 18 years. Shortnose sturgeon in southern rivers typically grow faster, mature at younger ages (two to five years for males and four to five for females), but attain smaller maximum sizes than those in the north which grow throughout their longer lifespans (Dadswell 1984).

6.1.2 Distribution

Historically, shortnose sturgeon are believed to have inhabited nearly all major rivers and estuaries along the entire east coast of North America. The Shortnose Sturgeon Recovery Plan identifies 19 populations based on the fish’s strong fidelity to natal rivers and the premise that populations in adjacent river systems did not interbreed with any regularity (NMFS 1998b). The recovery plan recommended that each population be managed separately until further evidence and information allowed for the consideration of potential DPS delineations for shortnose sturgeon. Since the recovery plan was published in 1998, additional information on straying rates and genetic analysis have been made available. Both mtDNA and nDNA analyses indicate effective (with spawning) coastal migrations are occurring between adjacent rivers in some areas, particularly within the Gulf of Maine and the southeast. The currently available genetic information suggests that shortnose sturgeon can be separated into smaller groupings that form regional clusters across their geographic range (SSSRT 2010). Differences in life history and ecology further support these genetic groupings or clusters. Both regional population and metapopulation structures may exist according to genetic analyses and dispersal and migration patterns (King 2014; Wirgin 2010).

The Shortnose Sturgeon Status Review Team (SNS SRT) concluded shortnose sturgeon across their geographic range include five genetically distinct groupings each of which have geographic ecological adaptations: 1) Gulf of Maine; 2) Connecticut and Housatonic Rivers; 3) Hudson River; 4) Delaware River and Chesapeake Bay; and 5) Southeast (SSSRT 2010). Three of these regional groups appear to be functioning as a metapopulation: Gulf of Maine, Delaware/Chesapeake Bay, and Southeast. The other two groups (Connecticut/Housatonic and the Hudson River) are thought to be evolutionarily significant. Two additional geographically separate populations occur behind dams in the Connecticut River (above the Holyoke Dam) and in Lake Marion on the Santee-Cooper River system in South Carolina (above the Wilson and Pinopolis Dams). Although these populations are geographically isolated, genetic analyses suggest individual shortnose sturgeon move between some of these populations each generation (Quattro 2002; Wirgin 2005; Wirgin 2010). The SNS SRT also recommended that each riverine population be considered as a separate management/recovery unit (SSSRT 2010).

Researchers have concluded that shortnose sturgeon are extirpated from the St. Johns River in Florida and the St. Mary’s River along the Florida-Georgia border. In 2002, a shortnose sturgeon was captured in the St. Johns River, Florida (NMFS 2010), suggesting either immigration or a small remnant population.

6.1.3 Status and Trends of Shortnose Sturgeon Populations in New York Harbor and Hudson River

The Hudson River population of shortnose sturgeon is the largest in the United States. Studies indicate an extensive increase in abundance from the late 1970s (13,844 adults; Dovel 1992) to the late 1990s (56,708 adults; 95% confidence interval [CI] = 50,862-64,072; Bain 1999b). This increase is thought to be the result of high recruitment (31,000-52,000 yearlings) from 1986-1992 (Woodland 2007). Woodland (2007) examined environmental conditions throughout this 20-year period and determined that years in which water temperatures drop quickly in the fall and flow increases rapidly in the fall (particularly October), are followed by high levels of recruitment in the spring. This suggests that these environmental factors may index a suite of environmental cues that initiate the final stages of gonadal development in spawning adults. The population in the Hudson River exhibits substantial recruitment and is considered to be stable at high levels.

New York's shortnose sturgeon population inhabits the entire Hudson River estuary, below the Federal Dam at Troy, consisting of 245 km of tidal freshwater river and brackish estuary habitats. Captures in coastal marine waters and non-natal rivers are rare, but have occurred (Bain 2007). From late spring to early fall, shortnose sturgeon are dispersed throughout the channel habitats of this river-estuary. Both adults and juvenile fish tend to overwinter near the fresh/brackish water interface in the Haverstraw Bay region while mostly adults aggregate near Kingston (river km [rkm] 139; Bain 1999b). Spawning occurs in between Coeymans and the Troy Dam from late April to May. Once eggs hatch, larvae disperse downstream; juvenile use much of the Hudson River estuary, commonly associated with deep waters and strong currents (Bain 2007). Summer habitat for all life stages is dispersed throughout much of the estuary in the mid-river region. See Figure 5 for the best known overwintering, spawning, and summer sites in the Hudson River.

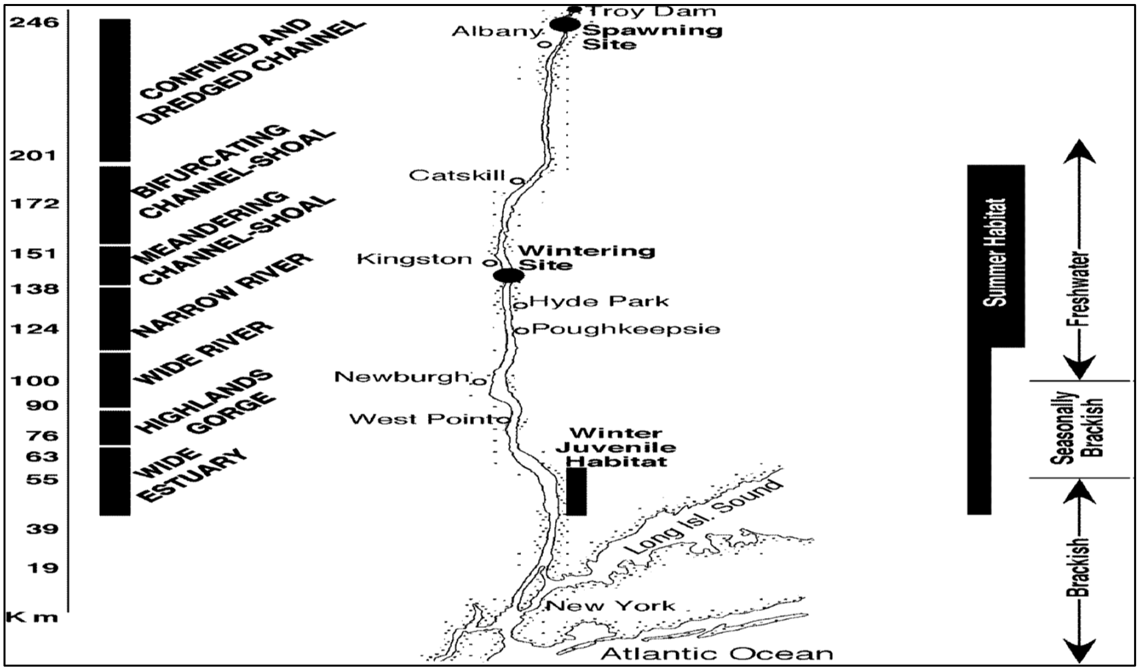

Figure 5. Map of the Hudson River estuary with key habitats and the salinity zones of the system (Bain et al. 2007)

The habitat characteristics of the lower Hudson (i.e., Manhattan to the confluence of New York Harbor) and the Upper New York Harbor, in general, consist of deep channel habitat and salinity levels that range from 11-30 ppt. Shortnose sturgeon eggs or yolk-sac larvae, occurrence is limited to the waters near the spawning grounds (i.e., Hudson River, below the Federal Dam at Troy to about Coxsackie, NY are likely to occur in this area (Bain 1997; Dovel 1992; Kazyak 2020). We also do expect that juveniles would be present due to the action area being the Hudson River, their natal river, which juveniles are known to exist as noted in Figure 5. As they grow and mature, they disperse downriver to juvenile nursery habitats in more brackish parts of the lower Hudson. Adult sturgeon migrate upriver from their overwintering sites to freshwater spawning sites from the Troy Dam to Coeymans in late April-May.

6.1.4 Recovery

The long-term recovery objective for the shortnose sturgeon is to recover all populations to levels of abundance at which they no longer require protection under the ESA. Downlisting can be considered when all populations:

1) Are large enough to prevent extinction, and

2) The loss of any one population will have minimal effect on the genetic diversity of the species.

This minimum abundance for each population segment has not yet been determined. Therefore, establishing ESA-listed species' population size thresholds is a priority. To achieve and preserve minimum population sizes for each population segment, essential habitats must be identified and maintained, and mortality must be monitored and minimized. Accordingly, other key recovery tasks are to define essential habitat characteristics, assess mortality factors, and protect shortnose sturgeon through applicable Federal and state regulations.

6.2 Atlantic Sturgeon, *Acipenser oxyrinchus*

Five separate DPSs of Atlantic sturgeon were listed under the ESA by NMFS effective April 6, 2012 (77 FR 5880 and 5914, February 6, 2012; Figure 6). The NYB DPS is being considered further in this opinion. While adult Atlantic sturgeon from all DPSs mix extensively in marine waters, Atlantic sturgeon return to their natal rivers to spawn approximately 96% of the time (Kazyak 2021). Genetic studies show that fewer than two adults per generation spawn in rivers other than their natal river (Waldman 2002; Wirgin 2000). Young sturgeon spend the first few years of life in their natal river estuary before moving out to sea (Waldman 2002). The Atlantic sturgeon were once present in 38 river systems and, of these, spawned in 35 of them. Individuals are currently present in 36 rivers, and spawning occurs in at least 20 of these (ASSRT 2007a).

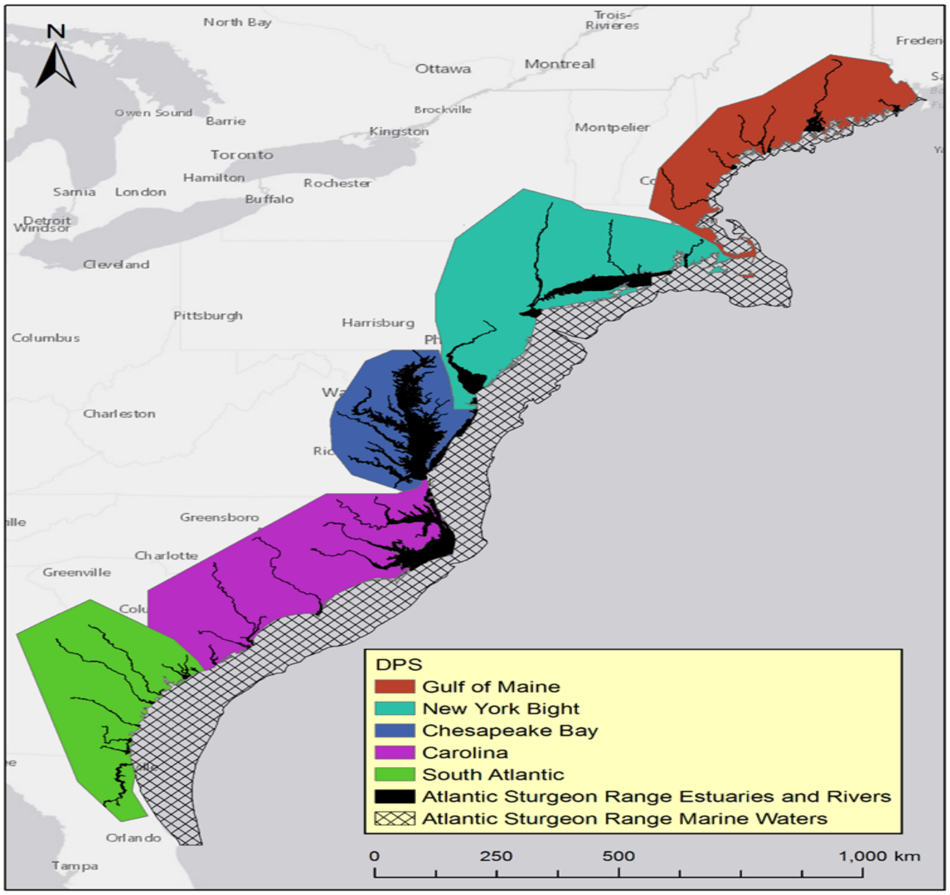

Figure 6. **Geographic range of Atlantic Sturgeon DPSs**

6.2.1 Description

Atlantic sturgeon are long-lived, late-maturing, estuarine-dependent, anadromous fish distributed along the eastern coast of North America (Waldman 1998). Historically, sightings have been reported from Hamilton Inlet, Labrador, Canada, south to the St. Johns River, Florida (Murawski 1977; Smith 1997b). Atlantic sturgeon may live up to 60 years, reach lengths up to 14 ft, and weigh over 800 lbs (ASSRT 2007c; Collette 2002). They are distinguishable by armor-like plates (called scutes) and a long protruding snout that has four barbels (slender, whisker-like feelers extending from the lower jaw used for touch and taste). Adult Atlantic sturgeon spend the majority of their lives in nearshore marine waters, returning to the rivers where they were born (natal rivers) to spawn (Wirgin 2002). Young sturgeon may spend the first few years of life in their natal river estuary before moving out to sea (Wirgin 2002). Atlantic sturgeon are omnivorous benthic (bottom) feeders. Diets of adult and subadult Atlantic sturgeon include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (ASSRT 2007c; Bigelow 1953; Guilbard 2007a; Savoy 2007). Juvenile Atlantic sturgeon feed on aquatic insects, insect larvae, and other invertebrates (ASSRT 2007c; Bigelow 1953; Guilbard 2007a).

6.2.2 Life History Information

The general life history pattern of Atlantic sturgeon is that of a long lived, late maturing, iteroparous, anadromous species. Atlantic sturgeon spawn in freshwater, but spend most of their subadult and adult life in the marine environment. Atlantic sturgeon feed on mollusks, polychaeta worms, gastropods, shrimps, pea crabs, decapods, amphipods, isopods, and small fishes in the marine environment (Collins 2008; Guilbard 2007b; Savoy 2007) while in fresh water they feed on oligochaetes, gammarids, mollusks, insects, and chironomids (Guilbard 2007b; Johnson 1997; Moser 1995b; Savoy 2007). The sturgeon "roots" in the sand or mud with its snout, like a pig, to dislodge worms and mollusks that it sucks into its protrusible mouth, along with considerable amounts of mud. The Atlantic sturgeon has a stomach with very thick, muscular walls that resemble the gizzard of a bird. This gizzard enables it to grind such food items as mollusks and gastropods (MSPO 1993).

Atlantic sturgeon spawn in freshwater, but spend most of their adult life in the marine environment. Spawning adults generally migrate upriver in the late summer/early fall (Balazik 2012c; Collins 2000b; Hager 2014b; Kahn 2014b; NMFS 1998a; 2012; Smith 1985). Atlantic sturgeon spawning is believed to occur in flowing water between the salt front and fall line of large rivers at depths of 11-27 m (Bain 2000b; Borodin 1925; Crance 1987; Leland 1968; Scott 1973). Atlantic sturgeon likely do not spawn every year. Spawning intervals range from one to five years for males (Caron 2002; Collins 2000b; Smith 1985) and two to five for females (Stevenson 2000; Van Eenennaam 1996; Vladykov 1963).

Sturgeon eggs are highly adhesive and are deposited on the bottom substrate, usually on hard surfaces (Gilbert 1989b; Smith 1997a) between the salt front and fall line of large rivers (Bain 2000b; Borodin 1925; Crance 1987; Scott 1973). Following spawning in northern rivers, males may remain in the river or lower estuary until the fall; females typically exit the rivers within four to six weeks (Savoy 2003). Hatching occurs approximately 94-140 hours after egg deposition at temperatures of 20° and 18° Celsius, respectively (Theodore 1980). The yolk sac larval stage is completed in about 8-12 days, during which time larvae move downstream to rearing grounds over a six to 12 day period (Kynard 2002). During the first half of their migration downstream, movement is limited to nighttime. During the day, larvae use benthic structure (e.g., gravel matrix) as refuge (Kynard 2002). The larvae grow rapidly and are 4 to 5.5 in long at a month old (MSPO 1993). At this size, the young sturgeon bear teeth and have sharp, closely spaced spine-tipped scutes. As growth continues, they lose their teeth, the scutes separate and lose their sharpness. During the latter half of migration when larvae are more fully developed, movement to rearing grounds occurs both day and night. Juvenile sturgeon continue to move further downstream into brackish waters ranging from zero to up to 10 parts per thousand salinity. Older juveniles are more tolerant of higher salinities as juveniles typically spend two to five years in freshwater before eventually becoming coastal residents as sub-adults (Boreman 1997b; Schueller 2010; Smith 1985).

Atlantic sturgeon undertake long marine migrations and utilize habitats up and down the East Coast for rearing, feeding, and migrating (Bain 1997; Dovel 1983a; Stevenson 1997). Migratory subadults and adults are normally located in shallow (10-50 m) nearshore areas dominated by gravel and sand substrate (Stein 2004c). Tagging and genetic data indicate that subadult and adult Atlantic sturgeon may travel widely once they emigrate from rivers (Bartron 2007; Wirgin 2015). Once in marine waters, subadults undergo rapid growth (Dovel 1983a; Stevenson 1997). Atlantic sturgeon have been aged to 60 years (Mangin 1964), but this should be taken as an approximation because the age validation studies conducted to date show ages cannot be reliably estimated after 15 to 20 years (Stevenson 2000). Vital parameters of sturgeon populations generally show clinal variation with faster growth, maturation at earlier age, and shorter life span in more southern systems. Spawning intervals range from one to five years for male Atlantic sturgeon (Collins 2000b; Smith 1985) and three to five years for females (Schueller 2010; Stevenson 2000). Fecundity of Atlantic sturgeon is correlated with age and body size, ranging from approximately 400,000 to 8 million eggs (Dadswell 2006; Smith 1982; Van Eenennaam 1998). The average age at which 50% of Atlantic sturgeon maximum lifetime egg production is achieved is estimated to be 29 years, approximately three to 10 times longer than for most other bony fish species (Boreman 1997b).

6.2.3 Status

Atlantic sturgeon were once present in 38 river systems and, of these, spawned in 35 of them. Individuals are currently present in 36 rivers, and spawning occurs in at least 20 of these (ASSRT 2007c). The decline in abundance of Atlantic sturgeon has been attributed primarily to the large U.S. commercial fishery that existed for the Atlantic sturgeon from the 1870s through the mid-1990s. The fishery collapsed in 1901 and landings remained at between one to five percent of the pre-collapse peak until the Atlantic States Marine Fisheries Commission (ASMFC) placed a two generation moratorium on the fishery in 1998 (ASMFC 1998a). The majority of the populations show no signs of recovery, and new information suggests that stressors such as bycatch, ship strikes, and low DO can and do have substantial impacts on populations (ASSRT 2007c). Additional threats to Atlantic sturgeon include habitat degradation from dredging, damming, and poor water quality (ASSRT 2007c). Climate change related impacts on water quality (e.g., temperature, salinity, DO, contaminants) have the potential to impact Atlantic sturgeon populations using impacted river systems. None of the spawning populations are currently large or stable enough to provide any level of certainty for continued existence of any of the DPSs.

6.2.4 Status and Trends of Atlantic Sturgeon Populations in New York & Hudson River

Prior to 1890, Atlantic sturgeon populations were at or near carrying capacity. Between 1890 and 1905, Atlantic sturgeon (and shortnose sturgeon) populations were drastically reduced as a result of overfishing for sale of meat and caviar. Between 1920 and 1998, the harvest level remained very low due to small remnant populations. Prompted by research on juvenile production between 1985 and 1995 Peterson et al. 2000), the Atlantic sturgeon fishery was closed by the ASMFC in 1998, when a coast-wide fishing moratorium was imposed for 20-40 years, or at least until 20 year classes of mature female Atlantic sturgeon were present (ASMFC 1998b).

The Hudson River most likely supports the largest population of Atlantic sturgeon in the United States. Research conducted by the NYSDEC and other researchers using side-scan sonar and acoustic telemetry "suggests that the Hudson River holds one of the largest contemporary populations of Atlantic sturgeon, yet the population remains severely depleted relative to virgin conditions." Effective population estimates for the Hudson River are 156 (95% confidence limits [CL], 138.3-176.1; n = 459; Waldman 2019) and 145.1 (82.5-299.4; n = 307; White 2021b). Kazyak (2020) produced an abundance estimate of the 2014 adult spawning run size of 466 individuals (95% CL, 310-745). While this spawning run size is nearly identical to that estimated by Kahnle (2007), monitoring of relative abundance of juveniles from 2004 through 2019 has shown production may have doubled during those 16 years (Pendleton 2021).

Eggs, early life stages, and juveniles (as used here referring to Atlantic sturgeon offspring that have not emigrated from the natal river) are not present in the action area, with the exception of the NYB DPS. We expect eggs and yolk-sac larvae (YSL) to appear in the same areas indicated for adult spawning (i.e., rkm 113 to 246) from April through August (Breece 2021). We expect post yolk-sac larvae (PYSL) and young-of-year (YOY) to appear anywhere in the Hudson River from the downstream limit of the saltwater line (approximately rkm 29) to the most upstream limit at the Troy Lock and Dam (approximately rkm 246; Dovel 1983b). PYSL are expected to be from April through September. We expect YOY to be present year-round. After their first year, juvenile Atlantic sturgeon become increasingly tolerant to saline water and may use the entirety of the species' range in the river year-round to forage from the mouth of the estuary to the upstream limit at Troy Lock and Dam (Dovel 1983b). Bain (1999a) noted that juvenile Atlantic sturgeon are well distributed over much of the Hudson River from July through September.

Subadult and adult Atlantic sturgeon occur in waters off of New York/New Jersey year-round. Atlantic sturgeon are known to use the action area for spawning migration and to opportunistically forage. Foraging behaviors typically occur in areas where suitable forage and appropriate habitat conditions are present. These areas include tidally influenced flats and mud, sand, and mixed cobble substrates (Stein 2004b). We expect migrating and foraging subadult and adult Atlantic sturgeon to have a similar arrival and departure timing Hudson River: we anticipate that males will arrive in April and stay through November, while females will arrive in May and leave after spawning, usually in July (Dovel 1983b) . Opportunistic foraging of the river ranges from the Hudson's mouth to the Troy Lock and Dam (Dovel 1983b).

In the Hudson, spawning of NYB DPS Atlantic sturgeon may occur anywhere from below Poughkeepsie to the upstream limit of the Troy Lock and Dam (approximately rkm 113 to 246; (Bain 1999a; Dovel 1983b) where the necessary PBFs for spawning are present. A recent study using acoustic telemetry to estimate spawning duration and return intervals shows that Hudson

River adults return much more frequently than previously thought; females every 1.66 years and males every 1.28 years (Breece 2021). This is in agreement with recent studies conducted in the York River (Hager et al. 2020), both suggesting females, in particular, spawn more often than previously thought. In the Hudson River, males were on spawning grounds on average from May 27 through July 11 and females from June 8 through June 29. The average male is also more likely to travel further upriver than the average female (Breece 2021).

Migratory behaviors occur starting from March or April to November (Dovel 1983b; Welsh 2002). Both adults and subadults are expected to wander among coastal and estuarine habitats of the channels. There is an Atlantic sturgeon aggregation off the coast of Long Island that is outside of Ambrose channel (Figure 7). Atlantic sturgeon aggregations are generally restricted to shallow depths (<20 m) in New York waters, following a seasonal pattern with peak abundance during the spring and fall (Dunton 2015). In a study by Dunton (2015), catches of Atlantic sturgeon were an order of magnitude higher than in other areas and months of the year during the peak aggregation months of May, June, September, and October.

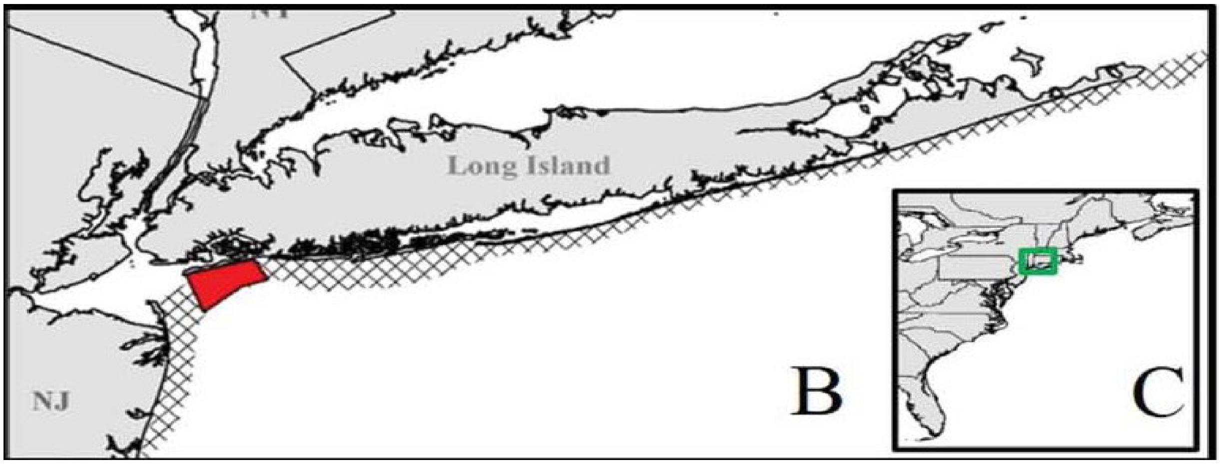

Figure 7. Atlantic sturgeon aggregation area (red area) and their migration corridors (hatched) (Dunton et al. 2015)

Erickson (2011) and Breece et al. (2018a; 2018b) also provided new information that better informs the seasonal, migratory movements of the NYB DPS, and their use of aggregation areas. The new information supports the understanding of the movements of Atlantic sturgeon into deeper waters in the fall compared to the depth where they occur in the spring. We knew when we listed the DPS that, in general, there is a northerly coastal migration of subadult and adult Atlantic sturgeon to estuaries in the spring, and a southerly coastal migration from estuaries in the fall. Some marine aggregation areas were suspected of being overwintering areas, such as in waters off of the Virginia and North Carolina coast. However, the adult sturgeon tagged by Erickson (2011) 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. The model constructed by Breece et al. (2018a; 2018b) similarly predicts an increase in probability of occurrence in shallow water during the spring, which shifts to an increase in probability of occurrence in deeper water in the fall.

Recent survival estimates do not suggest much of an improvement since the last estimates made during the commercial fishery (Boreman 1997a; Kahnle 1998). Melnychuk (2017) provided an updated estimate of survival of Hudson River Atlantic sturgeon of approximately 88.22%, while for similar life stages over a longer time frame, ASMFC (2017a) estimated survival of the entire NYB DPS to be 91% (95% CL, 71-99%).

6.2.5 NYB DPS-specific Information

The New York Bight, ranging from Cape Cod to the Delmarva Peninsula, historically supported four or more spawning subpopulations, but currently this DPS only supports two known spawning subpopulations: Delaware and Hudson River. The Connecticut, Hudson, and Delaware Rivers all support reproductive populations while the Taunton River population appears to be extirpated. A recent assessment of relatedness of these populations to others along the coast reveals, as was the case at the time of listing, that the Hudson and Delaware populations appear to be a separate groups from other populations but also different from one another (White 2021b).

As previously noted in Section 6.2.4, the Hudson River most likely supports the largest population of Atlantic sturgeon in the United States. Effective population estimates for the Hudson River are 156 (95% CL, 138.3-176.1; n = 459; Waldman 2019) and 145.1 (82.5-299.4; n = 307; White 2021b). Kazyak (2020) produced an abundance estimate of the 2014 adult spawning run size of 466 individuals (95% CL, 310-745). While this spawning run size is nearly identical to that estimated by Kahnle (2007), monitoring of relative abundance of juveniles from 2004 through 2019 has shown production may have doubled during those 16 years (Pendleton 2021). Long-term surveys indicate that the Hudson River subpopulation has been stable and/or slightly increasing since 1995 in abundance (ASSRT 2007b). Two estimates of immature Atlantic sturgeon have been calculated for the Hudson River stock based on mark-recapture studies. Dovel (1983a) estimated that there were approximately 25,000 wild age-1 Atlantic sturgeon in the Hudson River in 1977. Peterson (2000) estimated that there were approximately 4,314 wild age-1 Atlantic sturgeon in the Hudson River in 1995, a decline of about 80% from the similarly conducted population estimate of 1977.

In the Delaware River, the effective population size has been estimated to be 40 (95% CL, 34.7-46.2; n = 108) and 60.4 (42-85.6; n = 488) by Waldman (2019) and White (2021b), respectively. The significant difference between estimates is likely due to sample size. Therefore, the White (2021b) estimate is likely most accurate. Additionally, a recent close-kin mark-recapture estimate was produced for the Delaware River and suggests there are fewer than 250 adults (census) in the Delaware River population (White 2021a) .

In the Connecticut River, despite only limited collection of juvenile sturgeon (n = 47), there is an estimate of effective population size of two fish (95% CL, 2-2.7; Waldman 2019). This would suggest there has been a single spawning event in the Connecticut River that produced all of the juvenile fish collected or the spawning adults were so closely related as to be indistinguishable from a single pair. Either way, it is clear there is limited genetic diversity in this population and, unless these adults continue returning to the Connecticut River, it could take approximately 20 years to learn whether these juveniles have survived in sufficient numbers to sustain this new population.

The range of Atlantic sturgeon can be measured from north to south or inshore to offshore. While there has been no change to the range along the East Coast, there are detection data of acoustic transmitters much further offshore than had previously been documented. Kazyak (2021) studied the offshore composition of sturgeon between Cape Hatteras and Cape Cod and found that 37.5% of all bycaught fish in this region were from the NYB DPSs.

To understand movement along the coast, White (2021b) assessed the river of origin of Atlantic sturgeon harvested during the commercial fishery. This was a duplication of a study done by Waldman (1996), but showed fish harvested in the Hudson River were from many locations other than the Hudson. The makeup of the harvested fish in the 1990s was 82.3% Hudson, 7.3% Delaware, 4.7% James River spring run, 2.4% St. Lawrence, 2.1% Kennebec, 1.3% Pee Dee spring run, rather than 98% Hudson as had been estimated during the fishery. The reasons for the difference are likely a more thorough baseline consisting of 18 known populations rather than only nine (White 2021b) and the use of microsatellite DNA rather than mitochondrial. However, Wirgin (2018) sampling 148 sub-adult sturgeon in the Hudson River estuary and relying on microsatellite DNA, found 142 of those were of Hudson River origin with additional contributions from the Kennebec (2), Delaware (2), Ogeechee (1), and James (1) Rivers. This may suggest adults are more likely to enter estuaries than sub-adults.

The White (2024) mixture analysis provided support that the majority of individuals in the study area would be natal to the Hudson River, with an estimated 98.9 % (95 % CI: 96.3–99.6 %) of the total likely originating from the Hudson River population which in turn would assign them to the NYB DPS. In total, 96.7 % of the 452 individuals caught during the study were assigned to populations within the New York Bight DPS (i.e. the Hudson and Delaware rivers).

In terms of nearshore habitat use, Breece (2018a) showed habitat selection is driven by depth, time of year, sea surface temperature, and light absorption by seawater, while sex and natal river do not seem to be important predictors of habitat selection. Therefore, regardless of the makeup of the mixed populations in these estuarine areas, the drivers of where the fish are located affect all sexes and populations similarly. Inshore and offshore movement is highly dependent on photoperiod and temperature, with fish residing offshore from November to January and inshore from June to September (Ingram 2019). Fish gradually move inshore from February to May but rapidly move offshore during October (Ingram 2019). In the Delaware Bay, when fish have moved inshore for the spring and summer months, (Breece 2018b) showed Atlantic sturgeon prefer shallow water and warmer bottom temperatures primarily in the eastern portion of the bay during residency but that this preference changes to deep, cool water and the western edge of the bay during migration.

6.2.6 Recovery

Recovery Plans have not yet been drafted for any of the Atlantic sturgeon DPSs. A recovery outline was produced for Atlantic sturgeon (NMFS 2018). The goal for recovery is for ssubpopulations of each Atlantic sturgeon DPS must be present across the historical range. These subpopulations must be of sufficient size and genetic diversity to support successful reproduction and recovery from mortality events. The recruitment of juveniles to the sub-adult and adult life stages must also increase and that increased recruitment must be maintained over many years. Recovery of these DPSs will require conservation of the riverine and marine habitats used for spawning, development, foraging, and growth by abating threats to ensure a high probability of survival into the future. The ASMFC completed an Atlantic Sturgeon Benchmark Stock Assessment in 2017 that considered the status of each DPS individually, as well as all five Atlantic sturgeon DPSs collectively as a single unit (ASMFC 2017). The assessment concluded all five DPSs of Atlantic sturgeon, as well as each individual DPS remain depleted relative to historic abundance. The assessment also concluded that the population of all five DPSs together appears to be recovering slowly since implementation of a complete moratorium in 1998. They found there was a relatively high probability that abundance of the NYB DPS has increased since the implementation of the 1998 fishing moratorium. Therefore, while Atlantic sturgeon populations are showing signs of slow recovery when all five DPSs are considered collectively, these trends are not necessarily reflected with individual DPSs (ASMFC 2017).

6.2.6.1 Recovery NYB DPS

The recovery priority number for the NYB DPS is 1C based on the Listing and Recovery Priority Guidelines (84 FR 18243, April 30, 2019). This number is based on the following criteria: demographic risk, recovery potential, and conflict. The NYB DPS demographic risk is “High” because of its low productivity (e.g., relatively few adults compared to historical levels and irregular spawning success), low abundance (e.g., only a few known spawning populations and low DPS abundance, overall), and limited spatial distribution (e.g., limited spawning habitat within each of the few known rivers that support spawning). Based on the Listing and Recovery Priority Guidelines, meeting any one of these risk conditions ranks the NYB DPS as at high demographic risk (84 FR 18243; April 30, 2019).

The NYB DPS’ potential to recover is, however, also high because man-made threats that have a major impact on the species' ability to persist have been identified (e.g., bycatch in federally-managed fisheries, vessel strikes), the DPS’ response to those threats are well understood, management or protective actions to address major threats are primarily under U.S. jurisdiction or authority, and management or protective actions are technically feasible with respect to reducing fisheries bycatch even if they require further testing (e.g., gear modifications to minimize dredge or fishing gear interactions). The NYB DPS is also in conflict with construction and other developmental projects such as bridge construction projects and changes to the Hudson and Delaware rivers because of industrialization and commercial shipping.

7 ENVIRONMENTAL BASELINE

Environmental baseline refers to the condition of the ESA-listed species or its designated critical habitat in the action area, without the consequences to the ESA-listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone completed formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process. The impacts to ESA-listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The action area for this program is the Hudson River from Albany, NY to New York Harbor. This area has undergone significant physical, biological, and ecological changes over the past few centuries. These changes are primarily the result of human population growth and associated activities that have drastically altered the natural environment in this region. This section provides an overview of several past and ongoing threats to shortnose sturgeon and the NYB, DPS of Atlantic sturgeon. In some cases, because these are all migratory species, it may be appropriate to discuss threats occurring outside of the action area that affect the condition of individuals likely to be exposed to stressors caused by the program within the action area.

7.1 Climate Change

Primary effects of climate change on individual species include habitat loss or alteration, distribution changes, geographic isolation or extirpation of populations that are unable to adapt. Secondary effects include increased stress, disease susceptibility and predation, and reduced prey availability. Information on how climate change will impact the action area is extremely limited. However, since the turn of the century, temperatures in New York have increased 1.4°C (2.5°F). Temperatures are expected to continue increasing over the coming decades.

Sturgeon species first appear in the fossil record between 260 and 320 million years ago (Grunwald 2008), and they have survived extreme global temperature events without going extinct; however, the pace at which they need to adapt to those changes today is extremely different from under naturally occurring conditions. The risk to anadromous species is amplified because they consistently return to their natal rivers with minimal straying (Grunwald 2008; Kazyak 2021; King 2014). For both species of East Coast sturgeon that undergo long migrations, individual movements are usually associated with prey availability or habitat suitability. If either is disrupted, the timing of migration can change or negatively impact population sustainability (Simmonds 2009).

Climate change may alter the species or DPS ranges of these sturgeon due to salinity. Rising sea level may result in the salt wedge moving upstream in affected rivers. Atlantic sturgeon spawning occurs in fresh water reaches of rivers because early life stages have little to no tolerance for salinity. In river systems with dams (e.g., the Troy Dam on the Hudson River) or natural falls that are impassable by sturgeon, movement of the salt wedge further upstream would further restrict Atlantic sturgeon spawning and rearing habitat.

Sturgeon could be affected by changes in river ecology resulting from increases in precipitation and changes in water temperature, which may affect recruitment and distribution in these rivers. Temperatures above certain thresholds may eliminate sturgeon from some habitats. Some models predict that increased rainfall may increase runoff and scour in some spawning areas, while flooding events could cause temporary decreases in water quality. Rising temperatures and low flows could exacerbate existing water quality problems with DO and temperature. Increased droughts (and water withdrawal for human use) may cause loss of habitat, including loss of access to habitat and exposed eggs and larvae in rearing habitats.

Over the long term, increases in sea surface temperature can reduce the amount of nutrients, leading to declines in productivity and trophic abundance (Danovaro 2017; Sweetman 2017). Changes in the marine ecosystem caused by global climate change is already changing the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, and forage fish), ultimately affecting primary foraging areas of East Coast sturgeon and altering the marine regions that allow for greatest bioenergetic growth. When adults struggle to find sufficient resources, their egg production is lower than normal and body condition in the action area will be poorer. Additionally, cues for spawning migration and spawning could occur earlier in the season causing a mismatch in prey that are currently available to developing sturgeon in rearing habitat.

7.2 Human Population Density, Development, and Urbanization

The action area is within the Lower Hudson Watershed, which encompasses a 154-mile reach of the larger 13,400-square-mile Hudson River Basin. The section of river flows through farmland and forested mountains, as well as residential, commercial, and industrial land in the lowermost part of the basin. Over 14 million people live in the counties adjoining the river estuary from the dam at Troy down to Verrazzano Narrows below Manhattan Island (NYSDEC 2021). The Hudson River Estuary provides public access and recreation of boating, fishing, hiking, swimming, river watching, wildlife-related recreation, and river cruising. Nearly every community has some type of public access, and about 25% of the shoreline is available to the public (Beard 2020; NYSDEC 2021).

Many stream and riparian areas within the action area have been degraded by the effects of land and water use associated with urbanization, road construction, forest management, agriculture, mining, transportation, water development, and other human activities. Approximately 53% of the estuary's shoreline between the Federal dam at Troy and the Governor Mario M. Cuomo Bridge is currently hardened or engineered (NYSDEC 2021). Development activities contribute to a variety of interrelated factors that lead to the decline of sturgeon. These include reduced in-channel and off-channel habitat, restricted lateral channel movement, increased flow velocities, increased erosion, decreased cover, reduced prey sources, increased contaminants, increased water temperatures, degraded water quality, and decreased water quantity.

Urbanization causes loss of natural vegetation and increases in impervious cover, which results in dramatic changes to the natural hydrology, increased volumes of runoff, increased peak flows and flow duration, and greater stream velocity during storm events. Runoff from urban areas also contains chemical pollutants from vehicles and roads, industrial sources, and residential sources. Urban runoff is typically warmer than receiving waters and can significantly increase temperatures, particularly in smaller streams (Hester 2013). Urban and suburban nonpoint and point source discharges affect water quality and quantity in basin surface waters. Culvert and bridge stream crossings create additional problems for fish when they act as physical or hydraulic barriers that prevent fish access to spawning or rearing habitat, or contribute to adverse stream morphological changes upstream and downstream of the crossing itself.

7.3 Dams

Dams can have profound effects on anadromous species by fragmenting populations, impeding access to spawning and foraging habitat, and altering natural river hydrology and geomorphology, water temperature regimes, and sediment and debris transport processes (Pejchar 2001; Wheaton 2004). The loss of historic habitat ultimately affects anadromous fish in two ways: 1) it forces fish to spawn in sub-optimal habitats that can lead to reduced reproductive success and recruitment, and 2) it reduces the carrying capacity (physically) of these species and affects the overall health of the ecosystem (Patrick 2005). Dams' impact on individual fish include physical injury and mortality, disorientation, stress, exposure to high concentrations of dissolved gases, elevated water temperatures, and increased vulnerability to predation. The detrimental effects of dams on populations of shortnose and Atlantic sturgeon are generally well documented (Cooke 2004; Kynard 1998).

The Hudson River is dammed at river km 245 by the Troy Dam (built in 1825). Shortnose sturgeon migratory habitat on the Hudson River is likely restricted by the Troy Dam. It is believed shortnose sturgeon migrated above the location of the dam prior to its construction. Troy Dam is stream of the northern-most dock used by Clearwater.

7.4 Dredging

Riverine, nearshore, and offshore areas are often dredged to support commercial shipping, recreational boating, construction of infrastructure, and marine mining. The lower Hudson River is maintained at a depth of at least 32 ft for commercial traffic from the Port of Albany to New York City. Some of the consequences of dredging include habitat alteration, entrainment, changing DO and salinity gradients, and behavioral avoidance (Campbell 2004; Hatin 2007; Jenkins 1993; Secor 2001; Smith 1997a). Dredging operations may also pose risks to sturgeon by adversely affecting benthic feeding areas, disrupting spawning migrations, and filling spawning habitat with suspended fine sediments. As sturgeon are benthic omnivores, modification of the benthos could affect the quality, quantity and availability of sturgeon prey species.

The Hudson River navigation project authorizes maintenance of a channel that stretches 155 miles from New York City to Waterford, NY, and is between 200 and 600 ft wide 14 to 34 ft in depth, depending on location. The only portions of the channel that is regularly dredged are the North Germantown and Albany reaches. Dredging is scheduled at times of year when sturgeon are least likely to be in the dredged reaches.

7.5 Research

Atlantic sturgeon have been the focus of field studies since the 1970s. The primary purposes of most studies are for monitoring populations and gathering data for physiological, behavioral, and ecological studies. Research on sturgeon is managed so that it does not operate to the disadvantage of the species, and all scientific research permits are conditioned with mitigation measures to ensure that the research impacts species as minimally as possible.

Most current sturgeon research is managed under the *Programmatic Biological Opinion on the Implementation of a Program for the Issuance of Permits for Research and Enhancement Activities on Atlantic and Shortnose Sturgeon* (NMFS 2023). Atlantic sturgeon mortalities due to delayed mortality from surgeries, as described in the programmatic biological opinion, are shown in Table 3. Shortnose sturgeon research has been more limited, with range-wide delayed mortality estimates of adults and juveniles in the last five years being 8.295 and 1.75, respectively. There are an estimated 214 Atlantic sturgeon that will be captured under the permit functioning outside of the programmatic consultation, affecting approximately 3% CB DPS and 2% NYB DPS.

DPS	Delayed adult mortality estimates	Delayed juvenile mortality estimates
GOM	0.9	0.8
NYB	6.17	12.25
CB	2.46	3.705

Table 3. Estimates of adult and juvenile Atlantic sturgeon cumulative delayed mortalities over the past five years

Permitted researchers are also required to notify the appropriate NMFS Regional Office at least two weeks in advance of any planned field work so that the Regional Office can facilitate this coordination and take other steps appropriate to minimize disturbance from multiple permits. Permitted research in the action area is listed in Table 4. For each permit, the applicable biological opinion considered cumulative effects to the species (as defined for the ESA) and concluded that issuance was not likely to jeopardize the continued existence of the Atlantic sturgeon, either individually or cumulatively.

Table 4. Research Permits issued by NMFS for sturgeon in the action area

Organization	File #	Project	Location	Timeframe
NYSDEC	20340	Section 10 permit for research and monitoring of Atlantic sturgeon and Shortnose Sturgeon in the Hudson River Estuary	Hudson River	**Date Issued:** 2017-03-31 **Date Expires:** 2027-03-31
School of Marine and Atmospheric Sciences, Stony Brook University	20351	Atlantic and Shortnose Sturgeon Population Dynamics and Life History in New York and Coastal Marine an Riverine Waters	Hudson River and Atlantic Ocean	**Date Issued:** 2017-03-31 **Date Expires:** 2027-03-31
Delaware State University	20548	Reproduction, habitat use, and interbasin exchange of Atlantic and Shortnose Sturgeons in the mid-Atlantic	Tidal Delaware and Hudson Rivers and nearshore Atlantic Ocean	**Date Issued:** 2017-03-31 **Date Expires:** 2027-03-31
NMFS Greater Atlantic Region Fisheries Office	21858	Permit to Take/Collect, Receive/Possess, and Export Protected Atlantic Sturgeon and Shortnose Sturgeon, and their Parts for Scientific and Educational Purposes	U.S. east coast and western Atlantic Ocean within the U.S. exclusive economic zone (EEZ) and rivers from Maine through Florida	**Date Issued:** 2018-09-07 **Date Expires:** 2027-03-31

7.6 Fisheries Bycatch

Directed harvest of Atlantic and shortnose sturgeon is prohibited by the ESA. In the U.S., shortnose sturgeon have not been commercially fished since their ESA listing in 1967. Atlantic sturgeon have not been commercially fished since an ASMFC moratorium on their harvest in 1998 and have not been commercially fished in the Hudson since 1996. However, sturgeon are taken incidentally in fisheries targeting other species in rivers, estuaries, and marine waters throughout their range (ASSRT 2007c; Collins 1996; Dadswell 1979; Dovel 1992; NMFS 2007; NMFS 2014). Sturgeon populations can sustain minimal incidental mortality from fishery activity due to slow growth rates and late maturity.

Because sturgeon mix extensively in marine waters and may access several river systems, they are subject to being caught in multiple fisheries throughout their range. Commercial fishery bycatch represents a significant threat to the viability of ESA-listed sturgeon species and populations. Reported mortality rates of sturgeon (Atlantic and shortnose) captured in inshore and riverine fisheries range from 8% to 20% (Bahn 2012; Collins 1996). Incidental capture in riverine fisheries has also been reported to cause disruption and abandonment of spawning migrations among shortnose sturgeon (Moser 1993; Weber 1996).

Poaching represents another fishing threat, though its full extent and impact to individual populations is unknown. Poaching may be more prevalent where legal markets for sturgeon exist from importations, commercial harvest, or commercial culture. New York, New York, as a city, is one of the largest caviar importers in the world with at least six distributors in the city specializing in caviar sales and at least two restaurants, Caviar Russe and Caviarteria, with menus featuring caviar.

Sturgeon are benthic feeders, and as a result, they are generally captured near the seabed unless they are actively migrating (Moser 1995a). Sturgeon are particularly vulnerable to being caught in commercial gillnets; therefore, fisheries using this type of gear account for a high percentage of sturgeon bycatch and bycatch mortality. Sturgeon have also been documented in the following gears: otter trawls, pound nets, fyke/hoop nets, catfish traps, shrimp trawls, and recreational hook and line fisheries.

7.6.1 Federally Managed Fisheries

Several Federally regulated fisheries that may encounter Atlantic sturgeon have fishery management plans (FMPs) that have undergone section 7 consultation with NMFS. On December 16, 2013, NMFS issued a “batched” section 7 biological opinion on the following fisheries: Northeast multispecies; monkfish; spiny dogfish; Atlantic bluefish; Northeast skate complex; mackerel/squid/butterfish; and summer flounder/scup/black sea bass (NMFS 2013). Exempted average annual total captures (lethal and nonlethal) of Atlantic sturgeon in the seven batched fisheries was 2,560, with 197 exempted average annual mortalities. These estimates do not account for all actual Atlantic sturgeon bycatch in Federal fisheries, but if these take levels are exceeded, consultation must be reinitiated. Gillnet gear is used by five of the seven fisheries, and bottom trawl gear is used by six of the seven fisheries. It is also possible that bottom longline gear, which is used in the Northeast multispecies, monkfish, and spiny dogfish fisheries, could hook Atlantic sturgeon while foraging, but there have been no reported interactions.

Estimated rates of Atlantic sturgeon caught as bycatch in Federal fisheries are highly variable and somewhat imprecise due to small sample sizes of observed trips. The majority (73%) of all Atlantic sturgeon bycatch mortality in New England and Mid-Atlantic waters is attributed to the monkfish sink gillnet fishery (ASMFC 2007a). Several estimates of Atlantic sturgeon bycatch in the Atlantic are shown in Table 5. Atlantic sturgeon bycatch estimates for Northeast gillnet and trawl gear from 2011-2015 (approximately 761 fish per year for gillnets, 777 for trawls) are substantially lower than those from 2006-2010 (approximately 1,074 fish per year for gillnets, 1,016 for trawls; ASMFC 2017a).

Table 5. Atlantic sturgeon bycatch estimates

Fishery/Location	**Time Period**	**Estimated bycatch**	**Source**
Offshore gillnet fisheries operating from Maine through North Carolina	1989-2000	1,385 killed	Stein (2004b)
Offshore gillnet and otter trawl fisheries	2001-2006	649 killed	Stein (2004b)
Monkfish gillnet fishery	2001 to 2006	224 recorded interactions (99 lethal; 44%)	ASMFC (2007a)
gillnet fisheries	each year from 2000-2015	1,139 fish (295 lethal; 25%)	ASMFC (2017a)
otter trawl fisheries	each year from 2000-2015	1,062 fish (41 lethal; 4%)	ASMFC (2017a)

7.6.2 State-Authorized Fisheries

Several fisheries for species not managed by a Federal FMP occur in state waters of the action area, as well as fishing by dually permitted vessels (i.e., those possessing both a state and Federal permit). In addition, unmanaged fisheries may occur in Federal waters. Sturgeon may be vulnerable to capture, injury, and mortality in a number of these fisheries. Captures of sturgeon in these fisheries have been reported through state reporting requirements, research studies, vessel trip reports, Northeast Fisheries Science Center (NEFSC) observer programs, and anecdotal reports (ASMFC 2017a; ASSRT 2007c).

The available bycatch data for FMP fisheries indicate that sink gillnets and bottom otter trawl gear pose the greatest risk to Atlantic sturgeon, although they are also caught by hook and line gear, fyke nets, pound nets, drift gillnets, and crab pots (ASMFC 2017a; Mangold 2007). It is likely that this vulnerability to these types of gear is similar to Federal fisheries, although information on the number of Atlantic sturgeon captured or killed in non-Federal fisheries, which primarily occur in state waters, is extremely limited. Given the high prevalence of gillnet and otter trawl use in nearshore coastal and inland fisheries, state managed fisheries may have a greater impact on sturgeon than Federal fisheries using these same gear types. In an Atlantic sturgeon "reward program," which provided commercial fishermen monetary rewards for reporting captures of Atlantic sturgeon in the Chesapeake Bay over a 16-year period from 1996-2012, biologists counted 10 Atlantic sturgeon (from more than 2,000 reported) that died because of their capture (Mangold 2007).

The Recovery Plan for shortnose sturgeon (NMFS 1998b) lists commercial and recreational shad fisheries as a source of bycatch. Adult shortnose sturgeon are believed to be especially vulnerable to fishing gears for anadromous species (such as shad, striped bass, alewives and herring) during times of extensive migration – particularly their spawning migration (Litwiler 2001). Bycatch of shortnose sturgeon from the shad gillnet fisheries can be quite substantial. Catch rates in drift gillnets are believed to be lower than for fixed nets, longer soak times appear to be correlated with higher rates of mortalities, and the cooler water temperatures likely increase release survivability of shortnose sturgeon. As gillnet gear is known to pose an interaction risk to ESA-listed sturgeon, New York State gillnet fisheries have the potential to interact with these species when the fisheries overlap with them. Atlantic sturgeon are also known to be caught in state water horseshoe crab fisheries using trawl gear (Stein 2004a) and can interact with bottom otter trawls in the Northern shrimp fishery.

Atlantic sturgeon have also been observed captured in state recreational fisheries, yet the total number of interactions that occur annually is unknown. There are numerous reports of Atlantic sturgeon bycatch in recreational striped bass fishery along the south shore of Long Island, particularly around Fire Island and Far Rockaway. Unreported mortality is likely occurring. Data from the Atlantic Coast Sturgeon Tagging Database showed that from 2000-2004, the striped bass fishery accounted for 43% of Atlantic sturgeon recaptures (ASSRT 2007c). The striped bass-weakfish fishery also had one of the highest bycatch rates of 30 directed fisheries according to NMFS Observer Program data from 1989-2000 (ASSRT 2007c).

NMFS also engages in educational outreach efforts on disentanglement, release, and handling and resuscitation of sturgeon. Sturgeon handling instructions are based on best practices identified in NOAA Technical Memorandum documents (Damon-Randall 2010; Moser 2000b).

7.7 Water Quality

Anthropogenic sources of marine pollution, while difficult to attribute to a specific Federal, state, local, or private action, may affect ESA-listed species in the action area. Sources of contamination in the action area include atmospheric loading of pollutants, stormwater runoff from coastal development, groundwater discharges, industrial development, and debris. Coastal and riparian areas are also heavily impacted by real estate development and urbanization resulting in storm water discharges, non-point source pollution, and erosion. Contaminants can alter the pH or DO levels of receiving waters, which may lead to mortality, changes in fish behavior, deformations, and reduced egg production and survival.

While the consequences of contaminants on sturgeon are relatively unclear, pollutants may make sturgeon more susceptible to disease by weakening their immune systems or may have a consequence on sturgeon reproduction and survival. Chemicals such as chlordane, dichlorodiphenyldichloroethylene (DDE), dichlorodiphenyltrichloroethane (DDT), dieldrin, polychlorinated biphenyls or PCBs, cadmium, mercury, and selenium settle to the river bottom and are later consumed by benthic feeders, such as macroinvertebrates, and then work their way higher into the food web (e.g., to sturgeon). Some of these compounds may affect physiological processes and impede a fish's ability to withstand stress, while simultaneously increasing the stress of the surrounding environment by reducing DO, altering pH, and altering other physical properties of the water body.

Life histories of Atlantic and shortnose sturgeon (i.e., long lifespan, extended residence in estuarine habitats, benthic foraging) predispose both species to long-term, repeated exposure to environmental contamination and potential bioaccumulation of heavy metals and other toxicants (Dadswell 1979; NMFS 1998c). Dwyer (2005) compared the relative sensitivities of common surrogate species used in contaminant studies to 17 species, including Atlantic sturgeons, and found that Atlantic sturgeon were ranked the most sensitive species tested for four of the five chemicals.

Shortnose sturgeon collected from the Delaware and Kennebec Rivers had total toxicity equivalent concentrations of polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), PCBs, DDE, aluminum, cadmium, and copper above adverse effect concentration levels reported in the literature (ERC 2002). Contaminants, such as dioxin and furans, have also been detected in ovarian tissue from shortnose sturgeon. Heavy metals and organochlorine compounds accumulate in sturgeon tissue, but their long-term effects are not known (Ruelle 1992; Ruelle 1993). Increases in fecal coliform and estradiol concentrations also affect all wildlife that use the river as a habitat, such as impacts to sex ratios and gonadal development. Although the effects of these contaminants are unknown in Atlantic sturgeon, Omoto (2002) found that by varying the oral doses of estradiol-17β or 17α-methyltestosterone given to captive hybrid (*Huso huso* female × *Acipenser ruthenus* male) "bester" sturgeon they could induce abnormal ovarian development or a lack of masculinization.

Sensitivity to environmental contaminants also varies by life stage. Early life stages of fish appear to be more susceptible to environmental and pollutant stress than older life stages. Early life stage Atlantic and shortnose sturgeon are vulnerable to PCB and tetrachlorodibenzodioxin (TCDD) toxicities of less than 0.1 part per billion (Chambers 2012). Increased doses of PCBs and TCDD have been correlated with reduced physical development of Atlantic sturgeon larvae, including reductions in head size, body size, eye development and the quantity of yolk reserves (Chambers 2012). High levels of contaminants, including chlorinated hydrocarbons, are associated with reproductive impairment, reduced survival of larval fish, delayed maturity, and posterior malformations in fish species.

Contaminants in the Hudson River watershed

The Hudson River Estuary has a history of toxic contamination, with chemicals originated from many sources, including: electric capacitor and transformer manufacturing (polychlorinated biphenyls or PCBs), coal gasification (polycyclic aromatic hydrocarbons or PAHs), herbicide manufacturing and waste incineration (polychlorinated dibenzo-p-dioxins or dioxins), electric power generation (mercury from burning coal), battery manufacturing (cadmium), and pesticide production and application (e.g., DDT, chlordane, and dieldrin; Beard 2020). While contaminant removal efforts have been conducted and are ongoing, the scale and persistence of these contaminants cause them to remain an issue in the ecosystem.

All fishing in the upper Hudson was banned by the NYSDEC in 1976 because of health concerns. By 1983, nearly the entire Hudson River, from Hudson Falls to New York City (approximately 200 miles) was declared a superfund site by the Environmental Protection Agency (EPA). Despite becoming a superfund site in 1983, Phase I of the clean-up operation in the Hudson River did not begin until 2009 and clean-up was expected to be completed by 2020. Because of Covid, the cleanup is still ongoing. The first five-year review for the Hudson River PCBs Superfund site was completed in June 2012. The Proposed Second Five-Year Review report was provided to the public in June 2017 and included a public comment period. The final version of the report was released in April 2019. EPA initiated its third five-year review in spring 2022. These five-year reviews addressed Operable Units (OU) 1 and 2 (Upper Hudson in-river sediment and the Remnant Deposits). Five-year reviews will continue and will eventually include OU 4 (Upper Hudson River floodplain), once the floodplain cleanup decision is made. A study reported that mercury is in common Hudson River fish (Levinton 2008).

7.8 Non-Native and Invasive Species

Non-native species can have significant impacts on ecosystems and native fauna and flora. Non-native species can reduce native species abundance and distribution, and reduce local biodiversity by out-competing native species for food and habitat. They may also displace food items preferred by native predators, disrupting the natural food web. The introduction of non-native species is considered one of the primary threats to ESA-listed species (Brown 2005;

Wilcove 1998). Non-native species were cited as a contributing cause in the extinction of 27 species and 13 subspecies of North American fishes over the past 100 years (Miller 1989).

The introduction of invasive blue (*Ictalurus furcatus*) and flathead (*Pylodictis olivaris*) catfish along the Atlantic coast has the potential to adversely affect ongoing anadromous fish restoration programs and native fish conservation efforts, including Atlantic sturgeon restoration (Brown 2005; Bunch 2021). East Coast sturgeon evolved with the largest predators being striped bass (*Morone saxatilis*), which have a maximum gape size of approximately 8.7 in (0.22 m; Baird 2020), while blue and flathead catfish are essentially not gape-limited in their prey sizes (Locher 2022; Slaughter IV 2008) and are more consistent with a marine predator (Fabrizio 2021; Scharf 2000).

Invasive species could become an increasing issues when combined with climate change. The stationary nature of anadromous fish reproduction in an otherwise shifting area of habitat occupation could make some populations vulnerable to invasive species. Invasive species that are better adapted to warmer water temperatures can also outcompete native species that are physiologically geared towards lower water temperatures (Lockwood 2011).

7.9 Vessel Operations

The New York/New Jersey Harbor complex is a major shipping port and center of commerce, with numerous private and commercial vessels (e.g., container ships, commuter ferries, recreational boaters) that operating in the action area with the potential to interact with ESA-listed species. These activities have the potential to result in lethal (i.e., entanglement or boat strike) or non-lethal impacts to sturgeon.

The existing harbor development project consists of the main navigation channels in the Port of New York and New Jersey that support various vessels including container terminals. The Port of New York/New Jersey is a multi-use port and receives calls from bulkers, containerships, general cargo vessels, passenger vessels, Roll-on/roll-off vessels, and tankers. The navigation channels extend from the Atlantic Ocean through the Port of New York and New Jersey and to the marine terminals that are called on by commercial deep-draft vessels. The Port of New York and New Jersey is the busiest container port on the East Coast and the second busiest container gateway in the United States. The Port of New York and New Jersey is typically the first port of call for the largest container vessels calling on the U.S. East Coast.

7.9.1 Vessel Strike and Entanglement

Vessels operating in the action area have the potential to interact with ESA-listed sturgeon and may involve disturbance or injury/mortality due to collisions or entanglement in anchor lines. It is important to note that minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so it is more likely to become vulnerable to consequences such as entanglements.

Although the exact number of sturgeon killed as a result of being stuck by vessels is unknown, records of these interactions have been documented (Balazik 2012b; Brown 2010). Studies conducted in the Delaware River and in the James River indicate that Atlantic sturgeon do not avoid or move away from vessels (Barber 2017; DiJohnson 2019). The best available information supports the conclusion that sturgeon are struck by small (*e.g.*, recreational) as well as large vessels. However, examination of the salvaged carcasses indicates that most fatalities are the result of the sturgeon being struck by a large vessel causing either blunt trauma injuries (*e.g.*, broken scutes, bruising, damaged soft tissues) or propeller injuries (*e.g.*, decapitation, complete transection of other parts of the sturgeon body, or deep slices nearly through the body depth of large sturgeon) (Balazik 2012b). NMFS has only minimum counts of the number of Atlantic sturgeon that are struck and killed by vessels, because only sturgeon that are found dead with evidence of a vessel strike are counted. Looking at strandings from the NMFS Sturgeon Salvage Program (unpublished data) as far west as Rockaway, NY, only two salvage reports mention that the damage was from a vessel strike (one was very decomposed). From 2013 to 2020, there have also been 13 reported-but-not-salvaged carcass reports from the NYSDEC where they found some evidence of a possible vessel strike within the Harbor Deepening Channel Improvements (HDCI) project area. The reports do not mention the size of the vessels involved, but it is understood that only a large vessel could cut through a large fish or cause noticeable traumatic injury. There has been documentation of smaller fish with fatal wounds, but not necessarily cut through that appear to be from smaller vessels. It is unclear whether the strikes occurred before or after the sturgeon died. Most Atlantic sturgeon carcasses are not found and, when found, many are not reported to NMFS or to our sturgeon salvage co-investigators (Balazik 2012b; Fox 2020).

Other commercial and private activities, have the potential to result in lethal (boat strike) or non-lethal (through harassment) takes of ESA-listed species that could prevent or slow a species' recovery. As sea turtles, and Atlantic sturgeon may be in the area where high vessel traffic occurs, the potential exists for collisions with vessels transiting from within and out of the action area.

7.9.2 Vessel Noise

The noise level in the ocean is thought to be increasing at a substantial rate due to increases in shipping and other activities (Southall 2008). Concerns about noise in the action area of this consultation include increasing noise due to increasing commercial shipping and recreational vessels. Although noise pollution has been identified as a concern for marine mammals, these elevated levels of underwater noise may also be of concern for sturgeon. Until additional studies are undertaken, it is difficult to determine the consequences these elevated levels of noise will have on sturgeon and to what degree these levels of noise may be altering the behavior or physiology of these species.

8 EFFECTS OF THE ACTION

Effects of the action are all consequences to ESA-listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. This effects analyses section is organized following the stressor, exposure, response, risk assessment framework (50 CFR 402.02).

8.1 May Affect, Not Likely to Adversely Affect

8.1.1 Turbidity from trawling

Bottom trawling on flat sandy/muddy bottom can cause the sediments to become suspended in the water. Given the small size and short trawl times, as described in Section 3.2, areas of increased turbidity are expected to be small and temporary in nature. Avoiding sturgeon spawning and gathering areas further limits the number of sturgeon exposed to increased turbidity from trawls.

Turbidity is a well-known stressor to fish generally that can affect the gills and eyes, leading to reduced growth and survival (Lowe 2015; Sigler 1984; Sutherland 2007). However, sturgeon are a benthic species adapted to living in turbid conditions (Allen 2007; French 2014; Wildhaber 2007). Some studies have shown that lake sturgeon increase movement and foraging in increasingly turbid water (Rodrigues 2023). Other studies on Atlantic sturgeon suggest they neither move to nor avoid the increased turbidity (Reine 2014).

The Total suspended solids (TSS) levels expected for all of the proposed activities are below those shown to have adverse consequences on fish (typically up to 1,000 mg/L; Burton 1993). We expect sturgeon to either swim through the plumes associated with the proposed action, or make small evasive movements to avoid them. If they are in the area where trawling will be done, they would likely leave during the times of disturbance. The extent of the turbidity suspended by these activities and the short duration of the turbidity plumes are unlikely to cause any measurable response from Atlantic sturgeon or shortnose sturgeon. Based on the best available information as presented above, we will not be able to meaningfully detect, evaluate, or measure the consequences of re-suspended sediment on sturgeon when added to baseline conditions. Therefore we conclude that impacts from turbidity created by the proposed action is not likely to adversely affect Atlantic or shortnose sturgeon.

8.1.2 Vessel strike

Sturgeon interactions with vessels have been documented, and have been detected from propeller scars on sturgeon carcasses (Balazik 2012b). The benthic nature of sturgeon makes them vulnerable to vessel interactions by deep draft vessels. Exposure of sturgeon to vessel interaction depends on multiple factors, including geographic conditions (e.g., channel morphology, narrow channels, restrictions; Barber 2017), vessel size, and sturgeon behavior.

Large vessels have been typically implicated in vessel strikes because of their deep draft, which may increase the probability of vessel collision with demersal fishes like sturgeon (Brown 2010). Larger vessels also draw more water through their propellers given their large size and therefore may be more likely to entrain sturgeon in the vicinity. However, sturgeon are also at risk from exposure to smaller vessels. Although smaller vessels have a shallower draft and entrain less water, they often operate at higher speeds, which is expected to limit a sturgeon's opportunity to avoid being struck. There is evidence to suggest that small fast vessels with shallow drafts are a source of vessel strike mortality on Atlantic sturgeon (Ian Park, DENRC, personal communication, June 2017). Unlike most vessels described relative to vessel strike risk, the *Clearwater* is generally propelled by sails, rather than motor with propeller, which reduces the area of water where sturgeon would be exposed to vessel strike from the *Clearwater*.

Sturgeon are generally benthically-oriented unless they are migrating. Sturgeon tend to remain on or near the bottom while foraging, which would keep them well below any vessels (i.e., in sufficiently deep water; Balazik 2012b; Fisher 2011; Reine 2014). As sturgeon first move into a spawning river, they tend to follow the thalweg (the lowest point in a river channel) and be near the surface. However, while migrating, Atlantic sturgeon tend to move into the middle water column, but will still be below many vessel drafts as they move within the water column of the channel during this behavior.

Sturgeon are particularly susceptible to vessels when they ascend to the surface to gulp air (Logan-Chesney 2018; Watanabe 2008). Frequency and need for sturgeon to surface depend on depth and tidal stage (Logan-Chesney 2018; Watanabe 2008). Sturgeon actively swim when ascending and descending at swim speeds ranging from 0.17 to 3.17 m/s. Thus, the ability to avoid approaching vessels may be limited when ascending. For an ascending sturgeon to interact with the *Clearwater,* the two have to be at the exact same spot (within a few feet) at the exact same time (seconds). Therefore, the probability of the *Clearwater* striking an ascending sturgeon is extremely low given the large expanses of the channels and geomorphology of the action area, and the short time that the fish are at the surface where the vessel operates.

Vessel strikes or interactions could harm sturgeon. The factors relevant to determining the risk to Atlantic sturgeon and shortnose sturgeon from vessel strikes are currently unknown, but based on what is known for other species we expect they are related to size and speed of the vessels, navigational clearance (i.e., depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of sturgeon in the area (e.g., foraging, migrating, etc.). There are numerous documented sturgeon killed by large vessel propellers (Balazik 2012b; Brown 2010; Demetras 2020) and many documented injuries from recreational vessel strikes (J. Kahn, NOAA Fisheries, unpublished data). Vessel strike impacts from the *Clearwater* are expected to be discountable to individual sturgeon. The presence of the *Clearwater* may disturb sturgeon, resulting in their movement away from the vessel for a short time. Reactions may include a brief startle response, diving, submerging, or attempting to evade the vessel. Based on the anticipated responses, any disruptions are expected to be temporary in nature, with sturgeon resuming normal behaviors shortly after the exposure. No reduction in fitness or overall health of individual sturgeon is anticipated due to the presence of the *Clearwater* in areas occupied by sturgeon. Therefore, we find that the proposed action is not likely to adversely affect Atlantic and shortnose sturgeon from vessel strikes.

8.2 Exposure Analysis

The exposure analysis identifies the ESA-listed species that are likely to co-occur with the physical, chemical, and biological alterations to land, water, and air in space and time caused by the proposed action. We then identify the nature of that co-occurrence in terms of timing, location, duration, frequency, and intensity. The exposure analysis also identifies, as possible, the number, age or life stage, and gender of the individuals likely to be exposed to the actions' effects and the population(s) or subpopulation(s) those individuals represent.

In this section of the opinion, we assess the probable effects resulting from the proposed issuance of the 10(a)(1)(B) permit, which would allow trawling as part of Clearwater's educational program and incidental take of Atlantic sturgeon NYB DPS and shortnose sturgeon in the action area. We assess the probable amount of lethal and non-lethal take and estimate the proportion of those takes that affect each species and, for Atlantic sturgeon NYB DPS. We also summarize the results of studies that have examined effects of trawling and handling on Atlantic and shortnose sturgeon. We rely on these summaries of the literature to determine how individual sturgeon are likely to respond upon being captured in trawl nets and handled prior to release. Based on this body of information, we then assess the risks that capture in trawls and handling pose to individual sturgeon, sturgeon populations, and to the species as listed (NYB DPS of Atlantic sturgeon, and shortnose sturgeon).

This section of the opinion estimates the number of Atlantic and shortnose sturgeon that will be exposed to Clearwater's trawls from issuance of the permit through 2034 (over the 10-year duration of the ITP). This incorporates that Atlantic and shortnose sturgeon are not Clearwater's intended target species, and Clearwater would implement minimization measures (as described in Section 3.2.3) to avoid sturgeon capture, so in the vast majority of Clearwater's trawls there will be no Atlantic or shortnose sturgeon captured.

8.2.1 Trawling Entanglement and Handling

Clearwater has maintained records since 2004 on the number of fish and the fish species that have been captured in their trawls. Their data indicates that a total of 11 individual sturgeon have been captured over 15 total years of data collection (no data were reported for 2007, 2010, 2012, and 2013) for an average of 0.75, or rounded to whole fish, one sturgeon captured per year (Table 6).

Table 6. Reported incidental catch of sturgeon by Clearwater (2004-2022)

Year	*Number of sturgeon captured*	*Location of capture*
2004	2	79th St, Haverstraw
2005	1	[not reported]
2006	1	Haverstraw
2007	No Data Reported	
2008	3	Alpine (2), Verplank
2009	1	Poughkeepsie
2010	No Data Reported	
2011	1	Beacon
2012	No Data Reported	
2013	No Data Reported	
2014	0	0
2015	1 (Atlantic Sturgeon)	Beacon
2016	0	0
2017	0	0
2018	1 (Atlantic Sturgeon)	Ossining
2019	0	0
2020	0	0
2021	0	0
2022	0	0
Total	**11**	

Based on their previous capture rate, Clearwater would be expected to capture an average of one individual sturgeon per year, or 10 individual sturgeon over the 10-year period covered by the ITP (2024-2034). However, the population size of Atlantic and shortnose sturgeon in the Hudson River can reasonably be expected to deviate from year to year based on fluctuations in recruitment success and changes in environmental and other factors discussed in the Environmental Baseline (Section 7) that can affect sturgeon fitness, spawning and survival. Thus, it is possible that, in some years, Clearwater will capture more or less than their historical average of one individual sturgeon per year. Based on Clearwater's data and fluctuations in sturgeon recruitment, we would expect an average of one sturgeon per year to be exposed to effects from trawl entanglement and handling.

Sturgeon encountered by Clearwater are most likely to be Atlantic sturgeon individuals, mostly sub-adults. Larger individuals would likely be able to avoid the otter trawl that Clearwater uses, because of its small size and slow speed. A small otter trawl like the one employed by Clearwater has very low likelihood of catching a spawning-age sturgeon because of the small size of the net and slow speed of the towing vessel. Furthermore, Clearwater will not be trawling in known spawning areas between Norrie Point and Hyde Park during spawning season (May through June).

The majority of individual Atlantic sturgeon in the action area are likely to originate from the Hudson River population of the NYB DPS. White's (2024) mixture analysis provided additional support that the majority of individuals in the action area would be natal to the Hudson River, with an estimated 98.9 % (95 % CI: 96.3–99.6 %) of the total likely originating from the Hudson River population which in turn would assign them to the NYB DPS. White (2024) results also found 96.7 % of 452 individuals caught were assigned to populations within the New York Bight DPS (i.e. the Hudson and Delaware rivers). Due to the spatial extent of the action area (125 miles), which extends across euhaline, mesohaline and freshwater reaches of the river, the affected Atlantic sturgeon DPS is likely to be solely the NYB DPS throughout the action area as a result of the above stated distributions from the White (2024) study. The composition of Atlantic sturgeon in euhaline sections of river is likely to contain a higher proportion of adults and migratory subadults, and, thus, a higher proportion of migrants from other rivers but still within the NYB DPS than freshwater stretches of river that would be likely to contain individuals exclusively from the Hudson River population of the NYB DPS. While there is a chance of sturgeon from other DPSs being in the action area however, we find the probability of Clearwater catching an individual from any other DPS to be discountable based on the high probability (98.9%) of incidentally catching a Hudson River population sturgeon belonging to the NYB DPS and the limited historical catch rate of 11 sturgeon over 20 years and 98% being from NYB DPS.

Based on communication with the NYSDEC cited in the ITP application, Atlantic sturgeon encountered by Clearwater are most likely to be from the NYB DPS (98% of the time). In freshwater sections of the river we assume 100% of Atlantic sturgeon would be from the Hudson population of the NYB DPS. We do not know the exact ratio of the action that will occur in freshwater versus euhaline sections of the river. Based on the best available information on the action area including the location of the salt wedge in the Hudson River, we will assume that 50% of the action will occur in euhaline sections of river and 50% will occur in freshwater sections of the river. Based on recent population studies and historical data provided by NYSDEC, upwards of 96% of sturgeon caught in the Clearwater trawl will be Hudson River origin. Using the DPS ratios described in White et al. (2024), we would expect that all captured individuals to be from the Hudson River and any individuals that are not from Hudson River population they would be from the neighboring Delaware or Connecticut Rivers. We conclude, the Atlantic sturgeon DPS likely to adversely affected by the proposed ITP, incidental catch of 10 sturgeon over 10 years, to be exclusively from the NYB DPS.

8.2.2 Handling

Despite their general hardiness, handling sturgeon after capture can lead to severe stress or even mortality if done improperly or in combination with unfavorable environmental conditions such as elevated water temperatures or low DO (Kahn 2010; Moser 2000a). Handling stress generally increases the longer sturgeon are held out of the water (Beardsall 2013). Total handling time and associated stress will be greater for individual sturgeon undergoing invasive procedures. Among fish captured in trawls, higher survival is associated with short air exposure times and low air temperature on deck (Johnson 2015; Kumar 2006; Parker 2003).

8.3 Response Analysis

8.3.1 Trawling Entanglement

As noted above in our exposure analysis, we anticipate a small number of ESA-listed sturgeon will be captured in trawl gear as part of the proposed action. Injury and mortality among sturgeon as a result of trawl capture has been widely documented (ASMFC 2007b; Beardsall 2013; Miller 2011). Entanglement in trawling nets could result in injury and lethal physical trauma, reduced fecundity, and delayed or aborted spawning migrations of sturgeon (Moser 1995b). Entanglement in trawl nets can constrict a sturgeon’s gills, resulting in increased stress and risk of suffocation (Collins 2000a; Kahn 2010; Moser 2000a).

For all species of sturgeon, research has revealed that stress from capture is affected by temperature, DO, and salinity, and this vulnerability may be increased by the stress of capture, holding, and handling (Kahn 2010). Analysis of the empirical evidence suggests that individuals collected in high water temperatures and low DO concentrations, combined with longer times in nets, were more at risk of mortality (e.g., by suffocating, getting crushed, eaten by a predator that is also in the net) and stress (Broadhurst 2006; Kahnle 1998). Numerous studies document the effect of reduced DO, increased temperature, or increased salinity on sturgeon survival (e.g., Jenkins 1993; Niklitschek 2009; Secor 2001; Secor 2002; Sulak 1999).

Long-term responses, including serious injury and mortality, have been reported from commercial fisheries bycatch of sturgeon. Researchers have reported fisheries bycatch mortality rates of Atlantic and shortnose sturgeon ranging from 5% to 20% (ASMFC 2007b; ASMFC 2017b; Bahn 2012; Beardsall 2013; Collins 1996; Miller 2011; Stein 2004c). Contributing to the mortality in commercial fisheries bycatch are the typically extended durations of commercial trawling tow times, ranging from 60 to 180 minutes in many fisheries. By contrast, Clearwater’s trawling operations will occur for a maximum of five minutes per tow. Furthermore, reported mortality rates in trawls deployed for research purposes are even lower than those reported for fisheries. The NEFSC and Northeast Area Monitoring and Assessment Program (NEAMAP) bottom trawl surveys have recorded the capture of a few hundred Atlantic sturgeon since the inception of each (1972 and 2008, respectively). To date, there have been no recorded serious injuries or mortalities.

Most sturgeon captured in trawl gear would likely experience a short-term, physiological stress response. Except for very rare instances, results from previous sturgeon research trawl surveys indicate that capture in nets does not cause any effects on the vast majority of sturgeon beyond

24 hours post-release. No information is available on the impacts of trawl capture on sturgeon migration or spawning activity. Captures of shortnose sturgeon in commercial riverine gillnet fisheries have led to disruption and abandonment of spawning migrations (Moser 1995b; Weber 1998) in Southern rivers. However, stress responses in captured sturgeon are highly dependent on soak time and water temperature, thus it is difficult to compare the responses observed following gillnet capture to those that might occur following capture in trawls. Clearwater's limited trawl duration (five minutes) and avoidance of spawning areas would make impacts to migration and spawning unlikely.

As a condition of their ITP, Clearwater will be required to take necessary precautions while deploying and retrieving the trawl gear to ensure sturgeon are not unnecessarily harmed. The five minute tow, slow vessel speed (less than 2-3 kts), and 100% monitoring will significantly reduce the probability of stress and injury to individual fish. We anticipate the effects to be short-lived and not result in reduced reproductive capacity or other impairment.

In summary, the incidental capture of ESA-listed sturgeon species in trawl capture gear used will result in short-term negative effects (i.e., elevated stress levels, net abrasion), and one mortality over the 10-year permit term. Although one mortality would be permitted, killing a fish in five minute, slow tow is extremely unlikely.

8.3.2 Handling

Handling of Atlantic and shortnose sturgeon may cause short term stress responses; however those responses are not likely to result in pathologies because of the short duration of any handling. Signs of handling stress are redness around the neck and fins and soft fleshy areas, excess mucus production on the skin, and a rapid flaring of the gills. In some cases, sturgeon may display altered behavior after being released, for example, swimming towards the ocean rather than remaining in the river, or, in some instances, aborting spawning runs completely (Kahn 2010; Moser 1995a; Schaffter 1997). Whether these responses were a result of being handled or a result of their initial capture in a net is not clear. Sturgeon may also inflate their swim bladder when held out of water, and if they are not returned to neutral buoyancy prior to release they will float and possibly be susceptible to sunburn and bird attacks (Kahn 2010; Moser 2000a). Under certain circumstances, pre-spawning adults that are captured may interrupt or abandon their spawning migrations after being handled (Moser 1995a). However, based on telemetry data and other observations of individual animals captured on the spawning ground, Kahn (2014a) found that adult sturgeon did not stray far from the site of capture and many immediately returned to spawning behavior as soon as they were released.

If ESA-listed sturgeon are captured in Clearwater's trawls, they will be handled using NOAA safe handling protocols and returned back to the water immediately. Due to short air exposure and handling times, we anticipate most sturgeon caught to exhibit short term stress responses to handling caused by the proposed action, with very minimal risk to mortality.

8.4 Summary of Adverse Effects

Trawling in the Hudson River will lead to interaction with shortnose sturgeon and Atlantic Sturgeon. The five minute tow, slow vessel speed of less than 2-3 kts, and use of NOAA safe handling protocols (Damon-Randall 2010) will significantly reduce the probability of stress and injury to individual fish. In summary, while the capture of Atlantic and shortnose sturgeon in trawls may result in short-term negative effects (i.e., elevated stress levels, net abrasion), with the exception of those very rare instances of capture mortality, the proposed action is not expected to result in reduced fitness or have any long-term adverse effects on individual sturgeon. This conclusion can be reached as long as all of the handling protocols, mitigation measures, and any other required conditions of the ITP are closely followed by Clearwater. We anticipate the effects of being captured in a trawl net and subsequently handled to be released, to be short-lived and not result in reduced reproductive capacity or other impairment. We anticipate that Clearwater may capture and handle up to 10 individual sturgeon (either Atlantic or shortnose), which up to four sturgeon (any combination of Atlantic and shortnose sturgeon) may be taken in any year. Of these, one may be lethal for the duration of the 10-year permit, for a total of 10 individual sturgeon (either Atlantic or shortnose) through 2034. Although one mortality would be authorized, killing a fish in five minute, slow tow is extremely unlikely due to the limited time in the net and quick release handling protocols identified above.

9 CUMULATIVE EFFECTS

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

During this consultation, we searched for information on future state, tribal, local, or private (non-Federal) actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the environmental baseline, which we expect will continue in the future. Anthropogenic effects include climate change, ship strikes, sound, fisheries, dams, and pollution. An increase in these activities could result in an increased effect on ESA-listed species; however, the magnitude and significance of any anticipated effects remain unknown at this time. The best scientific and commercial data available provide little specific information on any long-term effects of these potential sources of disturbance.

10 INTEGRATION AND SYNTHESIS

This opinion includes a jeopardy analysis for NYB DPS of Atlantic sturgeon and shortnose sturgeon. Section 7(a)(2) of the ESA and its implementing regulations require every Federal agency, in consultation with and with the assistance of the Secretary, to insure that any action it authorizes, funds, or carries out, in whole or in part, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species. The jeopardy analysis therefore relies upon the regulatory definition of ‘jeopardize the continued existence of.’

Jeopardize the continued existence of means “to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR 402.02). Recovery, used in that definition, means “improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act” (50 CFR 402.02).

The Integration and Synthesis section is the final step in our assessment of the risk posed to species as a result of implementing the proposed action. In this section, we add the Effects of the Action (Section 8) to the Environmental Baseline (Section 7) and the Cumulative Effects (Section 9) to formulate the agency’s biological opinion as to whether the proposed action is likely to: reduce appreciably the likelihood of both the survival and recovery of a ESA-listed species in the wild by reducing its numbers, reproduction, or distribution. This assessment is made in full consideration of the Status of the Species Likely to be Adversely Affected (Section 6).

For the proposed action of issuing an ITP for the incidental take of sturgeon during operations on the *Clearwater*, we consider whether the effects of the proposed action reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of shortnose sturgeon and Atlantic sturgeon NYB DPS. The purpose of this analysis is to determine whether the proposed action, in the context established by the Status of Species Likely to be Adversely Affected, Environmental Baseline, and Cumulative Effects, would jeopardize the continued existence of shortnose sturgeon and Atlantic sturgeon NYB DPS.

10.1 Shortnose sturgeon

The Hudson River population of shortnose sturgeon is the largest in the United States. Studies indicate an extensive increase in abundance from the late 1970s (13,844 adults; Dovel 1992) to the late 1990s (56,708 adults; 95% confidence interval [CI] = 50,862-64,072; Bain 1999b). This increase is thought to be the result of high recruitment (31,000-52,000 yearlings) from 1986-1992 (Woodland 2007). Woodland (2007) examined environmental conditions throughout this 20-year period and determined that years in which water temperatures drop quickly in the fall and flow increases rapidly in the fall (particularly October), are followed by high levels of recruitment in the spring. This suggests that these environmental factors may index a suite of environmental cues that initiate the final stages of gonadal development in spawning adults. The population in the Hudson River exhibits substantial recruitment and is considered to be stable at high levels. The habitat characteristics of the lower Hudson (i.e., Manhattan to the confluence of New York Harbor) and the Upper New York Harbor, in general, consist of deep channel habitat and salinity levels that range from 11-30 ppt. Shortnose sturgeon eggs or yolk-sac larvae, occurrence is limited to the waters near the spawning grounds (i.e., Hudson River, below the Federal Dam at Troy to about Coxsackie, NY are likely to occur in this area (Bain 1997; Dovel 1992; Kazyak 2020). We also do expect that juveniles would be present due to the action area being the Hudson River, their natal river, which juveniles are known to exist.

The expected non-lethal take of up to 10, and the lethal take of up to one, shortnose sturgeon through 2034 is expected as a result of the action. Because the displacement of individual sturgeon as a result of incidental trawl capture is temporary and very small in relation to the individual and species' ranges, and because the action will not impede shortnose sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds in the Hudson River, no change in the distribution of shortnose sturgeon is anticipated from the action.

The number of lethal takes of shortnose sturgeon as a result of the action (maximum of one) represents an extremely small percentage of the shortnose sturgeon population in the Hudson River, which is believed to be stable at high numbers, and an even smaller percentage of the total population of shortnose sturgeon range-wide. While the death of up to one shortnose sturgeon over the 10 years covered by the proposed ITP will reduce the number of shortnose sturgeon in the population compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this population or its stable trend as this loss represents a very small percentage of the population. The non-lethal take of up to 10 shortnose sturgeon is not expected to result in a reduction in numbers as it is assumed those individuals will be returned to the population. The loss of one individual over 10 years from this population will not appreciably reduce the numbers of individuals from this population and therefore will not appreciably reduce the numbers of individuals of shortnose sturgeon.

Reproductive potential of the Hudson River population is not expected to be affected by the lethal take of one individual in any other way other than through a reduction in the population. The most publicized abundance estimate for the Hudson River shortnose population is 61,057 total individuals (Bain 2000a; Bain 1997; Bain 2007; NMFS 2010). A reduction in the number of female shortnose sturgeon in the Hudson River would have the effect of reducing the amount of potential reproduction in this system as an individual killed would have no potential for future reproduction. The loss of a male sturgeon may have less of an impact on future reproduction as other males are expected to be available to fertilize eggs in a particular year. In considering the best available information on the abundance of shortnose sturgeon both in the Hudson River and throughout the species' range, we believe it is unlikely that the loss of one individual over a 10-year period would affect the success of spawning in any year. Additionally, the proposed action will not affect spawning habitat in any way. A study by Moser (1995a) suggested that under certain circumstances pre-spawning adults that are captured may interrupt or abandon their spawning migrations after being handled (Moser 1995a). However, based on telemetry data and other observations of individual animals captured on the spawning ground, Kahn (2014a) found that adult sturgeon did not stray far from the site of capture and many immediately returned to spawning behavior as soon as they were released. The non-lethal take of up to 10 shortnose sturgeon is not expected to result in a reduction in reproductive potential as it is assumed those individuals will be returned to the population and will not be prevented from spawning as a result of the action. Recovery task priorities vary among population segments because not all segments experience the same sets of problems or receive the same level of research, the Hudson River shortnose sturgeon merited much research over the years. There is general agreement that the Hudson River population is the largest and healthiest shortnose sturgeon riverine population (Bain et al. 2007). Therefore, no sub-lethal effects are anticipated and the loss of one shortnose sturgeon would not appreciably reduce the reproductive potential of the Hudson River population.

Shortnose Sturgeon Recovery Team recommends that each riverine population be considered as a separate management/recovery unit. The recovery minimum abundance for each population segment has not yet been determined. Therefore, establishing ESA-listed species' population size thresholds is a priority. To achieve and preserve minimum population sizes for each population segment, essential habitats must be identified and maintained, and mortality must be monitored and minimized. Based on the information provided above, the non-lethal take of up to 10 individual shortnose sturgeon and the lethal take of up to one shortnose sturgeon through 2034 as a result of the proposed action will not appreciably reduce the likelihood of recovery of the shortnose sturgeon.

After reviewing the effects of the action and cumulative effects in light of the status of the species and environmental baseline, this action is not likely to reduce appreciably the likelihood of survival and recovery of shortnose sturgeon in the wild by reducing their numbers, reproduction, or distribution.

10.2 Atlantic sturgeon

The New York Bight DPS comprises known spawning populations in the Connecticut, Hudson, and Delaware Rivers. As noted previously this action will affect the Hudson River population of the NYB DPS. The Hudson River most likely supports the largest population of Atlantic sturgeon in the United States. Research conducted by the NYSDEC and other researchers using side-scan sonar and acoustic telemetry "suggests that the Hudson River holds one of the largest contemporary populations of Atlantic sturgeon, yet the population remains severely depleted relative to virgin conditions." NYSDEC has conducted annual surveys for Atlantic sturgeon juveniles in the Hudson River since 2004. Increases in juvenile catch rates in the Hudson River between 2004 and 2019 are encouraging and it is possible that if those juveniles reach maturity, the adult abundance may start to increase (Pendleton 2021). While the fisheries have been closed since 1998, recent abundance estimates are very similar to abundance estimates from the time the Atlantic sturgeon coastal fishery was closed (Kahnle et al. 2007; Kazyak et al. 2021). Thus, the 1998 fishing moratorium may have resulted in an increase in recruitment of female spawners (and consequently number of juveniles produced) or the increase may have been because survival of early life stages and/or juveniles has increased (for unknown reasons) in the Hudson River since 2004. Some of the impacts from the threats that contributed to the decline of the New York Bight DPS have been removed (e.g., directed fishing) or reduced as a result of improvements in water quality since passage of the Clean Water Act (CWA). In addition, there have been reductions in fishing effort in state and federal waters, which may result in a reduction in bycatch mortality of Atlantic sturgeon. Nevertheless, areas with persistent, degraded water quality, habitat impacts from dredging, global climate change, continued bycatch in state and federally-managed fisheries, and vessel strikes remain significant threats to the New York Bight DPS.

The expected non-lethal take of up to 10, and the lethal take of up to one, Atlantic sturgeon from the NYB DPS through 2034 is expected as a result of the action. Because the displacement of individual sturgeon as a result of incidental trawl capture is temporary and very small in relation to the individual and species ranges, and because the action will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds in the Hudson River, no change in the population distribution of Atlantic sturgeon is anticipated from the action.

Reproductive potential of the Hudson River population is not expected to be affected by the lethal take of one individual in any way other than through a reduction in the population. A reduction in the number of female Atlantic sturgeon in the Hudson River would have the effect of reducing the amount of potential reproduction in this system as an individual killed would have no potential for future reproduction. The loss of a male sturgeon may have less of an impact on future reproduction as other males are expected to be available to fertilize eggs in a particular year. The Hudson River supports one of the largest populations of Atlantic sturgeon in the United States (White et al. 2021). Effective population estimates for the Hudson River are 156 (95% confidence limits [CL], 138.3-176.1; n = 459; Waldman 2019) and 145.1 (82.5-299.4; n = 307; White 2021b). Kazyak (2020) produced an abundance estimate of the 2014 adult spawning run size of 466 individuals (95% CL, 310-745). Furthermore, long-term monitoring of juvenile production in the Hudson River may indicate a gradual increase in abundance (Pendleton and Adams 2021). Despite the population being relatively large, the Hudson River Atlantic Sturgeon, within the NYB DPS, are listed as because of the extensive threats they face. The White (2024) mixture analysis provided support that the majority of individuals in the action area would be natal to the Hudson River, with an estimated 98.9 % (95 % CI: 96.3–99.6 %) of the total likely originating from the Hudson River population which in turn would assign them to the NYB DPS. In total, 96.7 % of the 452 individuals caught were assigned to populations within the New York Bight DPS (i.e. the Hudson and Delaware rivers).

Recent survival estimates (ASMFC 2017; Melnychuk et al. 2017)) do not suggest much change since the last estimates made during the commercial fishery (Boreman 1997, Kahnle et al. 1998). Melnychuk et al. (2017) provided an updated estimate of survival of Hudson River Atlantic sturgeon of approximately 88.22%, while for similar life stages over a longer time frame, ASMFC (2017) estimated survival of the entire New York Bight to be 91% (95% confidence limits, 71-99%). It is accepted that fish populations decline when mortality exceeds 10-12% from all sources (Boreman 1997, Kahnle et al, 1998).

The anticipated lethal take of one Atlantic sturgeon equates to .21% of just the estimated 466 adult spawning run in 2014 estimated by Kazyak et al. (2020). While the death of up to one Atlantic sturgeon over the 10 years covered by the ITP will reduce the number of Atlantic sturgeon in the population compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will appreciably reduce the status of this population or its stable trend. The non-lethal take of up to 10 Atlantic sturgeon is not expected to result in a reduction in numbers as it is assumed those individuals will be returned to the population after minimal handling and time out of water. Therefore, the loss of one individual over 10 years from this population will not appreciably reduce the numbers of individuals from this population and therefore will not appreciably reduce the numbers of individuals of NYB DPS Atlantic sturgeon.

In considering the best available information on the abundance of Atlantic sturgeon both in the Hudson River, the NYB DPS, and throughout the species' range, we believe it is unlikely that the loss of one individual over a 10-year period would affect the success of spawning in any year. Additionally, the proposed action will not affect spawning habitat in any way. The non-lethal take of up to 10 Atlantic sturgeon is not expected to result in a reduction in reproductive potential as it is assumed those individuals will be returned to the population and will not be prevented from spawning as a result of the action. Therefore, the loss of one individual Atlantic sturgeon will not appreciably reduce the reproduction or distribution of the NYB DPS of Atlantic sturgeon.

The goal of the Recovery Outline (NMFS 2018) is to have reproductive populations across their historic range of sufficient size and diversity to support reproduction and recovery from mortality events. Atlantic sturgeon populations are showing signs of slow recovery when all five DPSs are considered collectively, these trends are not necessarily reflected with individual DPSs (ASMFC 2017). ASMFC (2017) found there was a relatively high probability that abundance of the NYB DPS has increased since the implementation of the 1998 fishing moratorium. Based on the minimal impacts from the proposed issuance of the ITP, the loss of one NYB DPS Atlantic sturgeon is not likely to appreciably reduce the likelihood or potential for recovery of the species.

Based on the information provided above, the non-lethal take of up to 10 individual Atlantic sturgeon and the lethal take of up to one Atlantic sturgeon through 2034 as a result of the proposed action will not appreciably reduce the likelihood of both the survival and recovery of NYB DPS Atlantic sturgeon in the wild by reducing their numbers, reproduction, or distribution.

11 CONCLUSION

Section 5.1.1 assessed the effects of stressors to North Atlantic DPS green, Kemp's ridley, leatherback, and Northwest Atlantic DPS loggerhead sea turtles and section 5.1.2 assessed the effects of stressors to GOM, CB, Carolina, or SA DPS Atlantic sturgeon. Sections 5.1.1 and 5.1.2 determined that exposure was discountable for all of those species and, therefore, the effects of this action may effect, but are not likely to adversely affect those species. Section 5.1.3 assessed the effects of the proposed action to NYB DPS Atlantic sturgeon designated critical habitat and determined the effects of the proposed action may affect, but is not likely to adversely affect that critical habitat. After reviewing and analyzing the current status of shortnose sturgeon and NYB DPS Atlantic sturgeon, the environmental baseline within the action area, the consequences of the proposed action and associated activities, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of shortnose sturgeon or NYB DPS Atlantic sturgeon.

12 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of ESA-listed species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to ESA-listed species by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). NMFS has not defined "harass" under the ESA in regulation. On May 1, 2023, NMFS adopted, as final, the previous interim guidance on the term "harass," defining it as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 C.F.R. §402.02). Section 7(b)(4) and section 7(o)(2) of the ESA, as well as in regulation at 50 C.F.R. §402.14(i)(5) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

12.1 Amount or Extent of Take

Section 7 regulations require NMFS to specify the impact of any incidental take of endangered or threatened species; that is, the amount or extent, of such incidental taking on the species (50 CFR 402.14(i)(1)(I)).

For the proposed issuance of an ITP for actions conducted by Clearwater Inc., take is anticipated for shortnose sturgeon and NYB DPS of Atlantic sturgeon incidental to the proposed activities of trawling as described in Section 3. NMFS expects that no more than 10 individuals of each species will be taken in the 10-year permit period, with no more than one mortality for each species over a 10-year period.

12.2 Reasonable and Prudent Measures

The measures described below are nondiscretionary, and must be undertaken by ESCD so that they become binding conditions for the exemption in section 7(o)(2) to apply. Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of ESA-listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. To minimize such impacts, reasonable and prudent measures, and term and conditions to implement the measures, must be provided. Only incidental take resulting from the agency actions and any specified reasonable and prudent measures and terms and conditions identified in the ITS are exempt from the taking prohibition of section 9(a), pursuant to section 7(o) of the ESA.

Reasonable and prudent measures refer to those actions the Director considers necessary or appropriate to minimize the impacts of the incidental take on the species (50 CFR 402.02). These measures "cannot alter the basic design, location, scope, duration, or timing of the action and may involve only minor changes" (50 CFR §402.14(i)(2)). NMFS believes the following RPMs are necessary and appropriate:

1. The ESCD must ensure that Clearwater implements the Conservation Plan to mitigate and report the potential effects of their operations on Atlantic and shortnose sturgeon as part of the proposed ITP for the incidental taking of fish of these species.
2. The ESCD must ensure that the provisions of the ITP are carried out.
3. If a sturgeon has been captured and comes up dead when the trawl net is brought back to the boat, Clearwater will contact NMFS Protected Resources Division, nmfs.gar.incidental-take@noaa.gov, OPR, *pr.esa.incidentaltakepermit@noaa.gov* and Steven Hughes at steven.hughes@noaa.gov as soon as feasible. Clearwater's email to these entities must include a copy of the NMFS Take Report Form (download at: https://media.fisheries.noaa.gov/202107/Take%20Report%20Form%2007162021.pdf) and a link to, or acknowledgement that a clear photograph or video of the animal was taken (multiple photographs are suggested, including at least one photograph of the head scutes).

12.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, ESCD must comply with the following terms and conditions, which implement the Reasonable and Prudent Measures described above. These include the take minimization, monitoring and reporting measures required by the section 7 regulations (50 CFR 402.14(i)). These terms and conditions are non-discretionary. If ESCD fail to ensure compliance with these terms and conditions and their implementing reasonable and prudent measures, the protective coverage of section 7(o)(2) may lapse.

The following term and condition implements RPM #1:

- Monitor Clearwater's compliance with the monitoring, minimization, and mitigation requirements detailed in the Conservation Plan and included in the ITP.

The following term and condition implements RPM #2:

- Monitor the extent of incidental take occurring under the Incidental Take Permit to ensure that the amount or extent of take set forth in the Incidental Take Permit is not exceeded. A copy of any reports on activities and monitoring results must be provided to the ESA Interagency Cooperation Division via email at nmfs.hq.esa.consultations@noaa.gov, with the subject line "ITP 27686, OPR-2023-03442, Report."

13 CONSERVATION RECOMMENDATIONS

Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 CFR 402.02).

In order for NMFS' OPR Endangered Species Act Interagency Cooperation Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their critical habitat, ESCD should notify the Endangered Species Act Interagency Cooperation Division of any conservation recommendations they implement in their final action.

NMFS believes the following conservation recommendations are likely to benefit shortnose and NYB Atlantic sturgeon impacted by the proposed action and could be implemented as part of the proposed ITP issuance:

1. We recommend that ESCD and Clearwater coordinate with NYSDEC regarding reporting all observed dead sturgeon. Observations of dead sturgeon should be reported to NYSDEC's Marine Life Incident Report online survey. For questions or more information about fish kills, contact fishkillmarine@dec.ny.gov or call 631-444-0714 for marine waters or 845-256-3199 on the Hudson River. For more information on sturgeon in the Hudson River region, contact NYSDEC by calling 845-256-3073 or emailing HudsonRiverFish@dec.ny.gov. When reporting, please provide the following information:

    - Specify the location of the fish carcass. Please be as specific as possible and provide coordinates, if possible.
    - Note the condition of the fish (e.g., really rotted or fresh kill).
    - Identify any signs of trauma, and if present, where on the fish.

- Estimate the total length of the carcass (measure from nose to tip of upper tail [caudal] fin) or whatever is left of the carcass.
- Describe any external tags found on the fish - usually a yellow streamer at or near the base of the dorsal fin; a second external mark can be a missing left pelvic fin clip.
- Take a photograph of the entire fish and any injury and include a picture of the head and mouth to verify the species.
- Send all information and pictures to the NYSDEC email above.
- Do not handle the fish, leave it where you found it - possession of Atlantic or shortnose sturgeon is prohibited.

2. We recommend that ESCD continue to prioritize research that will assist with species recovery. Researchers should also be encouraged to conduct research on under-studied sturgeon populations and river systems for which there is currently little available information.

14 REINITIATION NOTICE

This concludes formal consultation for the OPR ESCD's issuance of an ITP to Clearwater for educational boat and trawl operations. As 50 CFR 402.16(a) states, reinitiation of formal consultation is required and shall be requested by the Federal agency, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

(1) If the amount or extent of taking specified in the incidental take statement is exceeded;

(2) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

(3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or

(4) If a new species is listed or critical habitat designated that may be affected by the identified action.

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