NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION

AGENCY: Department of Energy

ACTIVITY CONSIDERED: Department of Energy's proposed funding to the Coonamessett Farm Foundation to carry out the proposed project "Surveying Commercial Fish Species and Habitat in Wind Farm Areas Using a Suite of Non-Lethal Methods." (Award # DE-EE0009799)

GARFO-2023-03431

CONDUCTED BY: National Marine Fisheries Service
Greater Atlantic Regional Fisheries Office

DATE ISSUED: March 29, 2024

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Assistant Regional Administrator
for Protected Resources

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1.0 INTRODUCTION

This constitute the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service's (NMFS) biological opinion (Opinion) issued to the U.S. Department of Energy (DOE), as the action agency, in accordance with Section 7 of the Endangered Species Act of 1973 (ESA), as amended, on the effects of their proposed funding of the "Surveying commercial fish species and habitat in wind farm areas using a suite of non-lethal survey methods" research project. This project will be carried out by Coonamessett Farm Foundation, Inc. (CFF) under a grant from DOE awarded under the Funding Opportunity Announcement (FOA) DE-FOA-0002237: *Offshore Wind Energy Environmental Research and Instrumentation Validation*. The proposed project will trial non-lethal and non-extractive survey equipment to evaluate the impacts of offshore wind development on commercial fish species and benthic habitats and communities. The proposed field efforts consist of testing of three different types of equipment (off-bottom towed vehicle, anchored and ropeless stationary cameras, and a bottom trawl equipped with video cameras) over the course of four calendar years (beginning spring 2024 through fall 2027) for potential use in Wind Energy Areas (WEAs)[1]. While the results of this study will inform considerations of the potential effects of offshore wind development to commercial fish species and benthic habitat areas, this activity is not associated with any particular offshore wind developer or development and is not associated with any approval or authorization for any offshore wind project. No offshore wind construction is part of the proposed action and any effects of any other future fish and/or habitat surveys in the study area or carried out related to offshore wind development is not a consequence of the proposed action.

This Opinion is based on information provided in the DOE's Biological Evaluation (BE) (December 2023) and other sources of information cited herein. We will keep a complete administrative record of this consultation at the NMFS Greater Atlantic Regional Fisheries Office (GARFO) in Gloucester, Massachusetts.

2.0 CONSULTATION HISTORY AND APPROACH TO THE ASSESSMENT

On November 10, 2022, we received a letter from DOE requesting informal consultation on their proposed funding of the "Surveying commercial fish species and habitat in wind farm areas using a suite of non-lethal survey methods" project along with a draft BE. Prior to this, NMFS provided ESA technical assistance to DOE about the consultation starting in May 2022. DOE submitted a revised BE on December 16, 2022; the revisions were due to a change in the action area. On January 19, 2023, following review of the BE, NMFS informed DOE that we could not concur with DOE's determination that the proposed action was not likely to adversely affect any ESA-listed species and as such, we recommended that they request formal consultation and submit a further revised BE. DOE submitted a revised BE and formal request for consultation on May 5, 2023. Following a request for additional information from NMFS, on December 1, 2023 NMFS received a revised BE.

Following review of the December 1, 2023 BE, we deemed the information submitted by DOE

[1] Wind Energy Areas (WEA) are part of the Area Identification step required by the Bureau of Ocean Energy Management's (BOEM) regulations (30 CFR 585.211). WEA(s) are areas BOEM has determined may be suitable for offshore wind energy leasing, and BOEM may decide to propose to lease the entirety or a portion of WEA(s) through a Proposed Sale Notice.

sufficient to assess the effects of the proposed action on ESA-listed species and designated critical habitat and that the information constituted the best scientific and commercial data available (50 CFR §402.14(c)-(d)); formal ESA Section 7 consultation was initiated on December 1, 2023.

Consideration of the 2019 ESA Regulations

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in this Opinion and its incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

Consideration of RSA HabCam Surveys

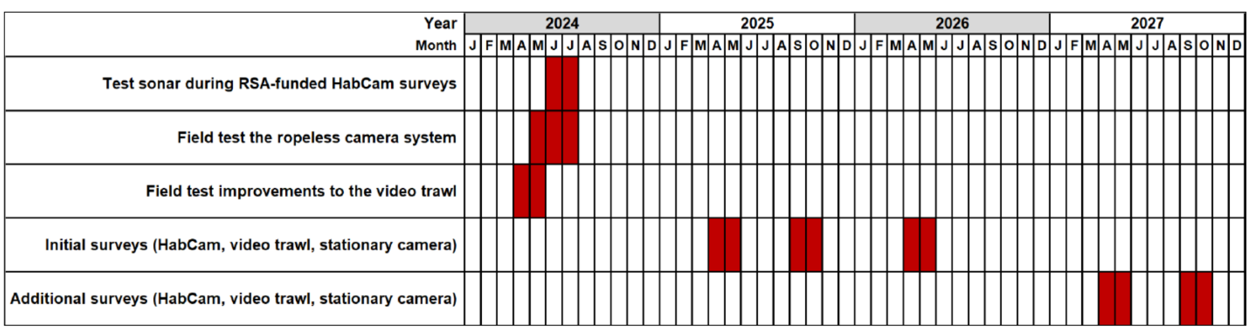
As described in Section 3 below, as one element of the proposed action, DOE is providing funding to install and test a front-facing sonar on HabCam surveys that occur through NMFS' Sea Scallop Research Set-Aside (RSA) program. Effects of these scallop surveys are addressed in NMFS GARFO's June 15, 2023 Biological Opinion issued to the NMFS Northeast Fisheries Science Center on *Fisheries and Ecosystem Research to be Conducted and Funded by the Northeast Fisheries Science Center and a Letter of Authorization under the Marine Mammal Protection Act for the Incidental Take of Marine Mammals Pursuant to those Research Activities from 2021-2026* (2023 NEFSC Opinion). The 2023 NEFSC Opinion is the result of reinitiation of an October 18, 2021 Opinion. In the 2023 NEFSC Opinion, NMFS considered the effects of a large suite of research on ESA-listed species and critical habitat along the U.S. Atlantic coast from the Maine/Canada border to Key West, Florida. In the 2023 NEFSC Opinion, NMFS did not identify any adverse effects to any ESA-listed species or critical habitat from the HabCam surveys and, as such, did not anticipate any incidental take of any ESA-listed species from the HabCam surveys. The HabCam surveys where the DOE-funded sonar will be utilized would occur regardless of the DOE funding; thus the only additional effect of the survey activity resulting from DOE's proposed action is the use of sonar.

The effects analyzed in the 2023 NEFSC Opinion will be considered as part of Section 5.0 *Environmental Baseline* of this Opinion, given the definition of that term at 50 CFR §402.02. The effects specific to the DOE grant, that is, addition of sonar to the vessels that would otherwise be carrying out the RSA HabCam surveys, will be discussed in Section 6.0 *Effects of the Action*. Effects of the transit of these vessels were already addressed in the 2023 NEFSC Opinion. In Section 8.0 *Integration and Synthesis*, if we determine any additional or different effects resulting from these survey activities will be caused by the proposed action, we will evaluate them in addition to the effects included in Section 5.0 *Environmental Baseline*, which already includes the effects of the HabCam surveys without the DOE funded sonar. By using this methodology, this Opinion ensures that all of the effects of the surveys will be considered in Section 8.0 *Integration and Synthesis* and reflected in this Opinion's final determination under ESA 7(a)(2). This methodology also ensures this Opinion does not "double-count" effects of the survey vessel transits to and from the port–once in Section 5.0 *Environmental Baseline* and then again in Section 6.0 *Effects of the Action*.

3.0. DESCRIPTION OF THE PROPOSED ACTION

This section of the Opinion describes the proposed action for consultation as described to us by DOE in their BE. DOE, through a FOA, is proposing to fund CFF to conduct field research in the waters offshore of Massachusetts (MA), Rhode Island (RI), New York (NY), and New Jersey (NJ) in the Northwest Atlantic Ocean. The field research will use a suite of non-lethal and non-extractive survey equipment to sample commercial fish species and benthic habitats and communities to evaluate the impacts of offshore wind development. The proposed project activities would be performed in MA coastal waters in Cape Cod Bay and Buzzards Bay, southern New England waters, the Mid-Atlantic Bight, and the Georges Bank Atlantic sea scallop ground. The surveys will be carried out over four seasons of sampling: spring and summer 2024 (April through July), spring (April/May) and fall (September/October) 2025, spring 2026, and spring and fall 2027 (Figure 3.1.1). The action will include equipment testing (2024) and surveys (2025-2027). Mobilization and testing of the survey equipment is expected to begin as soon as April 2024, following issuance of this Opinion and DOE's final action approving/issuing the grant funds to CFF.

Figure 3.1.1. Expected timeline for project activities included in the proposed action. Gear testing activities will take place in the spring and summer of 2024. Project surveys will begin in the spring of 2025 and continue in the spring and fall through the fall of 2027. No surveys will be conducted in the fall of 2026 due to a break for project review.



3.1 Field Sampling Methods

CFF will implement a survey design that includes HabCam sonar testing and benthic surveys, open and closed codend video trawl surveys, and anchored and on-call ropeless stationary camera testing. As described in the BE, the overarching objective is to evaluate the use of a suite of non-lethal and non-extractive survey equipment that could be used to assess the impacts of offshore wind development on commercial fish species and benthic habitats and communities.

3.1.1 HabCam Surveys

HabCam surveys will employ a HabCam v3 underwater vehicle owned and operated by CFF to map the physical, hydrographic, and biological environment in the project area. The HabCam v3 will be equipped with a Teledyne Blueview M450 front-facing sonar to avoid obstacles in the project area. CFF will conduct testing of the Teledyne Blueview M450 sonar in summer 2024 (consisting of two 8-10-day trips) and mapping surveys during the spring and fall field seasons over the next three years beginning spring 2025 (consisting of five 4-day trips). During each survey, the HabCam will be towed off a commercial scallop vessel using a taut cable/wire at target speeds of 4.5-5.0 knots while "flown" at altitudes of 1.5 to 2.5 meters off bottom. Images are taken at a rate of 5-7 images/second, providing an overlapping mosaic of images that are approximately one meter wide (Figure 3.1.2). The HabCam v3 is piloted using a joystick, with pilots controlling the vehicle altitude off bottom while monitoring image clarity in the live image feed and bathymetry in front of the vehicle based on data from the towing vessel. The HabCam v3 has four strobe lights that fire 5-7 times per second. Transits for the HabCam surveys will originate from New Bedford, MA, and will be approximately 1,200 nautical miles (nm) combined for the two HabCam sonar testing surveys and approximately 220 nm for each of the benthic surveys. The HabCam sonar survey area (green and red areas in Figure 3.4.1) will be located in the action area and include up to five offshore wind lease areas, encompassing an area of roughly 1,800 km^2 or 25% of the portion of the action area highlighted in red (Figure 3.4.1). HabCam survey tracks are expected to run in a N-S direction in the lanes between the planned or existing wind turbine foundations, with tracks spaced 2-4 nm apart depending on other obstacles present in lanes (e.g., construction activities, other monitoring equipment like passive acoustic monitoring stations, etc.). HabCam surveys will run 24 hours a day and will be the only project activity conducted at night. As described in the BE, the sonar testing and survey activities proposed by DOE would include the following:

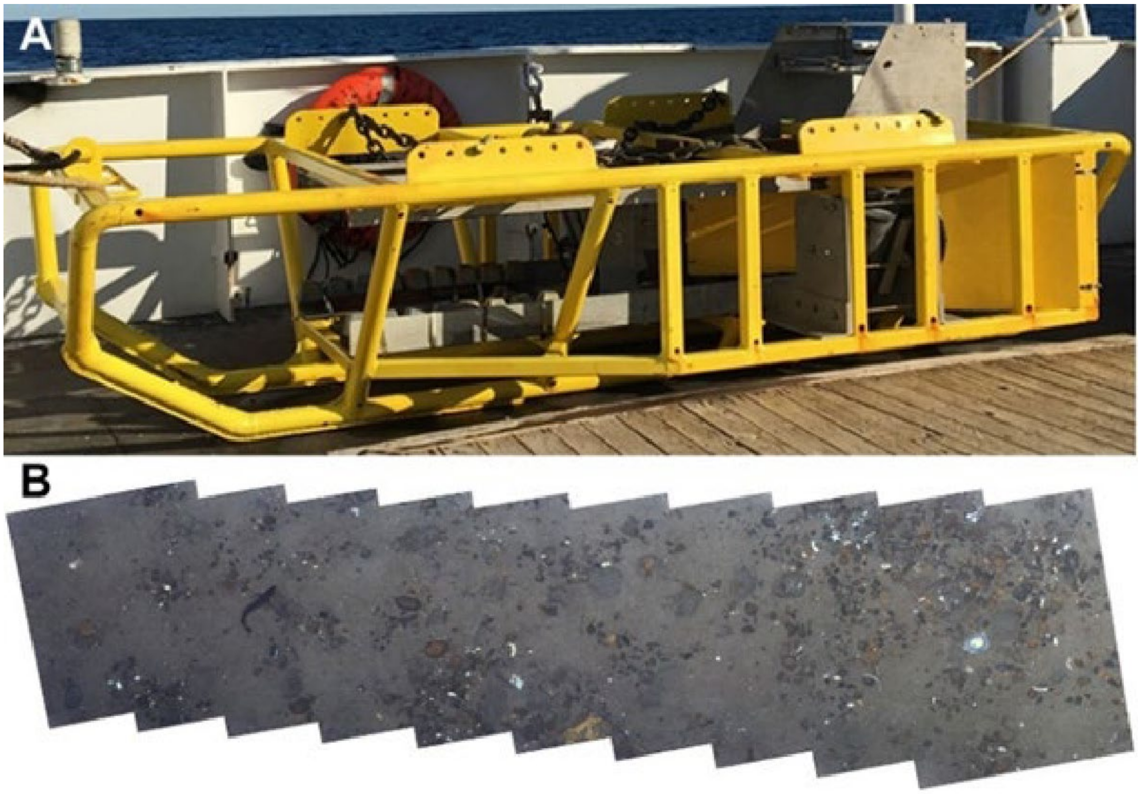
- Testing sonar during RSA-HabCam surveys (front facing sonar) for detecting and avoiding obstacles to allow for safe operation wind farms. The sonar device (Teledyne Blueview M450) will be tested in summer 2024 during surveys that are otherwise planned to occur through the Atlantic sea scallop research set-aside program[2].

- Still imaging to record marine animals for identification and analysis of species abundance and distribution using two camera systems mounted on the HabCam v3.

- Use of on-board sensors for altitude, depth, temperature, and conductivity/salinity as well as vehicle pitch and roll.

[2] Effects of these RSA HabCam surveys (without sonar) are addressed in the 2023 NEFSC Opinion referenced in Section 2.0.

Figure 3.1.2. (A) HabCam v3 and (B) Mosaic of images from the 2017 HabCam v3 survey.



Source: DOE 2023

3.1.2 Stationary Camera Surveys

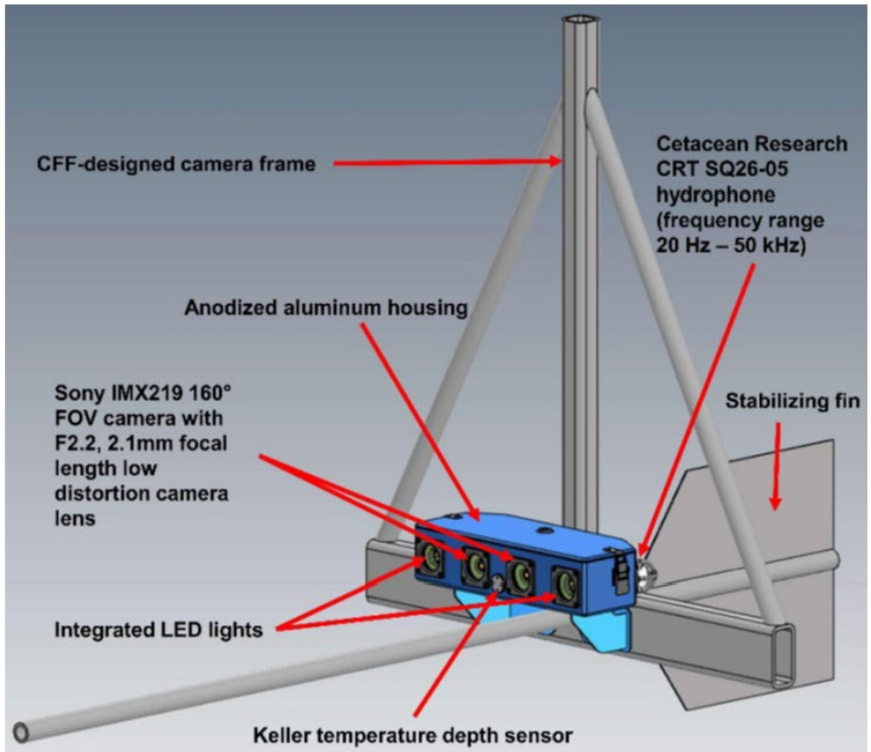
CFF will design a stationary camera survey methodology using baited and un-baited underwater video (BUV) systems that can be used for assessing species abundance and gradients around offshore wind energy turbine bases. Stationary camera monitoring will be conducted using 45-50 anchored and six on-demand ropeless camera systems within the action area. Stationary camera surveys will consist of anchored baited and unbaited cameras which have been used by CFF previously to survey blueline and golden tilefish, along with ropeless underwater camera systems. The ropeless camera systems will be tested for use to supplement data collected by anchored systems by collecting behavioral data over full tidal and diurnal cycles. Each anchored camera setup will have a camera mounted on a weighted frame that includes a stabilizing fin, 15 lb mushroom anchor, trawl ball floats, and sinking anchor rope and a chain (Figure 3.1.3). Under the proposed camera configuration, survey instruments will be anchored to the seafloor with the camera frame suspended approximately one meter above the anchor on the seafloor. Boxes with bait, squid and/or mackerel, will be located 1 meter from the cameras.

Anchored stationary camera arrays will be placed within wind farm areas at an overall density of roughly one camera for every 40 km^2. The survey area will include two or three lease areas, encompassing an area of roughly 1,800 km^2 or 25% of the portion of the action area highlighted in red (Figure 3.4.1). The lease areas that will be surveyed, and therefore the survey boundaries, will be determined based on planned wind farm construction schedules once the dates for the surveys are known. The deployment locations for cameras will be determined using a stratified random design, with strata defined based on distances from planned or existing turbine bases

Anchored camera systems will be deployed off the side of commercial Atlantic sea scallop vessels using the vessel winch, and once a deployed BUV reaches the bottom, surface markers will include a buoy and a high flyer. Vertical lines will be sinking line and scopes will range from 1.5:1 to 2:1 (i.e. the length of rope used will be 1.5 to 2 times the depth of the water it is deployed in). All anchored camera deployments will be continuously monitored, and cameras will be deployed for 60-90 minutes to provide a minimum of one hour of video from each camera. To assess any impacts from the use of bait or artificial lighting, the impacts of not baiting the system and not using artificial lights will be tested during the first two trips.

CFF will develop and deploy on-demand ropeless underwater camera systems using ropeless lobster traps and custom-built camera systems with extended battery packs. Both the stationary and ropeless camera systems will use EdgeTech 5112 Ropeless Fishing Systems as bases, and they will be equipped with low-light cameras, two LED lights, and extended battery packs. Each camera will have built-in temperature and depth sensors and a hydrophone to record underwater noise, with a frequency response from 20 hertz (Hz) to 50 kilohertz (kHz). CFF proposes to conduct tests of ropeless camera systems in the field prior to conducting any surveys. These will occur in the coastal areas near Cape Cod, MA, highlighted in blue as shown in Figure 3.4.1 with the final locations dependent on vessel availability. This activity will include only short deployments (< 30 min) conducted during day trips over two testing days in 2024. Tests will focus on determining if the system is easy to handle onboard fishing vessels and if it appropriately settles on the bottom in the correct orientation under field conditions in areas with waves and currents. The vessel will remain on-site during all tests, and the systems will be retrieved as soon as the buoys reach the surface. Each ropeless system will consist of one EdgeTech ropeless trap connected to an anchor by a short sinking groundline. This will allow the systems to be retrieved by grappling if the release mechanism in the ropeless fishing system fails. Six ropeless camera systems will also be deployed at the start and collected at the end of each survey trip along with the anchored stationary camera during seven-day long trips in the spring and fall from 2025 through 2027 in proposed wind farm areas. These systems will be deployed off commercial Atlantic sea scallop vessels and placed in close proximity to randomly selected turbine bases. The six ropeless cameras will be deployed first, followed by an anchored camera system attached to a buoy and high flyer (Figure 3.1.3). The anchored camera will be deployed for 60-90 minutes and monitored constantly, then retrieved. The anchored camera deployment and retrieval will be repeated 45-50 times in the action area. Only one vertical line attached to the anchored camera will be in the water at one time, and surveys will be conducted during daylight hours only. Cameras for these surveys will be deployed from commercial lobster vessels in Fairhaven, Woods Hole, Sandwich, or Duxbury, MA for the two testing trips and from commercial scallop vessels in New Bedford, MA for the project surveys.

Figure 3.1.3. Proposed CFF BUV frame with mounted camera for stationary camera surveys (right) and full anchored camera system setup including vertical buoy line (left).



Source: DOE 2023

3.1.3 Video Trawl Surveys

The open-codend video trawl was developed by University of Massachusetts School of Marine Science and Technology (SMAST) as an alternative to traditional trawl surveys. The design includes the use of a standardized bottom trawl used for stock assessment surveys, including the seasonal bottom trawl surveys conducted by the Northeast Fisheries Science Center (NEFSC) and the Northeast Area Monitoring and Assessment Program (NEAMAP) surveys conducted by Virginia Institute of Marine Science (VIMS). This trawl net is a four seam, three bridle 400x12 cm net with a cookie sweep. The video system in the bottom trawl is mounted in a rigid polyethylene cylinder sewn into the codend of the net, with an array of cameras and lights positioned inside of the cylinder facing the codend. The cylinder housing the cameras has a diameter of 1.34 m and cameras and lights are mounted on the top half of the cylinder. Power and video feed are provided by a custom third-wire cable connected to two power supplies in the wheelhouse. Live camera feed is relayed to a monitor and recorded for future analysis. During calibration tows, a combination of tows are made with the codend of the net either opened, so fish can pass through after being recorded by the camera, or with the codend closed, to collect traditional-trawl survey demographic information on the catch. The closed codend tows will be less than 20 minutes in duration and no more than 30% of total tows.

SMAST, in partnership with CFF, will conduct tests of trawl modification in spring 2024. These modifications will be designed to minimize sediment clouds in video imagery, and they include solid belly panels on the trawl net, a longer net, and use of additional floatation on the codend. Tow locations for gear testing will be chosen with a focus on testing the trawl modifications in areas with a silty bottom, and locations will be adjusted as needed to conduct tows over appropriate bottom types.

SMAST, in partnership with CFF, will conduct trawl surveys over five days during each of the spring and fall field seasons, beginning in April/May 2025 through September/October 2027. Video trawl survey tracks will run in an N-S or E-W direction in the lanes between the planned or existing offshore wind turbine foundations, and total tow time during a trip will be less than 40 hours and cover up to 120 nm. Target tow speed will be 2.8-3.0 knots. At standard towing speeds, mean door spread is 61m and mean wing spread is 15m. Open-codend tows will vary in length from less than one to nine hours depending on tow location. Because tows will start and end outside of the turbine footprint in the lease areas being surveyed, tow lengths will vary with the geometry of the lease area and the number of turbines along the randomly selected lanes.

Trawl surveys will occur aboard commercial scallop vessels for both the testing and the project surveys to test improvements on the video trawl net design. Surveys will originate from the Port of New Bedford, MA. The trawl survey will be conducted during daylight hours only (after sunrise and before sunset). The codend will be closed only for video validation for no more than 30% of the tows. Closed codend calibration tows will be a maximum of 20 minutes each at a speed of less than 3 knots.

3.2 Vessel Activity for the Surveys

As described in the BE, various types of vessels will be used during the planned testing and survey activities. The stationary camera surveys would involve the most vessel-based activity over relatively short-term periods, whereas the video trawl surveys will cover the largest area and the HabCam surveys will travel the most nautical miles of any activity. The information presented in the BE is summarized here.

CFF has identified various vessels that would be used to conduct surveys for the project. Each vessel would have operational Automatic Identification Systems (AIS), which can be used to monitor the number of vessels and traffic patterns for analysis and compliance with vessel speed requirements. All vessels will operate over a four-year period (currently anticipated 2024-2027). In the BE, DOE identifies that vessels would use existing port facilities primarily located in New Bedford, MA, with possible trips from ports in Fairhaven, Woods Hole, Sandwich, or Duxbury, MA. Two different classes of vessels are proposed to conduct surveys: 65-110 ft commercial scallop vessels and 25-40 ft commercial lobster vessels. Tables 3.2.1 summarizes the various vessels associated with project-related surveys. Number of trips refer to the total number of trips throughout the 4-year span of the project. All trips will be port-to-port (each individual vessel will leave from and return to the same port, staying at sea for the length of the trip) and each vessel will remain at sea for the duration of the trip.

Table 3.2.1. Vessels planned for use during testing and surveys.

Activity	Vessels	Port	Vessel Survey Speed	Vessel Transit Speed	Length of Trip	Number of Trips	Coverage/ Deployments
HabCam Sonar	80-110 ft. commercial	New Bedford,	4.5-5.0 knots	<10 knots	8-10 days	2	1200 nm combined for

Testing	scallop vessel (1 vessel)	MA					both trips
HabCam Surveys	80-110 ft. commercial scallop vessel (1-2 vessels)	New Bedford, MA	4.5-5.0 knots	<10 knots	4 days	5	220 nm per trip
Ropeless Camera Testing	25-40 ft commercial lobster vessels (1-2 vessels)	Fairhaven, Woods Hole, Sandwich, or Duxbury, MA	N/A	<10 knots	<1 day	2	5 deployments per trip, <2.5 hrs per day in water
Stationary Camera Surveys	65-110 commercial scallop vessels (3-5 vessels)	New Bedford, MA	2.5-5.5 knots	<10 knots	7 days	5	45-50 deployments per trip (1 camera per 40 km^2)
Video Trawl Testing	80-110 ft commercial scallop vessel (1 vessel)	New Bedford, MA	2.8-3.0 knots	<10 knots	5 days	1	40 hours, 120 nm per trip
Video Trawl Surveys	80-110 ft commercial scallop vessel (1-2 vessels)	New Bedford, MA	2.8-3.0 knots	<10 knots	5 days	5	40 hours, 120 nm per trip

3.3 Mitigation and Monitoring Measures that are part of the Proposed Action

There are a number of measures that DOE and CFF are proposing to take that are designed to avoid, minimize, or monitor effects of the action on ESA-listed species. For the purpose of this consultation, the avoidance, minimization and monitoring measures identified in the BE are considered as part of the proposed action. DOE will require CFF to implement the following measures to avoid and minimize effects to listed species.

Vessel Strike Avoidance (note that all vessels will operate at speeds of less than 10 knots at all times, including during transit):

- Maintain vigilant watch for protected species during transit and execute vessel slow down and avoidance procedures when sightings occur;
- Brief all crew members on the identification of protected species, along with regulations and best practices for avoiding collisions;
- Have a minimum of one trained lookout on the vessel that will serve as an ESA-listed species lookout and all people on the vessel will have access to binoculars to assist the lookout;
- If the trained lookout is a vessel crew member, this must be their designated role and primary responsibility while the vessel is transiting;

- For HabCam survey activities that run during the night, a minimum of one pair of night-vision goggles will be onboard for a lookout to continue operations after dark;
- Maintain 200 m distance from all whales, and 500 m from North Atlantic right whale;
- If a large whale is identified within the forward path of any vessel (1000 m), the vessel operator will steer a course away from the whale at 10 knots (18.5 km/hr) or less until the minimum separation distance has been established. Vessels may also shift to idle if feasible;
- If a large whale is sighted within 200 m of the forward path of a vessel, the vessel operator will reduce speed to under 4 knots and steer a course away from the whale. If stationary, the vessel will not engage engines until the large whale has moved beyond 500 m;
- If a sea turtle is sighted within the operating vessel's forward path, the vessel operator will slow down to 4 knots (unless unsafe to do so) and steer away as possible. The vessel may resume normal operations once the vessel has passed the individual;
- During times of year when sea turtles are known to occur in the survey area, vessels will avoid transiting through areas of visible jellyfish aggregations or floating vegetation (e.g., Sargassum lines or mats). In the event that operational safety prevents avoidance of such areas, vessels must slow to 4 knots or less while transiting through such areas;
- Abide by Dynamic Management Areas (DMA) and Seasonal Management Areas (SMA) speed restrictions, including compliance with 10 knot speed restrictions in these areas by all survey vessels; and
- Check for information regarding mandatory or voluntary ship strike avoidance areas and daily information regarding North Atlantic right whale sighting locations before the trip starts and during the trip as information is available using the NOAA North Atlantic right whale sightings page (https://www.fisheries.noaa.gov/resource/map/north-atlantic-right-whale-sightings), NOAA weather radio, U.S. Coast Guard NAVTEX and channel 16 broadcasts, Notices to Mariners, the Whale Alert app, or WhaleMap website (https://whalemap.org/). The chief scientists will also monitor the sea turtle sighting hotline (www.seaturtlesightings.org) prior to each trip and report any observations of sea turtles in the vicinity of the planned transit to all vessels.

HabCam v3 Survey Specific Measures:

- Maintain tension on the tether from the vessel to the HabCam v3 to prevent entanglement and make every effort to keep it above the seafloor.

Stationary Camera Specific Measures:

- Follow Project Design Criteria (PDC) 6 (Minimize Risk During Buoy Deployment, Operations, and Retrieval) for protected species (BOEM 2021);
- Keep soak time for anchored cameras short (under 90 minutes);
- Pause deployment and retrieve anchored camera systems if any ESA-listed species is spotted with 500 m (or 1000 m for North Atlantic right whale) and only resume testing after no listed species have been observed for 30 minutes;
- Surveys will only be conducted during the months of May, September, and October to avoid putting any vertical lines in the water during months when fishing gear with vertical lines are prohibited in the South Island Restricted Area (February-April); and

- Use weak links approved for offshore lobster fisheries on ropeless cameras to minimize risk to listed species if the vertical lines release prematurely.

Trawl Survey Specific Measures:

- Closed codend trawls will be no more than 30% of total trawls and trawl times no more than 20 minutes long;
- If any listed species are observed in the video feed during closed codend tows the tow will be immediately terminated and the net will be hauled back to allow rapid release of any listed species caught;
- The same procedure will be followed during open-codend tows if the live video feed does not show a listed species passing through safely and completely; and
- ESA-listed species will only be handled by science staff or vessel captain and crew who have received dedicated training on identifying and handling listed species.

Reporting Measures:

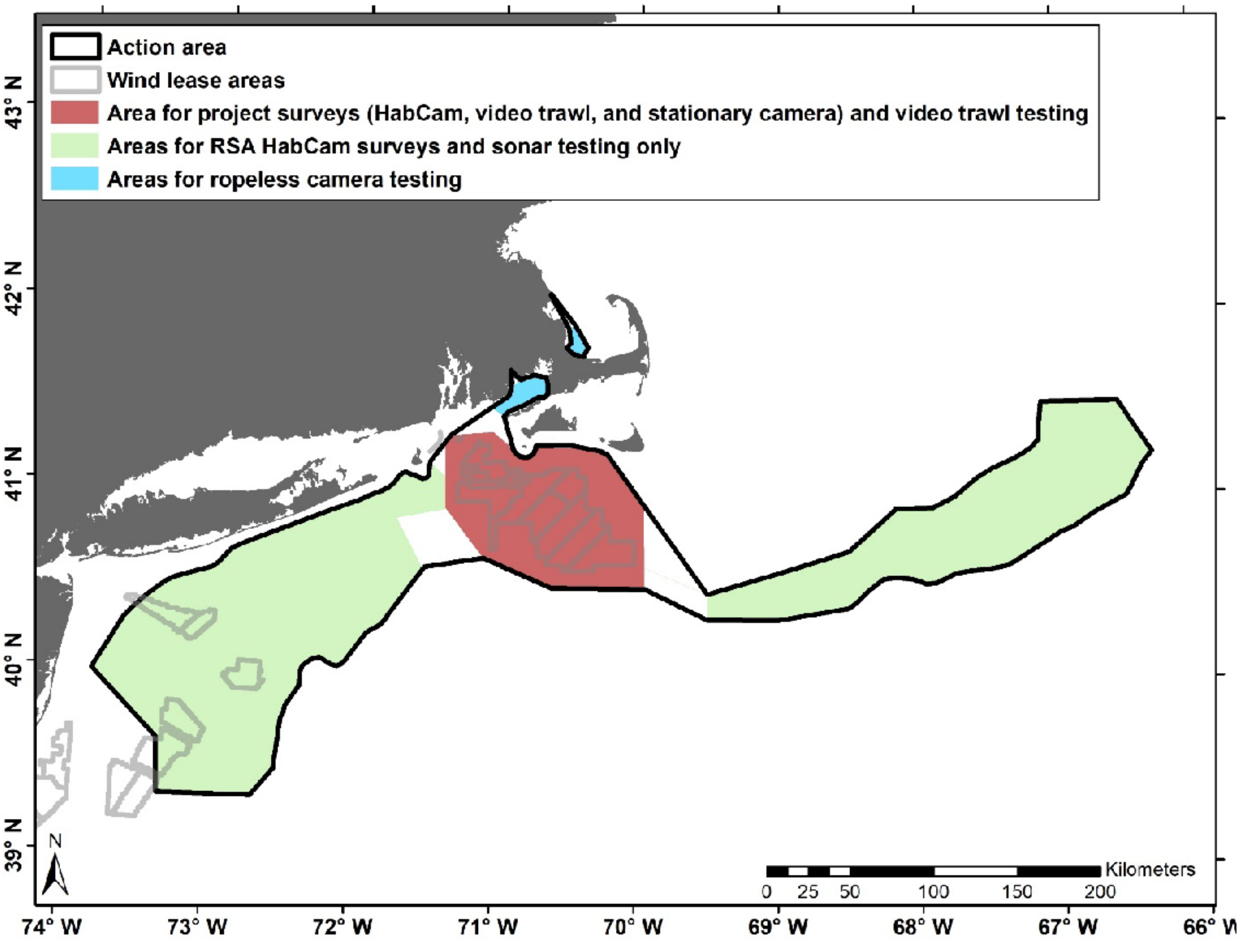
- Departure and return dates and times for all field activities will be reported to the DOE project officer immediately before departure and upon return to port;
- All North Atlantic right whale sightings will be immediately reported to the Coast Guard (channel 16) and additional reports made to NOAA Fisheries Stranding Hotline (866-755-6622) and WhaleAlert (http://www.whalealert.org/) as soon as possible including date, location, and number of animals, evidence of distress or entanglement and photographs when possible;
- Any sturgeon or sea turtles caught during trawl surveys will be handled according to sturgeon and sea turtle standard operating procedures. Handling times will be minimized to limit the amount of stress placed on the animals. Takes will be documented with the required measurements and photographs, and all vessels will be equipped with a Passive Integrated Transponder (PIT) tag reader to scan for previously implanted tags. Sturgeon will be PIT tagged when possible if no PIT tags are present. A NMFS Take Report Form (https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic) will be filled out for each individual sturgeon and sea turtle. In addition and when possible, fin clips will be taken from all captured Atlantic sturgeon following approved procedures for obtaining sturgeon fin clips; and
- Any sightings of sea turtles or sturgeon from the vessel or in the live video feeds will be documented with details on the species included when possible, the number of animals sighted, and the location based on vessel coordinates. The sightings data will be shared with appropriate agencies after each trip concludes.

3.4 Action Area

The action area is defined in 50 CFR 402.02 as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” The action area includes the area where testing and survey activities will occur, as well as where associated vessel transits will occur and extends from waters in the Mid-Atlantic Bight offshore New Jersey and New York, south of Long Island, southern New England, eastern Georges Bank, and north through Buzzards Bay and the western portion of Cape Cod Bay. This action area includes the Port of New Bedford, MA, where most fishing vessels being used for project research will originate. It also includes Atlantic sea scallop grounds in the Mid-Atlantic Bight and on Georges Bank where the sonar system for HabCam v3 will be tested during sea scallop surveys funded by the scallop RSA program (highlighted in green). The action area also includes two areas where the ropeless camera systems may be tested near Cape Cod (highlighted in light blue), including ports in Woods Hole, Fairhaven, Sandwich, or Duxbury, MA and the waters from these ports to the coastal test areas. The entire action area is within the boundaries below (in decimal degrees):

- Latitude: 40.48° to 41.33°
- Longitude: -71.38° to -69.94°

Figure 3.4.1. Action area including all locations where proposed project activities will occur (both survey and testing areas), vessel ports, and vessel transit routes.



Source: DOE 2023

4.0. LISTED SPECIES AND CRITICAL HABITAT CONSIDERED IN THIS OPINION

4.1 Listed Species and Critical Habitat Not Considered for Further Analysis

In the BE, DOE concludes that the proposed action will have no effect on the Gulf of Maine DPS of Atlantic salmon, shortnose sturgeon, hawksbill sea turtles, blue whales, giant manta rays, and oceanic whitetip sharks and critical habitat designated for North Atlantic right whales. As explained below, we agree with DOE's determination that the project will have no effect on the Gulf of Maine DPS of Atlantic salmon, shortnose sturgeon, hawksbill sea turtles, and oceanic whitetip sharks as these species do not occur in the action area. Additionally, as explained below, we agree with the determination that the proposed action will have no effect on critical habitat designated for North Atlantic right whales. As section 7 consultation is only required when a proposed action "may affect" a listed species or critical habitat, these species and critical habitat will not be considered further. In the BE, DOE concludes that effects to blue whales and giant manta rays are "extremely unlikely," this conclusion is appropriate to support a "not likely to adversely affect" determination. We have carefully reviewed the best available information on blue whales, and, as explained below, have determined that all effects to blue whales and giant manta rays will be insignificant or discountable; as such, blue whales are not considered further in this Opinion.

Blue whales (Balaenoptera musculus) – Endangered
In the North Atlantic Ocean, the range of blue whales extends from the subtropics to the Greenland Sea. As described in Hayes et al. (2020; the most recent stock assessment report), blue whales have been detected and tracked acoustically in much of the North Atlantic with most of the acoustic detections around the Grand Banks area of Newfoundland and west of the British Isles. Photo-identification in eastern Canadian waters indicates that blue whales from the St. Lawrence, Newfoundland, Nova Scotia, New England, and Greenland all belong to the same stock, while blue whales photographed off Iceland and the Azores appear to be part of a separate population (CETAP 1982; Wenzel et al. 1988; Sears and Calambokidis 2002; Sears and Larsen 2002). The largest concentrations of blue whales are found in the lower St. Lawrence Estuary (LeSage et al. 2017, Comtois et al. 2010) which is outside of the action area. Blue whales do not regularly occur within the U.S. EEZ and typically occur further offshore in areas with depths of 100 m or more (Waring et al. 2010).

As stated in the BE and supported by sightings recorded in the OBIS-SEAMAP database[3], approximately 18 blue whales have been sighted in the deeper water portions of the action area where the RSA HabCam surveys will take place; however, these records are intermittent and infrequent. No blue whales have been sighted in any other parts of the action area; this includes during recent year-round aerial and acoustic surveys of the waters south of MA and RI (Kraus et al. 2016, O'Brien et al. 2022). Although acoustic detections of blue whale calls have been recorded in the vicinity of the action area, these calls were detected only in the winter when no project activities will be conducted and due to the long distance these calls can travel, detection of these calls do not mean that that individual blue whales were necessarily present in the action area. (Kraus et al. 2016, Davis et al. 2020).

The rarity of observations in the action area is consistent with the conclusion in Waring et al. (2010) that the blue whale is best considered as an occasional visitor in U.S. Atlantic EEZ waters and the conclusions in the BE that blue whales would be rare in the action area. Occasional blue whales may be present in the deeper, offshore areas where the RSA HabCam surveys will be

[3] https://seamap.env.duke.edu/species/180528; last accessed March 27, 2024.

equipped with sonar. As explained above, there were no adverse effects identified for blue whales from any of the survey activities, inclusive of consideration of vessel traffic and the HabCam surveys, considered in the 2023 NEFSC Opinion[4]. As noted in the BE, the sonar system operates at a frequency of 450 kHz which is well above the hearing threshold of low frequency cetaceans such as blue whales (hearing frequency 7Hz-35 KHz, NMFS 2018). As such, even if any blue whales were exposed to the sonar, there would be no effects as they cannot perceive the sound. Therefore, based on the best available information cited herein, we do not anticipate any effects to blue whales from the sonar equipped HabCam surveys beyond the effects for all RSA HabCam surveys evaluated in the 2023 NEFSC Opinion, which concluded the research activities were not likely to adversely affect blue whales.

Gulf of Maine DPS of Atlantic salmon (Salmo salar) – Endangered

The only remaining populations of Gulf of Maine DPS Atlantic salmon are in Maine. Smolts migrate from their natal rivers in Maine north to foraging grounds in the Western North Atlantic off Canada and Greenland (Fay et al. 2006). After one or more winters at sea, adults return to their natal river to spawn. As Gulf of Maine DPS Atlantic salmon do not occur in the action area, the proposed action will have no effect on the species.

Shortnose sturgeon (Acipenser brevirostrum) – Endangered

Shortnose sturgeon are benthic fish that mainly occupy the deep channel sections of large rivers. While occasional marine migrations occur between coastal rivers, particularly in the Gulf of Maine between the Penobscot and Kennebec rivers, shortnose sturgeon do not occur in the action area (SSSRT 2010). As such, the proposed action will have no effect on shortnose sturgeon.

Hawksbill sea turtle (Eretmochelys imbricate) – Endangered

The hawksbill sea turtle is typically found in tropical and subtropical regions of the Atlantic, Pacific, and Indian Oceans, including the coral reef habitats of the Caribbean and Central America. Hawksbill turtles generally do not migrate north of Florida and their presence north of Florida is rare (NMFS and USFWS 1993). Given their rarity in waters north of Florida, hawksbill sea turtles are not expected to occur in the project action area. As hawksbill sea turtles do not occur in the action area, the proposed action will have no effect on hawksbill sea turtles.

Giant Manta Ray (Mobula birostris) – Threatened

The giant manta ray inhabits temperate, tropical, and subtropical waters worldwide, primarily between 35° N and 35° S latitudes. In the western Atlantic Ocean, this includes waters off South Carolina south to Brazil and Bermuda. On the U.S. Atlantic coast, nearshore distribution is limited to areas off the Florida coast; otherwise, distribution occurs in offshore waters at the shelf edge. Occasionally, manta rays are observed as far north as Long Island (Miller and Klimovich 2017, Farmer et al. 2021); however, these sightings are in offshore waters along the continental shelf edge and the species is considered rare in waters north of Cape Hatteras. Distribution of giant manta rays is limited by their thermal tolerance (19-22°C off the U.S. Atlantic coast) and influenced by depth. As noted by Farmer et al. (2021), cold winter air and sea surface temperatures in the western North Atlantic Ocean likely create a physiological barrier to manta rays that restricts the northern boundary of their distribution. The only activities that will occur in

[4] Biological Opinion available online at: https://repository.library.noaa.gov/view/noaa/50901

the portion of the action area that overlaps with the distribution of giant manta rays is the use of sonar in the RSA HabCam surveys. As explained above, there were no adverse effects identified for giant manta rays from any of the survey activities, inclusive of consideration of vessel traffic and the HabCam surveys, considered in the 2023 NEFSC Opinion. As noted in the BE, the sonar system operates at a frequency of 450 kHz which is well above the hearing threshold of elasmobranchs such as the giant manta ray (hearing frequency 20-1,000Hz, Myrberg 2001). As such, even if any giant manta rays were exposed to the sonar, there would be no effects as they cannot perceive the sound. Therefore, based on the best available information cited herein, we do not anticipate any effects to giant manta rays from the sonar equipped HabCam surveys beyond the effects for all RSA HabCam surveys evaluated in the NMFS 2023 NEFSC Opinion, which concluded the research activities were not likely to adversely affect giant manta rays.

Oceanic White Tip Shark (Carcharhinus longimanus) – Threatened
The oceanic whitetip shark is usually found offshore in deep waters of the open ocean, on the outer continental shelf, or around oceanic islands in deep water greater than 184 m. As noted in Young et al. (2017), the species has a clear preference for open ocean waters between 10°N and 10°S, but can be found in decreasing numbers out to latitudes of 30°N and 35°S, with abundance decreasing with greater proximity to continental shelves. In the western Atlantic, oceanic whitetips occur from Maine to Argentina, including the Caribbean and Gulf of Mexico (Young et al. 2017). In the central and eastern Atlantic, the species occurs from Madeira, Portugal south to the Gulf of Guinea, and possibly in the Mediterranean Sea. The action area does not overlap with the distribution of oceanic white tip sharks. As such, the proposed action will have no effect on oceanic white tip sharks.

4.1.7 Critical Habitat Designated for North Atlantic right whales
On January 27, 2016, NMFS issued a final rule designating critical habitat for North Atlantic right whales (81 FR 4837). Critical habitat includes Unit 1 located in the Gulf of Maine and Georges Bank Region and Unit 2 off the coast of North Carolina, South Carolina, Georgia and Florida. The area where testing for on-demand ropeless cameras for use in the stationary camera surveys in Cape Cod Bay overlaps with Unit 1. Additionally, up to two 25-40 foot commercial lobster vessels will transit from ports in Massachusetts through portions of Unit 1 to support the deployment of the ropeless cameras. The action area does not overlap with Unit 2.

Consideration of Potential Effects to Unit 1
As identified in the final rule (81 FR 4837), the physical and biological features essential to the conservation of the North Atlantic right whale that provide foraging area functions in Unit 1 are: The physical oceanographic conditions and structures of the Gulf of Maine and Georges Bank region that combine to distribute and aggregate *C. finmarchicus* for right whale foraging, namely prevailing currents and circulation patterns, bathymetric features (basins, banks, and channels), oceanic fronts, density gradients, and temperature regimes; low flow velocities in Jordan, Wilkinson, and Georges Basins that allow diapausing *C. finmarchicus* to aggregate passively below the convective layer so that the copepods are retained in the basins; late stage *C. finmarchicus* in dense aggregations in the Gulf of Maine and Georges Bank region; and diapausing *C. finmarchicus* in aggregations in the Gulf of Maine and Georges Bank region. The only project activities that overlap with Unit 1 will be testing of on-demand ropeless cameras for the stationary camera surveys and vessel transits to support the testing. This testing will include

up to ten total ropeless camera deployments for less than five total hours during one season. Here, we explain our consideration of whether the testing of on-demand ropeless cameras may affect any physical or biological features of the designated critical habitat.

Vessel transits that may occur within Unit 1 will have no effect on any of the physical or biological features of critical habitat because there are no pathways for effects to the physical or biological features. Similarly, the temporary placement of the cameras will have no effect on any of the physical or biological features of critical habitat. Therefore, we have determined that the proposed action will have no effect on North Atlantic right whale critical habitat.

4.2 Status of the Species: Listed Species Considered for Further Analysis

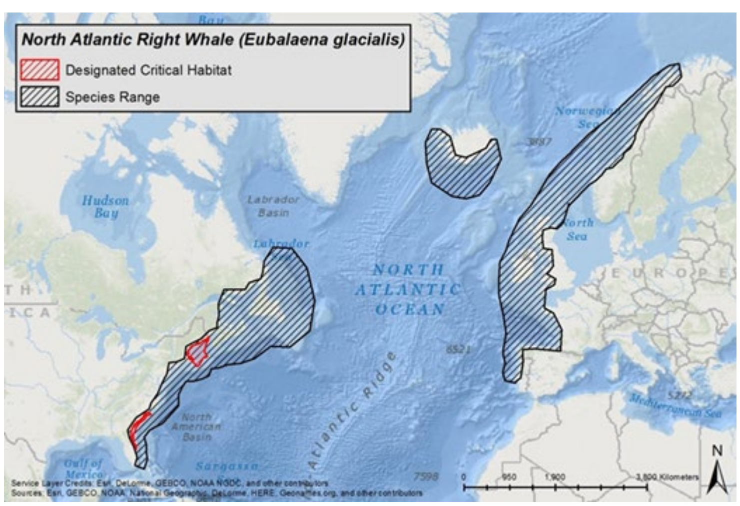
4.2.1 Marine Mammals

4.2.1.1 North Atlantic Right Whale (Eubalaena glacialis)

There are three species classified as right whales (genus *Eubalaena*): North Pacific (*E. japonica*), Southern (*E. australis*), and North Atlantic (*E. glacialis*). The North Atlantic right whale is the only species of right whale that occurs in the North Atlantic Ocean (Figure 4.1.1) and, therefore, is the only species of right whale that may occur in the action area.

North Atlantic right whales occur primarily in the western North Atlantic Ocean. However, there have been acoustic detections, reports, and/or sightings of North Atlantic right whales in waters off Greenland (east/southeast), Newfoundland, northern Norway, and Iceland, as well as within Labrador Basin (Hamilton et al. 1998, Jacobsen et al. 2004, Knowlton et al. 1992, Mellinger et al. 2011). These latter sightings/detections are consistent with historic records documenting North Atlantic right whales south of Greenland, in the Denmark straits, and in eastern North Atlantic waters (Kraus et al. 2007). There is also evidence of possible historic North Atlantic right whale calving grounds in the Mediterranean Sea (Rodrigues et al. 2018), an area not currently considered as part of this species' historical range.

Figure 4.2.1.1. Approximate historic range and currently designated U.S. critical habitat of the North Atlantic right whale.



The North Atlantic right whale is distinguished by its stocky body and lack of a dorsal fin. The species was listed as endangered on December 2, 1970. We used information available in the most recent five-year review for North Atlantic right whales (NMFS 2022), the most recent stock assessment report (Hayes et al. 2022 and Hayes et al. 2023 *draft*[5]), and the scientific literature to summarize the status of the species, as follows.

Life History

The maximum lifespan of North Atlantic right whales is unknown, but one individual reached at least 70 years of age (Hamilton et al. 1998, Kenney 2009). Previous modeling efforts suggest that in 1980, females had a life expectancy of approximately 51.8 years of age, which was twice that of males at the time (Fujiwara and Caswell 2001); however, by 1995, female life expectancy was estimated to have declined to approximately 14.5 years (Fujiwara and Caswell 2001). Most recent estimates indicate that North Atlantic right whale females are only living to 45 and males to age 65 (https://www.fisheries.noaa.gov/species/north-atlantic-right-whale). Females, ages 5+, have reduced survival relative to males, ages 5+, resulting in a decrease in female abundance relative to male abundance (Pace et al. 2017). Specifically, state-space mark-recapture model estimates show that from 2010-2015, males declined just under 4.0%, and females declined approximately 7% (Pace et al. 2017).

Gestation is estimated to be between 12 and 14 months, after which calves typically nurse for around one year (Cole et al. 2013, Kenney 2009, Kraus and Hatch 2001, Lockyer 1984). After weaning a calf, females typically undergo a 'resting' period before becoming pregnant again, presumably because they need time to recover from the energy deficit experienced during lactation (Fortune et al. 2013, Fortune et al. 2012, Pettis et al. 2017). From 1983 to 2005, annual average calving intervals ranged from 3 to 5.8 years (overall average of 4.23 years) (Kraus et al. 2007). Between 2006 and 2015, annual average calving intervals continued to vary within this range, but in 2016 and 2017 longer calving intervals were reported (6.3 to 6.6 years in 2016 and 10.2 years in 2017) (Hayes et al. 2018a, Pettis and Hamilton 2015, Pettis and Hamilton 2016, Pettis et al. 2018a, Pettis et al. 2018b, Pettis et al. 2020). There were no calves recorded in 2018. Annual average calving interval between 2019 and 2022 ranged from a low of 7 in 2019 to a high of 9.2 in 2021 (Pettis et al. 2022). The calving index is the annual percentage of reproductive females assumed alive and available to calve that was observed to produce a calf. This index averaged 47% from 2003 to 2010 but has dropped to an average of 17% since 2010 (Moore et al. 2021). The percentage of available females that had calves ranged from 11.9% to 30.5% from 2019-2022 (Pettis et al. 2022). Females have been known to give birth as young as five years old, but the mean age of a female first giving birth is 10.2 years old (n=76, range 5 to 23, SD 3.3) (Moore et al. 2021). Taken together, changes to inter-birth interval and age to first reproduction suggest that both parous (having given birth) and nulliparous (not having given birth) females are experiencing delays in calving. These calving delays correspond with the recent distribution shifts. The low reproductive rate of right whales is likely the result of several

[5] NMFS considers the population estimate for North Atlantic right whales published in the draft Stock Assessment Report (Hayes et al. 2023 draft) to be part of the best available data; this is because the population estimate is developed using a peer-reviewed model and the population estimate and accompanying text has been reviewed by the Atlantic Scientific Review Group (ASRG). See, generally, https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments and imbedded link to the Scientific Review Groups.

factors including nutrition (Fortune et al. 2013, Moore et al. 2021). Evidence also indicates that North Atlantic right whales are growing to shorter adult lengths than in earlier decades (Stewart et al. 2021) and are in poor body condition compared to southern right whales (Christiansen et al. 2020). As stated in the 2023 draft SAR, all these changes may result from a combination of documented regime shifts in primary feeding habitats (Meyer-Gutbrod and Greene 2014; Meyer-Gutbrod et al. 2021; Record et al. 2019), and increased energy expenditures related to non-lethal entanglements (Rolland et al. 2016; Pettis et al. 2017; van der Hoop 2017). As noted in the 2022 Five-Year Review (NMFS 2022), poor body condition, arrested growth, and maternal body length have led to reduced reproductive success and are contributors to low birth rates for the population over the past decade (Christiansen et al. 2020; Reed et al. 2022; Stewart et al. 2021; Stewart et al. 2022).

Pregnant North Atlantic right whales migrate south, through the mid-Atlantic region of the U.S., to low latitudes during late fall where they overwinter and give birth in shallow, coastal waters (Kenney 2009, Krzystan et al. 2018). During spring, these females and new calves migrate to high latitude foraging grounds where they feed on large concentrations of copepods, primarily *C. finmarchicus* (Mayo et al. 2018, NMFS 2017). Some non-reproductive North Atlantic right whales (males, juveniles, non-reproducing females) also migrate south, although at more variable times throughout the winter. Others appear to not migrate south and remain in the northern feeding grounds year round or go elsewhere (Bort et al. 2015, Mayo et al. 2018, Morano et al. 2012, NMFS 2017, Stone et al. 2017). Nonetheless, calving females arrive to the southern calving grounds earlier and stay in the area more than twice as long as other demographics (Krzystan et al. 2018). Little is known about North Atlantic right whale habitat use in the mid-Atlantic, but recent acoustic data indicate near year round presence of at least some whales off the coasts of New Jersey, Virginia, and North Carolina (Davis et al. 2017, Hodge et al. 2015, Salisbury et al. 2016, Whitt et al. 2013). While it is generally not known where North Atlantic right whales mate, some evidence suggests that mating may occur in the northern feeding grounds (Cole et al. 2013, Matthews et al. 2014).

Population Dynamics

Today, North Atlantic right whales are primarily found in the western North Atlantic, from their calving grounds in lower latitudes off the coast of the southeastern United States to their feeding grounds in higher latitudes off the coast of New England and Nova Scotia (Hayes et al. 2018a). Beginning in 2010, a change in seasonal residency patterns has been documented through visual and acoustic monitoring with declines in presence in the Bay of Fundy, Gulf of Maine, and Great South Channel, and more animals being observed in Cape Cod Bay, the Gulf of Saint Lawrence, the mid-Atlantic, and south of Nantucket, Massachusetts (Daoust et al. 2018, Davies et al. 2019, Davis et al. 2017, Hayes et al. 2018a, Hayes et al. 2019, Meyer-Gutbrod et al. 2018, Moore et al. 2021, Pace et al. 2017, Quintana-Rizzo et al. 2021). Right whales have been observed nearly year round in the area south of Martha’s Vineyard and Nantucket, with highest sightings rates between December and May (Leiter et al., 2017, Stone et al. 2017, Quintana-Rizzo et al. 2021, O’Brien et al. 2022). Increased detections of right whales in the Gulf of St. Lawrence have been documented from late spring through the fall (Cole et al. 2016, Simard et al. 2019, DFO 2020).

There are two recognized populations of North Atlantic right whales, an eastern, and a western population. Very few individuals likely make up the population in the eastern Atlantic, which is thought to be functionally extinct (Best et al. 2001). However, in recent years, a few known individuals from the western population have been seen in the eastern Atlantic, suggesting some individuals may have wider ranges than previously thought (Kenney 2009). Specifically, there have been acoustic detections, reports, and/or sightings of North Atlantic right whales in waters off Greenland (east/southeast), Newfoundland, northern Norway, and Iceland, as well as within Labrador Basin (Jacobsen et al. 2004, Knowlton et al. 1992, Mellinger et al. 2011). It is estimated that the North Atlantic historically (i.e., pre-whaling) supported between 9,000 and 21,000 right whales (Monsarrat et al. 2016). The western population may have numbered fewer than 100 individuals by 1935, when international protection for right whales came into effect (Kenney et al. 1995).

Genetic analyses, based upon mitochondrial and nuclear DNA analyses, have consistently revealed an extremely low level of genetic diversity in the North Atlantic right whale population (Hayes et al. 2018a, Malik et al. 2000, McLeod and White 2010, Schaeff et al. 1997). Waldick et al. (2002) concluded that the principal loss of genetic diversity occurred prior to the 18th century, with more recent studies hypothesizing that the loss of genetic diversity may have occurred prior to the onset of Basque whaling during the 16th and 17th century (Mcleod et al. 2008, Rastogi et al. 2004, Reeves et al. 2007, Waldick et al. 2002). The persistence of low genetic diversity in the North Atlantic right whale population might indicate inbreeding; however, based on available data, no definitive conclusions can be reached at this time (Hayes et al. 2019, Radvan 2019, Schaeff et al. 1997). By combining 25 years of field data (1980-2005) with high-resolution genetic data, Frasier et al. (2013) found that North Atlantic right whale calves born between 1980 and 2005 had higher levels of microsatellite (nuclear) heterozygosity than would be expected from this species' gene pool. The authors concluded that this level of heterozygosity is due to postcopulatory selection of genetically dissimilar gametes and that this mechanism is a natural means to mitigate the loss of genetic diversity, over time, in small populations (Frasier et al. 2013).

In the western North Atlantic, North Atlantic right whale abundance was estimated to be 270 animals in 1990 (Pace et al. 2017). From 1990 to 2011, right whale abundance increased by approximately 2.8% per year, despite a decline in 1993 and no growth between 1997 and 2000 (Pace et al. 2017). However, since 2011, when the abundance peaked at 481 animals, the population has been in decline, with a 99.99% probability of a decline of just under 1% per year (Pace et al. 2017). Between 1990 and 2015, survival rates appeared relatively stable, but differed between the sexes, with males having higher survivorship than females (males: 0.985 ± 0.0038; females: 0.968 ± 0.0073) leading to a male-biased sex ratio (approximately 1.46 males per female) (Pace et al. 2017).

As reported in the most recent final SAR (Hayes et al. 2023), the western North Atlantic right whale stock size is estimated based on a published state-space model of the sighting histories of individual whales identified using photo-identification techniques (Pace et al. 2017; Pace 2021). Sightings histories were constructed from the photo-ID recapture database as it existed in December 2021, and included photographic information up through November 2020. Using a hierarchical, state-space Bayesian open population model of these histories produced a median abundance value (N_{est}) as of November 30, 2020 of 338 individuals (95% Credible Interval (CI): 325–350). The minimum population estimate included in the most recent SAR is 332 (Hayes et al. 2023). Linden 2023[6] updated the population size estimate of North Atlantic right whales at the beginning of 2022 using the most recent year of available sightings data (collected through December 2022) and the existing modeling approach. Using the established capture-recapture framework (Pace et al. 2017), the estimated population size in 2022 was 356 whales, with a 95% credible interval ranging from 346 to 363. Linden notes that given uncertainty in the accuracy of the terminal year estimate (Pace 2021), interpretations should focus on the multi-year population trend. The sharp decrease observed from 2015-2020 appears to have slowed, though the right whale population continues to experience annual mortalities above recovery thresholds.

Each year, scientists at NMFS' Northeast Fisheries Science Center estimate the right whale population abundance and share that estimate at the North Atlantic Right Whale Consortium's annual meeting in a "Report Card." This estimate is considered preliminary and undergoes further review before being included in the draft North Atlantic Right Whale Stock Assessment Report. Each draft stock assessment report is peer-reviewed by one of three regional Scientific Review Groups, revised after a public comment period, and published. The 2022 "Report Card" (Pettis et al. 2022) data reports a preliminary population estimate for 2021 using data as of August 30, 2022 is 340 (+/- 7). Pettis et al. (2022) also report that fifteen mother calf pairs were sighted in 2022, down from 18 in 2021. There were no first time mothers sighted in 2022. Initial analyses detected at least 16 new entanglements in 2022: five whales seen with gear and 11 with new scarring from entanglements. Additionally, there was one non-fatal vessel strike detected. No carcasses were detected. Of the 15 calves born in 2022, one is known to have died and another is thought likely to have died. During the 2022-2023 season, there were 11 mothers with associated calves and one newborn documented alone that was later found dead. Through March 12, 2024, 17 mother-calf pairs have been sighted in the 2023-2024 calving season; of these, 3 are thought to be first time mothers. One calf (mother Juno, #1612) had been sighted with serious injuries consistent with a vessel strike; while there were signs that the injuries were healing the dead calf stranded in Georgia in early March. Additionally, two other calves are considered "missing" and are likely mortalities as the mothers have been seen alone after only a single sighting with their calves.

In addition to finding an overall decline in the North Atlantic right whale population, Pace et al. (2017) also found that between 1990 and 2015, the survival of age 5+ females relative to 5+ males has been reduced; this has resulted in diverging trajectories for male and female abundance. Specifically, there was an estimated 142 males (95% CI=143-152) and 123 females (95% CI=116-128) in 1990; however, by 2015, model estimates show the species was comprised of 272 males (95% CI=261-282) and 186 females (95% CI=174-195; Pace et al. 2017). Calving rates also varied substantially between 1990 and 2015 (i.e., 0.3% to 9.5%), with low calving rates coinciding with three periods (1993-1995, 1998-2000, and 2012-2015) of decline or no growth (Pace et al. 2017). Using generalized linear models, Corkeron et al. (2018) found that between 1992 and 2016, North Atlantic right whale calf counts increased at a rate of 1.98% per year. Using the highest annual estimates of survival recorded over the time series from Pace et al. (2017), and an assumed calving interval of approximately four years, Corkeron et al. (2018) suggests that the North Atlantic right whale population could potentially increase at a rate of at

[6] Available at: https://www.fisheries.noaa.gov/s3/2023-10/TM314-508-0.pdf

least 4% per year if there was no anthropogenic mortality.[7] This rate is approximately twice that observed, and the analysis indicates that adult female mortality is the main factor influencing this rate (Corkeron et al. 2018). Right whale births remain significantly below what is expected and the average inter-birth interval remains high (Pettis et al. 2022). Additionally, there were no first-time mothers in 2022, underscoring recent research findings that fewer adult, nulliparous females are becoming reproductively active (Reed et al., 2022).

Status

The North Atlantic right whale is listed under the ESA as endangered. Anthropogenic mortality and sub-lethal stressors (i.e., entanglement) that affect reproductive success are currently affecting the ability of the species to recover (Corkeron et al. 2018, Stewart et al. 2021), currently, none of the species' recovery goals (see below) have been met. With whaling now prohibited, the two major known human causes of mortality are vessel strikes and entanglement in fishing gear (Hayes et al. 2018a). Estimates of total annual anthropogenic mortality (i.e., ship strike and entanglement in fishing gear), as well as the number of undetected anthropogenic mortalities for North Atlantic right whales are presented in the annual SARs. These anthropogenic threats appear to be worsening (Hayes et al. 2018a).

On June 7, 2017, NMFS declared an Unusual Mortality Event (UME) for the North Atlantic right whale, as a result of 17 observed right whale mortalities in the U.S. and Canada. Under the Marine Mammal Protection Act, a UME is defined as "a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response." As of March 12, 2024, there are 39 confirmed mortalities for the UME (including a juvenile female stranded on Martha's Vineyard in January 2024; while cause of death is pending the animal was previously observed with an entanglement, no evidence of vessel strike has been reported), 34 serious injuries, and 51 sublethal injuries or illness (for more information on UMEs, see https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-unusual-mortality-events). Mortalities are recorded as vessel strike (14), entanglement (9), perinatal (2), unknown/undetermined (3), examined (10), and pending (1; the January 24 female noted above).[8]

The North Atlantic right whale population continues to decline. As noted above, between 1990 to 2011, right whale abundance increased by approximately 2.8% per year; however, since 2011 the population has been in decline (Pace et al. 2017). The 2023 draft SAR reports an overall abundance decline between 2011 and 2020 of 23.5% (CI=21.4% to 26.0%) (Hayes et al. 2023). Recent modeling efforts indicate that low female survival, a male biased sex ratio, and low calving success are contributing to the population's current decline (Pace et al. 2017). For instance, five new calves were documented in 2017 calving season, zero in 2018, and seven in 2019 (Pettis et al. 2018a, Pettis et al. 2018b, Pettis et al. 2020), these numbers of births are well

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[7] Based on information in the North Atlantic Right Whale Catalog, the mean calving interval is 4.69 years (P. Hamilton 2018, unpublished, in Corkeron et al. 2018). Corkeron et al. (2018) assumed a 4 year calving interval as the approximate mid-point between the North Atlantic Right Whale Catalog calving interval and observed calving intervals for southern right whales (i.e., 3.16 years for South Africa, 3.42 years for Argentina, 3.31 years for Auckland Islands, and 3.3 years for Australia).

[8] https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2023-north-atlantic-right-whale-unusual-mortality-event; last accessed February 27, 2024

below the number needed to compensate for expected mortalities. More recently, there were 10 calves in the 2020 calving season, 18 calves in 2021, and 15 in 2022. Two of the 2020 calves and one of the 2021 calves died or were seriously injured due to vessel strikes. Two additional calves were reported in the 2021 season, but were not seen as a mother/calf pair. One animal stranded dead with no evidence of human interaction and initial results suggest the calf died during birth or shortly thereafter. The second animal was an anecdotal report of a calf off the Canary Islands. Two calves in 2022 are suspected to have died, with the causes of death unknown. As noted above, 11 mother-calf pairs were sighted in the 2022-2023 calving season[9] as well as one lone calf that died shortly after being spotted. As of March 12, 2024, 17 mother-calf pairs have been sighted in the 2023-2024 calving season, 1 mortality has been confirmed and 2 calves have not been resighted.

Long-term photographic identification data indicate new calves rarely go undetected (Kraus et al. 2007, Pace et al. 2017). While there are likely a multitude of factors involved, low calving has been linked to poor female health (Rolland et al. 2016) and reduced prey availability (Devine et al. 2017, Johnson et al. 2017, Meyer-Gutbrod and Green 2014, Meyer-Gutbrod and Greene 2018, Meyer-Gutbrod et al. 2018). A recent study comparing North Atlantic right whales to other right whale species found that juvenile, adult, and lactating female North Atlantic right whales all had lower body condition scores compared to the southern right whale populations, with lactating females showing the largest difference; however, North Atlantic right whale calves were in good condition (Christiansen et al. 2020). While some of the difference could be the result of genetic isolation and adaptations to local environmental conditions, the authors suggest that the magnitude indicates that North Atlantic right whale females are in poor condition, which could be suppressing their growth, survival, age of sexual maturation and calving rates. In addition, they conclude that the observed differences are most likely a result of differences in the exposure to anthropogenic factors (Christiansen et al. 2020). Furthermore, entanglement in fishing gear appears to have substantial health and energetic costs that affect both survival and reproduction (Hayes et al. 2018a, Hunt et al. 2016, Lysiak et al. 2018, Pettis et al. 2017, Robbins et al. 2015, Rolland et al. 2017, van der Hoop et al. 2017).

Kenney et al. (2018) projected that if all other known or suspected impacts (e.g., vessel strikes, calving declines, climate change, resource limitation, sublethal entanglement effects, disease, predation, and ocean noise) on the population remained the same between 1990 and 2016, and none of the observed fishery related mortality and serious injury occurred, the projected population in 2016 would be 12.2% higher (506 individuals). Furthermore, if the actual mortality resulting from fishing gear is double the observed rate (as estimated in Pace et al. 2017), eliminating all mortalities (observed and unobserved) could have resulted in a 2016 population increase of 24.6% (562 individuals) and possibly over 600 in 2018 (Kenney 2018).

Given the above information, North Atlantic right whales' resilience to future perturbations affecting health, reproduction, and survival is expected to be very low (Hayes et al. 2018a). The observed (and clearly biased low as described in Hayes et al. 2022) human-caused mortality and serious injury was 7.7 right whales per year from 2015 through 2019 (Hayes et al. 2022). Using the refined methods of Pace et al. (2021), the estimated annual rate of total mortality for the

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[9] https://mission.cmaquarium.org/2022-2023-right-whale-calving-season/#:~:text=Calving%20season%20is%20vital%20for,for%20mother%20and%20calf%20pairs.

period 2014–2018 was 27.4, which is 3.4 times larger than the 8.15 total derived from reported mortality and serious injury for the same period (Hayes et al. 2022). The 2023 draft SAR reports the observed human-caused mortality and serious injury was 8.1 right whales per year from 2016 through 2020 (Hayes et al. 2023 draft). Using the refined methods of Pace et al. (2021), the estimated annual rate of total mortality for the period 2015–2019 was 31.2, which is 4.1 times larger than the 7.7 total derived from reported mortality and serious injury for the same period. Using a matrix population projection model, it is estimated that by 2029 the population will decline from 160 females to the 1990 estimate of 123 females if the current rate of decline is not altered (Hayes et al. 2018a).

Climate change poses a significant threat to the recovery of North Atlantic right whales. The information presented here is summarized from a more complete description of this threat in the 2022 5-Year Review (NMFS 2022). The documented shift in North Atlantic right whale summer habitat from the Gulf of Maine to waters further north in the Gulf of St. Lawrence in the early 2010s is considered to be related to an oceanographic regime shift in Gulf of Maine waters linked to a northward shift of the Gulf Stream which caused the availability of the primary North Atlantic right whale prey, the copepod *Calanus finmarchicus*, to decline locally, forcing North Atlantic right whales to forage in areas further north (Meyer-Gutbrod et al. 2021; Record et al. 2019; Sorochan et al. 2019). The shift of North Atlantic right whale distribution into waters further north also created policy challenges for the Canadian government, which had to implement new regulations in areas that were not protected because they were not documented as right whale habitat in the past (Davies and Brillant 2019; Meyer-Gutbrod et al. 2018; Record et al. 2019).

When prey availability is low, North Atlantic right whale calving rates decline, a well-documented phenomenon through periods of low prey availability in the 1990s and the 2010s; without increased prey availability in the future, low population growth is predicted (Meyer-Gutbrod and Greene 2018). Prey densities in the Gulf of St. Lawrence have fluctuated irregularly in the past decade, limiting suitable foraging habitat for North Atlantic right whales in some years and further limiting reproductive rates (Bishop et al. 2022; Gavrilchuck et al. 2020; Gavrilchuck et al. 2021; Lehoux et al. 2020).

Recent studies have investigated the spatial and temporal role of oceanography on copepod availability and distribution and resulting effects on foraging North Atlantic right whales. Changes in seasonal current patterns have an effect on the density of *Calanus* species in the Gulf of St. Lawrence, which may lead to further temporal variations over time (Sorochan et al. 2021a). Brennan et al. (2019) developed a model to estimate seasonal fluctuations in C. finmarchicus availability in the Gulf of St. Lawrence, which is highest in summer and fall, aligning with North Atlantic right whale distribution during those seasons. Pendleton et al. (2022) found that the date of maximum occupancy of North Atlantic right whales in Cape Cod Bay shifted 18.1 days later between 1998 and 2018 and was inversely related to the spring thermal transition date, when the regional ocean temperature surpasses the mean annual temperature for that location, which has trended towards moving earlier each year as an effect of climate change. This inverse relationship may be due to a 'waiting room' effect, where North Atlantic right whales wait and forage on adequate prey in the waters of Cape Cod Bay while richer prey develops in the Gulf of St. Lawrence, and then migrate directly there rather than following migratory pathways used previously (Pendleton et al. 2022; Ganley et al. 2022). Although the date of maximum occupancy in Cape Cod Bay has shifted to later in the spring, initial sightings of individual North Atlantic right whales have started earlier, indicating that they may be using regional water temperature as a cue for migratory movements between habitats (Ganley et al. 2022).

North Atlantic right whales rely on late stage or diapause copepods, which are more energy-rich, for prey; diving behavior is highly reliant on where in the vertical strata *C. finmarchicus* is distributed (Baumgartner et al. 2017). There is evidence that *C. finmarchicus* are reaching the diapause phase at deeper depths to account for warming water on the Newfoundland Slope and Scotian Shelf, forcing North Atlantic right whales to forage deeper and further from shore (Krumhansl et al. 2018; Sorochan et al. 2021a).

Several studies have already used the link between *Calanus* distribution and North Atlantic right whale distribution to determine suitable habitat, both currently and in the future (Gavrilchuk et al. 2020; Pershing et al. 2021; Silber et al. 2017; Sorochan et al. 2021b). Plourde et al. (2019) used suitable habitat modeling using *Calanus* density to confirm new North Atlantic right whale hot spots for summer feeding in Roseway Basin and Grand Manan and identified other potential aggregation areas further out on the Scotian Shelf. Gavrilchuk et al. (2021) determined suitable habitat for reproductive females in the Gulf of St. Lawrence, finding declines in foraging habitat over a 12- year period and indicating that the prey biomass in the area may become insufficient to sustain successful reproduction over time. Ross et al. (2021) used suitable habitat modeling to predict that the Gulf of Maine habitat would continue to decline in suitability until 2050 under a range of climate change scenarios. Similarly, models of future copepod density in the Gulf of Maine have predicted declines of up to 50 percent under high greenhouse gas emission scenarios by 2080- 2100 (Grieve et al. 2017). It is clear that climate change does and will continue to have an impact on the availability, supply, aggregation, and distribution of *C. finmarchicus*, and North Atlantic right whale abundance and distribution will continue to vary based on those impacts; however, more research must be done to better understand these factors and associated impacts (Sorochan et al. 2021b). Climate change will likely have other secondary effects on North Atlantic right whales, such as an increase in harmful algal blooms of the toxic dinoflagellate *Alexandrium catenella* due to warming waters, increasing the risk of North Atlantic right whale exposure to neurotoxins (Boivin-Rioux et al. 2021; Pershing et al. 2021).

Factors Outside the Action Area Affecting the Status of the Right Whale: Fishery Interactions and Vessel Strikes in Canadian Waters

In Canada, right whales are protected under the Species at Risk Act (SARA) and the Fisheries Act. The right whale was considered a single species and designated as endangered in 1980. SARA includes provisions against the killing, harming, harassing, capturing, taking, possessing, collecting, buying, selling, or trading of individuals or its parts (SARA section 32) and damage or destruction of its residence (SARA section 33). In 2003, the species was split to allow separate designation of the North Atlantic right whale, which was listed as endangered under SARA in May 2003. All marine mammals are subject to the provisions of the marine mammal regulations under the Fisheries Act. These include requirements related to approach, disturbance, and reporting. In the St. Lawrence estuary and the Saguenay River, the maximum approach distance for threatened or endangered whales is 1,312 ft. (400 m).

North Atlantic right whales have died or been seriously injured in Canadian waters by vessel strikes and entanglement in fishing gear (DFO 2014). Serious injury and mortality events are rarely observed where the initial entanglement occurs. After an event, live whales or carcasses may travel hundreds of miles before ever being observed, including into U.S. waters given prevailing currents. It is unknown exactly how many serious injuries and mortalities have occurred in Canadian waters historically. However, at least 14 right whale carcasses and 20 injured right whales were sighted in Canadian waters between 1988 and 2014 (Davies and Brillant 2019); 25 right whale carcasses were first sighted in Canadian waters or attributed to Canadian fishing gear from 2015 through 2019. In the sections to follow, information is provided on the fishing and shipping industry in Canadian waters, as well as measures the Canadian government is taking (or will be taking) to reduce the level of serious injuries and mortalities to North Atlantic rights resulting from incidental entanglement in fishing gear or vessel strikes.

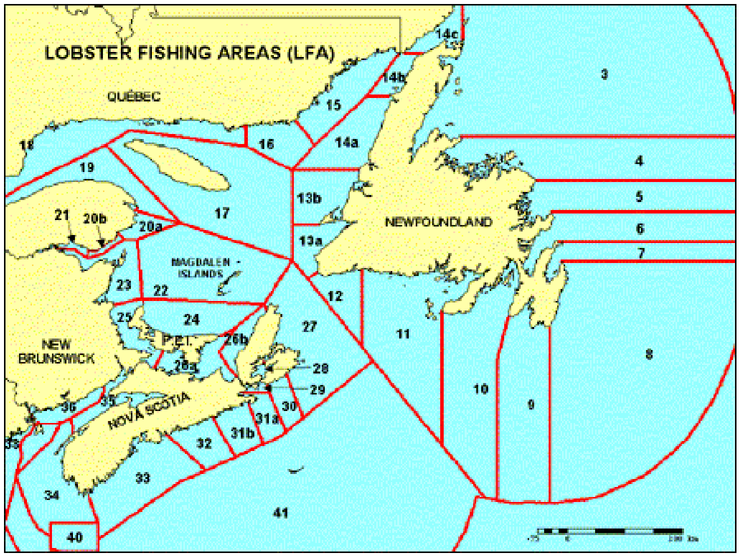
Fishery Interactions in Canadian Waters

There are numerous fisheries operating in Canadian waters. Rock and toad crab fisheries, as well as fixed gear fisheries for cod, Atlantic halibut, Greenland halibut, winter flounder, and herring have historically had few interactions. While these fisheries deploy gear that pose some risk, this analysis focuses on fisheries that have demonstrated interactions with ESA-listed species (i.e., lobster, snow crab, mackerel, and whelk). Based on information provided by the Department of Fisheries and Oceans Canada (DFO), a brief summary of these fisheries is provided below.

The American lobster fishery is DFO's largest fishery, by landings. It is managed under regional management plans with 41 Lobster Fisheries Areas (Figure 5.1.2); in which 10,000 licensed harvesters across Atlantic Canada and Quebec participate.[10] In addition to the one permanent closure in Lobster Fishery Area 40 (Figure 4.1.2), fisheries are generally closed during the summer to protect molts. Lobster fishing is most active in the Gulf of Maine, Bay of Fundy, Southern Gulf of St. Lawrence, and coastal Nova Scotia. Most fisheries take place in shallow waters less than 130 ft. (40 m) deep and within 8 nm (15 km) of shore, although some fisheries will fish much farther out and in waters up to 660 ft. (200 m) deep. Management measures are tailored to each Area and include limits on the number of licenses issued, limits on the number of traps, limited and staggered fishing seasons, limits on minimum and maximum carapace size (which differs depending on the Area), protection of egg-bearing females (females must be notched and released alive), and ongoing monitoring and enforcement of fishing regulations and license conditions. The Canadian lobster fisheries use trap/pot gear consistent with the gear used in the American lobster fishery in the U.S. While both Canada and the U.S. lobster fisheries employ similar gears, the two nations employ different management strategies that result in divergent prosecution of the fisheries.

[10] Of the 41 Lobster Fisheries Areas, one is for the offshore fishery, and one is closed for conservation.

Figure 4.2.1.2. Lobster fishing areas in Atlantic Canada (https://www.dfo-mpo.gc.ca/fisheries-peches/commercial-commerciale/atl-arc/lobster-homard-eng.html).



The snow crab fishery is DFO's second largest fishery, by landings. It is managed under regional management plans with approximately 60 Snow Crab Management Areas in Canada spanning four regions (Scotia-Fundy, Southern Gulf of St. Lawrence, Northern Gulf of St. Lawrence, and Newfoundland and Labrador). Approximately 4,000 crab fishery licenses are issued annually[11]. The management of the snow crab fishery is based on annual total allowable catch, individual quotas, trap and mesh restrictions, minimum legal size, mandatory release of female crabs, minimum mesh size of traps, limited seasons, and areas. Protocols are in place to close grids when a percentage of soft-shell crabs in catches is reached. Harvesters use baited conical traps and pots set on muddy or sand-mud bottoms usually at depths of 230-460 ft. (70-140 m). Annual permit conditions have been used since 2017 to minimize the impacts to North Atlantic right whales, as described below.

DFO manages the Atlantic mackerel fishery under one Atlantic management plan, established in 2007. Management measures include fishing seasons, total allowable catch, gear, Safety at Sea fishing areas, licensing, minimum size, fishing gear restrictions, and monitoring. The plan allows the use of the following gear: gillnet, handline, trap net, seine, and weir. When established, the DFO issued 17,182 licenses across four regions, with over 50% of these licenses using gillnet gear. In 2020, DFO issued 7,812 licenses; no gear information was available. Commercial harvest is timed with the migration of mackerel into and out of Canadian waters. In Nova Scotia, the gillnet and trap fisheries for mackerel take place primarily in June and July. Mackerel generally arrive in southwestern Nova Scotia in May and Cape Breton in June. Migration out of the Gulf of St. Lawrence begins in September, and the fishery can continue into October or early November. They may enter the Gulf of St. Lawrence, depending on temperature conditions. The gillnet fishery in the Gulf of St. Lawrence also occurs in June and July. Most nets are fixed,

[11] https://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/licences-permis-atl-eng.htm#Species; Last accessed February 12, 2024

except for a drift fishery in Chaleurs Bay and the part of the Gulf between New Brunswick, Prince Edward Island, and the Magdalen Islands.[11]

Conservation harvesting plans are used to manage waved whelk in Canadian waters, which are harvested in the Gulf of St. Lawrence, Quebec, Maritimes, and Newfoundland and Labrador regions. The fishery is managed using quotas, fishing gear requirements, dockside monitoring, traps limits, seasons, tagging, and area requirements. In 2017, there were 240 whelk license holders in Quebec; however, only 81 of them were active. Whelk traps are typically weighted at the bottom with cement or other means and a rope or other mechanism is positioned in the center of the trap to secure the bait. Between 50 and 175 traps are authorized per license. The total number of authorized traps for all licenses in each fishing area varies between 550 and 6,400 traps, while the number of used or active traps is lower, with 200 to 1,700 traps per fishing area. Since 2017, the Government of Canada has implemented measures to protect right whales from entanglement. These measures have included seasonal and dynamic closures for fixed gear fisheries, changes to the fishing season for snow crab, reductions in traps in the mid-shore fishery in Crab Fishing Area 12, and license conditions to reduce the amount of rope in the water. Measures to better track gear, require reporting of gear loss, require reporting of interactions with marine mammals, and increased surveillance for right whales have also been implemented. Measures to reduce interactions with fishing gear are adjusted annually. In 2021, mandatory closures for non-tended fixed gear fisheries, including lobster and crab, will be put in place for 15 days when right whales are sighted. If a whale is detected in days 9-15 of the closure, the closure will be extended. In the Bay of Fundy and the critical habitats in the Roseway and Grand Manan basins, this extension will be for an additional 15 days. If a right whale is detected in the Gulf of St. Lawrence, the closure will be season-long. Outside the dynamic area, closures are considered on a case-by-case basis. There are also gear marking and reporting requirements for all fixed gear fisheries. The Government of Canada will also continue to support industry trials of innovative fishing technologies and methods to prevent and mitigate whale entanglement. This included authorizing ropeless gear trials in closed areas in 2021. Measures to implement weak rope or weak-breaking points were delayed and will be implemented in 2024. Measures related to maximum rope diameters, sinking rope between traps and reductions in vertical and floating rope were implemented in 2023.[12]

In August 2016, NMFS published the MMPA Import Provisions Rule (81 FR 54389, August 15, 2016), which established criteria for evaluating a harvesting nation's regulatory program for reducing marine mammal bycatch and the procedures for obtaining authorization to import fish and fish products into the United States. Specifically, to continue in the international trade of seafood products with the United States, other nations must demonstrate that their marine mammal mitigation measures for commercial fisheries are, at a minimum, equivalent to those in place in the United States. A five-year exemption period (beginning January 1, 2017) was created in this process to allow foreign harvesting nations time to develop, as appropriate, regulatory programs comparable in effectiveness to U.S. programs at reducing marine mammal bycatch. To comply with its requirements, it is essential that these interactions are reported, documented, and quantified. To guarantee that fish products have access to the U.S. markets,

[12] More information on these measures is available at https://www.dfo-mpo.gc.ca/fisheries-peches/commercial-commerciale/atl-arc/narw-bnan/management-gestion-eng.html.

DFO must implement procedures to reliably certify that the level of mortality caused by fisheries does not exceed U.S. standards. DFO must also demonstrate that the regulations in place to reduce accidental death of marine mammals are comparable to those of the United States.

Vessel Strikes in Canadian Waters

Vessel strikes are a threat to right whales throughout their range. In Canadian waters where right whales are present, vessels include recreational and commercial vessels, small and large vessels, and sail, and power vessels. Vessel categories include oil and gas exploration, fishing and aquaculture, cruise ships, offshore excursions (whale and bird watching), tug/tow, dredge, cargo, and military vessels. At the time of development of the Gulf of St. Lawrence management plan, approximately 6,400 commercial vessels transited the Cabot Strait and the Strait of Belle Isle annually. This represents a subset of the vessels in this area as it only includes commercial vessels (DFO 2013). To address vessel strikes in Canadian waters, the International Maritime Organization (IMO) amended the Traffic Separation Scheme in the Bay of Fundy to reroute vessels around high use areas. In 2007, IMO adopted and Canada implemented a voluntary seasonal Area to Be Avoided (ATBA) in Roseway Basin to further reduce the risk of vessel strike (DFO 2020). In addition, Canada has implemented seasonal speed restrictions and developed a proposed action plan to identify specific measures needed to address threats and achieve recovery (DFO 2020).

The Government of Canada has also implemented measures to mitigate vessel strikes in Canadian waters. Each year since August 2017, the Government has implemented seasonal speed restrictions (maximum 10 knots) for vessels 20 meters or longer in the western Gulf of St. Lawrence. In 2019, the area was adjusted and the restriction was expanded to apply to vessels greater than 13 m. Smaller vessels are encouraged to respect the limit. Dynamic area management has also been used in recent years. Currently, there are two shipping lanes, south and north of Anticosti Island, where dynamic speed restrictions (mandatory slowdown to 10 knots) can be activated when right whales are present. In 2020 and 2021, the Government of Canada also implemented a trial voluntary speed restriction zone from Cabot Strait to the eastern edge of the dynamic shipping zone at the beginning and end of the season and a mandatory restricted area in or near Shediac Valley mid-season.[13] Modifications to measures in 2021 include refining the size, location, and duration of the mandatory restricted area in and near Shediac Valley and expanding the speed limit exemption in waters less than 20 fathoms to all commercial fishing vessels. In 2022, a variety of measures were in place to reduce the risk of vessel strike including vessel speed limits and restricted access areas.

Critical Habitat

Critical habitat for North Atlantic right whales has been designated in U.S. waters as described in Section 4.1 of this Opinion.

Recovery Goals

Recovery is the process of restoring endangered and threatened species to the point where they no longer require the safeguards of the Endangered Species Act. A recovery plan serves as a road

[13] More information is available at https://www.tc.gc.ca/en/services/marine/navigation-marine-conditions/protecting-north-atlantic-right-whales-collisions-ships-gulf-st-lawrence.html

map for species recovery—the plan outlines the path and tasks required to restore and secure self-sustaining wild populations. It is a non-regulatory document that describes, justifies, and schedules the research and management actions necessary to support recovery of a species. The goal of the 2005 Recovery Plan for the North Atlantic right whale (NMFS, 2005) is to promote the recovery of North Atlantic right whales to a level sufficient to warrant their removal from the List of Endangered and Threatened Wildlife and Plants under the ESA. The intermediate recovery goal is to reclassify the species from endangered to threatened. The recovery strategy identified in the Recovery Plan focuses on reducing or eliminating deaths and injuries from anthropogenic activities, namely shipping and commercial fishing operations; developing demographically-based recovery criteria; the characterization, monitoring, and protection of important habitat; identification and monitoring of the status, trends, distribution and health of the species; conducting studies on the effects of other potential threats and ensuring that they are addressed, and conducting genetic studies to assess population structure and diversity. The plan also recognizes the need to work closely with State, other Federal, international and private entities to ensure that research and recovery efforts are coordinated. The recovery plan includes the following downlisting criteria, the achievement of which would demonstrate significant progress toward full recovery:

> North Atlantic right whales may be considered for reclassifying to threatened when all of the following have been met: 1) The population ecology (range, distribution, age structure, and gender ratios, etc.) and vital rates (age-specific survival, age-specific reproduction, and lifetime reproductive success) of right whales are indicative of an increasing population; 2) The population has increased for a period of 35 years at an average rate of increase equal to or greater than 2% per year; 3) None of the known threats to North Atlantic right whales (summarized in the five listing factors) are known to limit the population's growth rate; and 4) Given current and projected threats and environmental conditions, the right whale population has no more than a 1% chance of quasi-extinction in 100 years.

Specific criteria for delisting North Atlantic right whales are not included in the recovery plan; as described in the recovery plan, conditions related to delisting are too distant and hypothetical to realistically develop specific criteria. The current abundance of North Atlantic right whales is currently an order of magnitude less than an abundance at which NMFS would even consider delisting the species. The current dynamics indicate that the North Atlantic right whale population is in decline, rather than recovering, and decades of population growth at rates considered typical for large whales would be required before the population could attain an abundance that may suggest that delisting was appropriate to consider. Specific criteria for delisting North Atlantic right whales will be included in a future revision of the recovery plan well before the population is at a level when delisting becomes a reasonable decision (NMFS 2005).

The most recent five-year review for right whales was completed in 2022 (NMFS 2022). The recommendation in that plan was for the status to remain as endangered. As described in the report, the North Atlantic right whale faces continued threat of human-caused mortality due to lethal interactions with commercial fisheries and vessel traffic. As stated in the 5-Year Review, there is also uncertainty regarding the effect of long-term sublethal entanglements, emerging environmental stressors including climate change, and the compounding effects of multiple continuous stressors that may be limiting North Atlantic right whale calving and recovery. In addition, the North Atlantic right whale population has been in a state of decline since 2010. Management measures in the United States have been in place for an extended period of time and continued modifications are underway/anticipated, and measures in Canada since 2017 also suggest continued progress toward implementing conservation regulations. Despite these efforts to reduce the decline and promote recovery, progress toward right whale recovery has continued to regress.

4.2.1.2 Fin Whale (Balaenoptera physalus)

Globally there is one species of fin whale, *Balaenoptera physalus*. Fin whales occur in all major oceans of the Northern and Southern Hemispheres (NMFS 2010a) (Figure 4.1.3). Within this range, three subspecies of fin whales are recognized: *B. p. physalus* in the Northern Hemisphere, and *B. p. quoyi* and *B. p. patachonica* (a pygmy form) in the Southern Hemisphere (NMFS 2010a). For management purposes in the northern Hemisphere, the United States divides, *B. p. physalus,* into four stocks: Hawaii, California/Oregon/Washington, Alaska (Northeast Pacific), and Western North Atlantic (Hayes et al. 2019, NMFS 2010a).

Figure 4.2.1.3. Range of the fin whale.

Fin whales are distinguishable from other whales by a sleek, streamlined body, with a V-shaped head, a tall hooked dorsal fin, and a distinctive color pattern of a black or dark brownish-gray body and sides with a white ventral surface. The lower jaw is gray or black on the left side and creamy white on the right side. The fin whale was listed as endangered on December 2, 1970 (35 FR 18319).

Information available from the recovery plan (NMFS 2010a), recent stock assessment reports (Carretta et al. 2019a, Hayes et al. 2022, Muto et al. 2019a), the five-year status review (NMFS 2019b), as well as the recent International Union for the Conservation of Nature's (IUCN) fin whale assessment (Cooke 2018b) were used to summarize the life history, population dynamics and status of the species as follows.

Life History

Fin whales can live, on average, 80 to 90 years. They have a gestation period of less than one year, and calves nurse for six to seven months. Sexual maturity is reached between 6 and 10 years of age with an average calving interval of two to three years. They mostly inhabit deep, offshore waters of all major oceans. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed, although some fin whales appear to be residential to certain areas.

Population Dynamics

The pre-exploitation estimate for the fin whale population in the entire North Atlantic was approximately 30,000-50,000 animals (NMFS 2010a), and for the entire North Pacific Ocean, approximately 42,000 to 45,000 animals (Ohsumi and Wada 1974). In the Southern Hemisphere, prior to exploitation, the fin whale population was approximately 40,000 whales (Mizroch et al. 1984b). In the North Atlantic Ocean, fin whales were heavily exploited from 1864 to the 1980s; over this timeframe, approximately 98,000 to 115,000 fin whales were killed (IWC 2017). Between 1910-1975, approximately 76,000 fin whales were recorded taken by modern whaling in the North Pacific; this number is likely higher as many whales killed were not identified to species or while killed, were not successfully landed (Allison 2017). Over 725,000 fin whales were killed in the Southern Hemisphere from 1905 to 1976 (Allison 2017).

In the North Atlantic Ocean, the IWC has defined seven management stocks of fin whales: (1) North Norway (2) East Greenland and West Iceland (EGI); (3) West Norway and the Faroes; (4) British Isles, Spain and Portugal; (5) West Greenland and (6) Nova Scotia, (7) Newfoundland and Labrador (Donovan 1991, NMFS 2010a). Based on three decades of survey data in various portions of the North Atlantic, the IWC estimates that there are approximately 79,000 fin whales in this region. Under the present IWC scheme, fin whales off the eastern United States, Nova Scotia and the southeastern coast of Newfoundland are believed to constitute a single stock; in U.S. waters, NMFS classifies these fin whales as the Western North Atlantic stock (Donovan 1991, Hayes et al. 2019, NMFS 2010a). NMFS' best estimate of abundance for the Western North Atlantic Stock of fin whales is 6,802 individuals (N_{min}=5,573); this estimate is the sum of the 2016 NOAA shipboard and aerial surveys and the 2016 Canadian Northwest Atlantic International Sightings Survey (Hayes et al. 2022). Currently, there is no population estimate for the entire fin whale population in the North Pacific (Cooke 2018b). However, abundance estimates for three stocks in U.S. Pacific Ocean waters do exist: Northeast Pacific (N= 3,168; N_{min}=2,554), Hawaii (N=154; N_{min}=75), and California/Oregon/Washington (N= 9,029; N_{min}=8,127) (Nadeem et al. 2016). Abundance data for the Southern Hemisphere stock remain highly uncertain; however, available information suggests a substantial increase in the population has occurred (Thomas et al. 2016).

In the North Atlantic, estimates of annual growth rate for the entire fin whale population in this region is not available (Cooke 2018b). However, in U.S. Atlantic waters NMFS has determined that until additional data are available, the cetacean maximum theoretical net productivity rate of 4.0% will be used for the Western North Atlantic stock (Hayes et al. 2019). In the North Pacific, estimates of annual growth rate for the entire fin whale population in this region is not available (Cooke 2018b). However, in U.S. Pacific waters, NMFS has determined that until additional data are available, the cetacean maximum theoretical net productivity rate of 4.0% will be used for the Northeast Pacific stock (Muto et al. 2019b, NMFS 2016b). Overall population growth rates and total abundance estimates for the Hawaii stock of fin whales are not available at this time (Carretta et al. 2018). Based on line transect studies between 1991-2014, there was estimated a

7.5% increase in mean annual abundance in fin whales occurring in waters off California, Oregon, and Washington; to date, this represents the best available information on the current population trend for the overall California/Oregon/Washington stock of fin whales (Carretta et al. 2019a, Nadeem et al. 2016).[14] For Southern Hemisphere fin whales, as noted above, overall information suggests a substantial increase in the population; however, the rate of increase remains poorly quantified (Cooke 2018b).

Archer et al. (2013) examined the genetic structure and diversity of fin whales globally. Full sequencing of the mitochondrial DNA genome for 154 fin whales sampled in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere, resulted in 136 haplotypes, none of which were shared among ocean basins suggesting differentiation at least at this geographic scale. However, North Atlantic fin whales appear to be more closely related to the Southern Hemisphere population, as compared to fin whales in the North Pacific Ocean, which may indicate a revision of the subspecies delineations is warranted. Generally, haplotype diversity was found to be high both within and across ocean basins (Archer et al. 2013). Such high genetic diversity and lack of differentiation within ocean basins may indicate that despite some populations having small abundance estimates, the species may persist long-term and be somewhat protected from substantial environmental variance and catastrophes. Archer et al. (2019) suggests that within the Northern Hemisphere, populations in the North Pacific and North Atlantic oceans can be considered at least different subspecies, if not different species.

Status

The fin whale is endangered because of past commercial whaling. Prior to commercial whaling, hundreds of thousands of fin whales existed. Fin whales may be killed under “aboriginal subsistence whaling” in Greenland, under Japan’s scientific whaling program, and Iceland’s formal objection to the IWC’s ban on commercial whaling. Additional threats include vessel strikes, reduced prey availability due to overfishing or climate change, and sound. The species’ overall large population size may provide some resilience to current threats, but trends are largely unknown. The total annual estimated average human-caused mortality and serious injury for the western North Atlantic fin whale for the period 2015−2019 is 1.85 (1.45 incidental fishery interactions and 0.40 vessel collisions) (Henry et al. 2022). Hayes et al. (2022) notes that these represent a minimum estimate of human-caused mortality, which is almost certainly biased low.

Critical Habitat

No critical habitat has been designated for the fin whale.

Recovery Goals

The goal of the 2010 Recovery Plan for the fin whale (NMFS 2010a) is to promote the recovery of fin whales to the point at which they can be downlisted from endangered to threatened status, and ultimately to remove them from the list of Endangered and Threatened Wildlife and Plants, under the provisions of the ESA. The intermediate goal is to reclassify the species from endangered to threatened. The recovery plan also includes downlisting and delisting criteria. Key

[14] Since 2005, the fin whale abundance increase has been driven by increases off northern California, Oregon, and Washington; numbers off Central and Southern California have remained stable (Carretta et al. 2020, Nadeem et al. 2016).

elements for the recovery program for fin whales are:

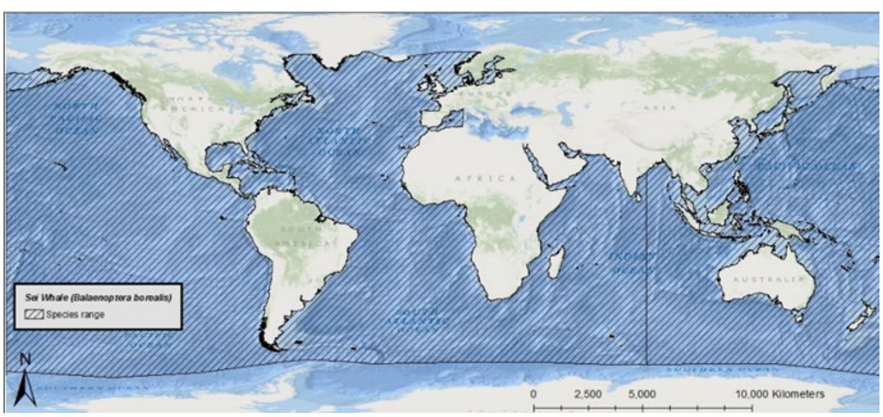
1. Coordinate state, federal, and international actions to implement recovery actions and maintain international regulation of whaling for fin whales;
2. Determine population discreteness and population structure of fin whales;
3. Develop and apply methods to estimate population size and monitor trends in abundance;
4. Conduct risk analysis;
5. Identify, characterize, protect, and monitor habitat important to fin whale populations in U.S. waters and elsewhere;
6. Investigate causes and reduce the frequency and severity of human-caused injury and mortality;
7. Determine and minimize any detrimental effects of anthropogenic noise in the oceans;
8. Maximize efforts to acquire scientific information from dead, stranded, and/or entrapped fin whales; and,
9. Develop post-delisting monitoring plan.

In February 2019, NMFS published a Five-Year Review for fin whales. This 5-year review indicates that, based on a review of the best available scientific and commercial information, that the fin whale should be downlisted from endangered to threatened. The review also recommended that NMFS consider whether listing at the subspecies or distinct population segment level is appropriate in terms of potential conservation benefits and the use of limited agency resources (NMFS 2019). To date, no changes to the listing for fin whales have been proposed.

4.2.1.3 Sei Whale (Balaenoptera borealis)

Globally there is one species of sei whale, *Balaenoptera borealis borealis*. Sei whales occur in subtropical, temperate, and subpolar marine waters across the Northern and Southern Hemispheres (Figure 5.1.4) (Cooke 2018a, NMFS 2011a). For management purposes, in the Northern Hemisphere, the United States recognizes four sei whale stocks: Hawaii, Eastern North Pacific, and Nova Scotia (NMFS 2011a).

Figure 4.2.1.4. Range of the sei whale.



Sei whales are distinguishable from other whales by a long, sleek body that is dark bluish-gray to black in color and pale underneath, and a single ridge located on their rostrum. The sei whale was listed as endangered on December 2, 1970 (35 FR 18319).

Information available from the recovery plan (NMFS 2011a), recent stock assessment reports (Carretta et al. 2019a, Hayes et al. 2022, Hayes et al. 2017), 5-Year Review (NMFS 2021), as well as the recent IUCN sei whale assessment (Cooke 2018a) were used to summarize the life history, population dynamics and status of the species as follows.

Life History

Sei whales can live, on average, between 50 and 70 years. They have a gestation period of 10 to 12 months, and calves nurse for six to nine months. Sexual maturity is reached between 6 and 12 years of age with an average calving interval of two to three years. Sei whales mostly inhabit continental shelf and slope waters far from the coastline. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed on a range of prey types, including: plankton (copepods and krill), small schooling fishes, and cephalopods.

Population Dynamics

There are no estimates of pre-exploitation sei whale abundance in the entire North Atlantic Ocean; however, approximately 17,000 sei whales were documented caught by modern whaling in the North Atlantic (Allison 2017). In the North Pacific, the pre-whaling sei abundance was estimated to be approximately 42,000 (Tillman 1977 as cited in (NMFS 2011a)). In the Southern Hemisphere, approximately 63,100 to 65,000 occurred in the Southern Hemisphere prior to exploitation (Mizroch et al. 1984a, NMFS 2011a).

In 1989, the entire North Atlantic sei whale population was estimated to be 10,300 whales (Cattanach et al. 1993 as cited in (NMFS 2011a)). While other surveys have been completed in portions of the North Atlantic since 1989, the survey coverage levels in these studies are not as complete as those done in Cattanach et al. (1993) (Cooke 2018a). As a result, to date, updated abundance estimates for the entire North Atlantic population of sei whales are not available. However, in the western North Atlantic, Palka et al. (2017) has provided a recent abundance estimate for the Nova Scotia stock of sei whales. Based on survey data collected from Halifax, Nova Scotia, to Florida between 2010 and 2013, it is estimated that there are approximately 6,292 sei whales (N_{min}=3,098) (Palka et al. 2017); this estimate is considered the best available scientific information for the Nova Scotia stock (NMFS 2021). In the North Pacific, an abundance estimate for the entire North Pacific population of sei whales is not available. However, in the western North Pacific, it is estimated that there are 35,000 sei whales (Cooke 2018a). In the eastern North Pacific (considered east of longitude 180°), two stocks of sei whales occur in U.S. waters: Hawaii and Eastern North Pacific. Abundance estimates for the Hawaii stock are 391 sei whales (N_{min}=204), and for Eastern North Pacific stock, 519 sei whales (N_{min}=374) (Carretta et al. 2019a). In the Southern Hemisphere, recent abundance of sei whales is estimated at 9,800 to 12,000 whales. Population growth rates for sei whales are not available at this time as there are little to no systematic survey efforts to study sei whales; however, in U.S. waters, NMFS has determined that until additional data is available, the cetacean maximum theoretical net productivity rate of 4.0% will be used for the Hawaii, Eastern North Pacific, and Hawaii stocks of sei whales (Hayes 2019).

Based on genetic analyses, there appears to be some differentiation between sei whale populations in different ocean basins. In an early analysis of genetic variation in sei whales, some differences between Southern Ocean and the North Pacific sei whales were detected (Wada and Numachi 1991). However, more recent analyses of mtDNA control region variation show no significant differentiation between Southern Ocean and the North Pacific sei whales, though both appear to be genetically distinct from sei whales in the North Atlantic (Huijser et al. 2018). Within each ocean basin, there appears to be intermediate to high genetic diversity and little genetic differentiation despite there being different managed stocks (Danielsdottir et al. 1991, Kanda et al. 2011, Kanda et al. 2006, Kanda et al. 2013, Kanda et al. 2015).

Status

The sei whale is endangered because of past commercial whaling. Now, only a few individuals are taken each year by Japan. Current threats include vessel strikes, fisheries interactions (including entanglement), climate change (habitat loss and reduced prey availability), and anthropogenic sound. Given the species' overall abundance, they may be somewhat resilient to current threats. However, trends are largely unknown, especially for individual stocks, many of which have relatively low abundance estimates. The most recent 5-year average human-caused mortality and serious injury rate for sei whales in the North Atlantic is 0.80 (0.4 incidental fishery interactions, 0.2 vessel collisions, 0.2 other human-caused mortality; Hayes et al. 2022). These represent a minimum estimate of human-caused mortality, which is almost certainly biased low.

Critical Habitat

No critical habitat has been designated for the sei whale.

Recovery Goals

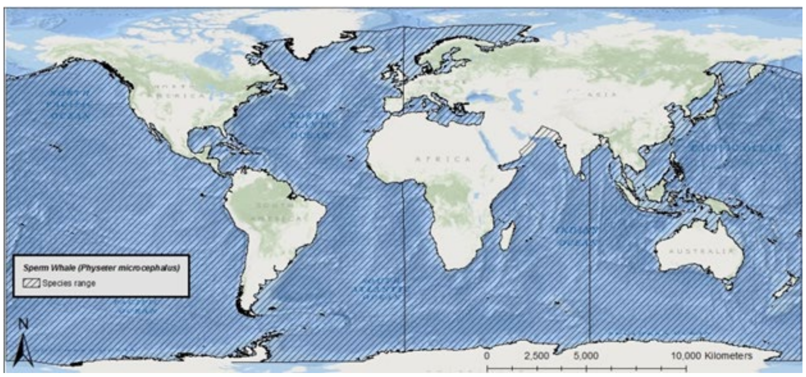
The 2011 Recovery Plan for the sei whale (NMFS 2011b) indicates that, "because the current population status of sei whales is unknown, the primary purpose of this Recovery Plan is to provide a research strategy to obtain data necessary to estimate population abundance, trends, and structure and to identify factors that may be limiting sei whale recovery." The goal of the Recovery Plan is to promote the recovery of sei whales to the point at which they can be downlisted from Endangered to Threatened status, and ultimately to remove them from the list of Endangered and Threatened Wildlife and Plants, under the provisions of the ESA. The intermediate goal is to reclassify the species from endangered to threatened. The recovery plan incorporates an adaptive management strategy that divides recovery actions into three tiers. Tier I involves: 1) continued international regulation of whaling (i.e., a moratorium on commercial sei whaling); 2) determining population size, trends, and structure using opportunistic data collection in conjunction with passive acoustic monitoring, if determined to be feasible; and 3) continued stranding response and associated data collection.

NMFS completed the most recent five-year review for sei whales in 2021 (NMFS 2021). In that review, NMFS concluded that the listing status should remain unchanged. They also concluded that recovery criteria outlined in the sei whale recovery plan (NMFS 2011b) do not reflect the best available and most up-to date information on the biology of the species. The 5-Year review states that currently, there is insufficient data to undertake an assessment of the sei whale's present status due to a number of uncertainties and unknowns for this species: (1) lack of scientifically reliable population estimates for the North Atlantic and Southern Hemisphere; (2) lack of comprehensive information on status and trends; (3) existence of critical knowledge gaps; and (4) emergence of potential new threats. Thus, further research is needed to fill critical knowledge gaps.

4.2.1.4 Sperm Whale (Physter macrocephalus)

Globally there is one species of sperm whale, *Physeter macrocephalus*. Sperm whales occur in all major oceans of the Northern and Southern Hemispheres (NMFS 2010b)(Figure 5.1.5). For management purposes, in the Northern Hemisphere, the United States recognizes six sperm whale stocks: California/Oregon/Washington, Hawaii, North Pacific, North Atlantic, Northern Gulf of Mexico, and Puerto Rico and the U.S. Virgin Islands (NMFS 2010b); see NMFS Marine Mammal Stock Assessment Reports: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-species-stock).

Figure 4.2.1.5. Range of the sperm whale.



The sperm whale is the largest toothed whale and distinguishable from other whales by its extremely large head, which takes up 25 to 35% of its total body length and a single blowhole asymmetrically situated on the left side of the head near the tip. The sperm whale was originally listed as endangered on December 2, 1970 (35 FR 18319).

Information available from the recovery plan (NMFS 2010b), recent stock assessment reports (Carretta et al. 2018, Hayes et al. 2020, Muto et al. 2019), status review (NMFS 2015b), as well as the recent IUCN sperm whale assessment (Taylor et al. 2019) were used to summarize the life history, population dynamics and status of the species as follows.

Life History

The average lifespan of sperm whales is estimated to be at least 50 years (Whitehead 2009). They have a gestation period of one to one and a half years, and calves nurse for approximately two years, though they may begin to forage for themselves within the first year of life (Tønnesen et al. 2018). Sexual maturity is reached between 7 and 13 years of age for females with an average calving interval of four to six years. Male sperm whales reach full sexual maturity in their 20s. Sperm whales mostly inhabit areas with a water depth of 600 m or more, and are uncommon in waters less than 300 m deep. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed primarily on squid; other prey includes octopus and demersal fish (including teleosts and elasmobranchs).

Population Dynamics
Pre-whaling, the global population of sperm whales was estimated to be approximately 1,100,000 animals (Taylor et al. 2019, Whitehead 2002). By 1880, due to whaling, the population was approximately 71% of its original level (Whitehead 2002). In 1999, ten years after the end of large-scale whaling, the population was estimated to be about 32% of its original level (Whitehead 2002).

The most recent global sperm whale population estimate is 360,000 whales (Whitehead 2009). There are no reliable estimates for sperm whale abundance across the entire (North and South) Atlantic Ocean. However, estimates are available for two of three U.S. stocks in the western North Atlantic Ocean; the Northern Gulf of Mexico stock is estimated to consist of 763 individuals (N_{min}=560) (Waring et al. 2016) and the North Atlantic stock is estimated to consist of 4,349 individuals (N_{min}=3,451) (Hayes 2019). There is insufficient data to estimate abundance for the Puerto Rico and U.S. Virgin Islands stock. Similar to the Atlantic Ocean, there are no reliable estimates for sperm whale abundance across the entire (North and South) Pacific Ocean. However, estimates are available for two of three U.S. stocks that occur in the eastern Pacific; the California/Oregon/ Washington stock is estimated to consist of 1,997 individuals (N_{min}=1,270; Carretta et al. 2019b), and the Hawaii stock is estimated to consist of 4,559 individuals (N_{min}=3,478) (Carretta et al. 2019a). We are aware of no reliable abundance estimates for sperm whales in other major oceans in the Northern and Southern Hemispheres. Although maximum net productivity rates for sperm whales have not been clearly defined, population growth rates for sperm whale populations are expected to be low (i.e., no more than 1.1% per year) (Whitehead 2002). In U.S. waters, NMFS determined that, until additional data is available, the cetacean maximum theoretical net productivity rate of 4.0% will be used for, among others, the North Atlantic, Northern Gulf of Mexico, and Puerto Rico and the U.S. Virgin Islands stocks of sperm whales (Carretta et al. 2019a, Carretta et al. 2019b, Hayes 2019, Muto et al. 2019, Waring et al. 2010, Waring et al. 2016).

Ocean-wide genetic studies indicate sperm whales have low genetic diversity, suggesting a recent bottleneck, but strong differentiation between matrilineally related groups (Lyrholm and Gyllensten 1998). Consistent with this, two studies of sperm whales in the Pacific Ocean indicate low genetic diversity (Mesnick et al. 2011, Rendell et al. 2012). Furthermore, sperm whales from the Gulf of Mexico, the western North Atlantic Ocean, the North Sea, and the Mediterranean Sea all have been shown to have low levels of genetic diversity (Engelhaupt et al. 2009). As none of the stocks for which data are available have high levels of genetic diversity, the species may be at some risk to inbreeding and 'allee' effects[15], although the extent to which is currently unknown. Sperm whales have a global distribution and can be found in relatively deep waters in all ocean basins. While both males and females can be found in latitudes less than 40 degrees, only adult males venture into the higher latitudes near the poles.

Status
The sperm whale is endangered as a result of past commercial whaling. Although the aggregate abundance worldwide is probably at least several hundred thousand individuals, the extent of depletion and degree of recovery of populations are uncertain. Commercial whaling is no longer

[15] Allee effects are broadly characterized as a decline in individual fitness in populations with a small size or density.

allowed, however, illegal hunting may occur. Continued threats to sperm whale populations include vessel strikes, entanglement in fishing gear, competition for resources due to overfishing, loss of prey and habitat due to climate change, and sound. The Deepwater Horizon Natural Resource Damage Assessment Trustees assessed effects of oil exposure on sea turtles and marine mammals. Sperm whales in the Gulf of Mexico were impacted by the oil spill with 3% of the stock estimated to have died (DWH NRDA Trustees 2016). The most recent SAR for sperm whales in the North Atlantic notes that there were no documented reports of fishery-related mortality or serious injury to the North Atlantic stock in the U.S. EEZ during 2013–2017 (Hayes et al. 2020); there are also no reports in NMFS records from 2018-2023. The species' large population size shows that it is somewhat resilient to current threats.

Critical Habitat
No critical habitat has been designated for the sperm whale.

Recovery Goals
The goal of the Recovery Plan is to promote recovery of sperm whales to a point at which they can be downlisted from endangered to threatened status, and ultimately to remove them from the list of Endangered and Threatened Wildlife and Plants, under the provisions of the ESA. The primary purpose of the Recovery Plan is to identify and take actions that will minimize or eliminate effects of human activities that are detrimental to the recovery of sperm whale populations. Immediate objectives are to identify factors that may be limiting abundance, recovery, and/or productivity, and cite actions necessary to allow the populations to increase. The Recovery Plan includes downlisting and delisting criteria (NMFS 2010b).

The most recent Five-Year Review for sperm whales was completed in 2015 (NMFS 2015). In that review, NMFS concluded that no change to the listing status was recommended.

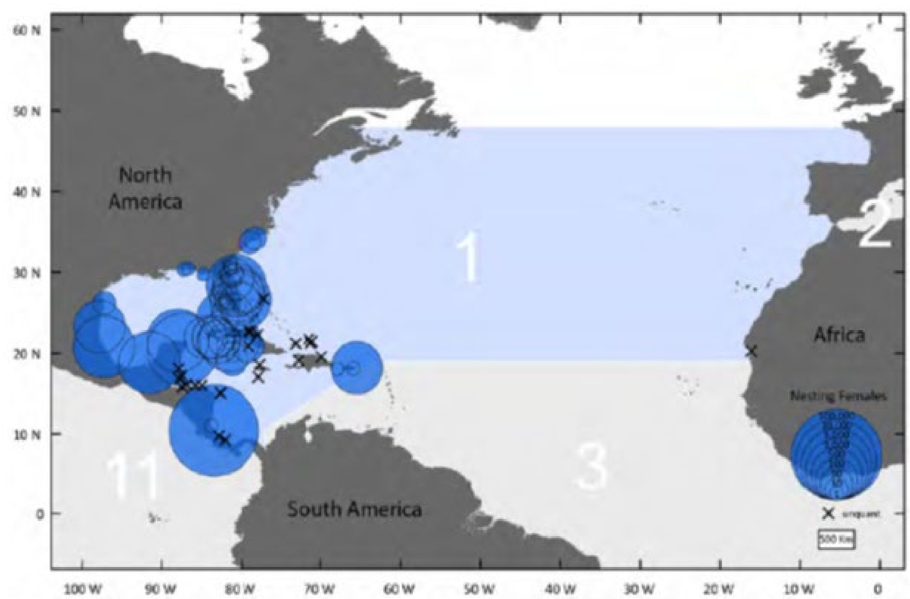
4.2.2 Sea Turtles

Kemp's ridley and leatherback sea turtles are currently listed under the ESA at the species level; green and loggerhead sea turtles are listed at the DPS level. Therefore, we include information on the range-wide status of Kemp's ridley and leatherback sea turtles to provide the overall status of each species. Information on the status of loggerhead and green sea turtles is for the DPS affected by this action.

4.2.2.1 Green Sea Turtle (Chelonia mydas, North Atlantic DPS)
The green sea turtle has a circumglobal distribution, occurring throughout tropical, subtropical and, to a lesser extent, temperate waters. They commonly inhabit nearshore and inshore waters. It is the largest of the hardshell marine turtles, growing to a weight of approximately 350 lbs. (159 kg) and a straight carapace length of greater than 3.3 ft. (1 m). The species was listed under the ESA on July 28, 1978 (43 FR 32800) as endangered for breeding populations in Florida and the Pacific coast of Mexico and threatened in all other areas throughout its range. On April 6, 2016, NMFS listed 11 DPSs of green sea turtles as threatened or endangered under the ESA (81 FR 20057). The North Atlantic DPS of green turtle is found in the North Atlantic Ocean and Gulf of Mexico (Figure 4.2.1) and is listed as threatened. Green turtles from the North Atlantic DPS range from the boundary of South and Central America (7.5° N, 77° W) in the south, throughout the Caribbean, the Gulf of Mexico, and the U.S. Atlantic coast to New Brunswick,

Canada (48° N, 77° W) in the north. The range of the DPS then extends due east along latitudes 48° N and 19° N to the western coasts of Europe and Africa.

Figure 4.2.1. Range of the North Atlantic distinct population segment green turtle (1), with location and abundance of nesting females (Seminoff et al. 2015).



We used information available in the 2015 Status Review (Seminoff et al. 2015), relevant literature, and recent nesting data from the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWRI) to summarize the life history, population dynamics and status of the species, as follows.

Life History

Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, Quintana Roo), United States (Florida) and Cuba support nesting concentrations of particular interest in the North Atlantic DPS (Seminoff et al. 2015). The largest nesting site in the North Atlantic DPS is in Tortuguero, Costa Rica, which hosts 79% of nesting females for the DPS (Seminoff et al. 2015). In the southeastern United States, females generally nest between May and September (Seminoff et al. 2015, Witherington et al. 2006). Green sea turtles lay an average of three nests per season with an average of one hundred eggs per nest (Hirth 1997, Seminoff et al. 2015). The remigration interval (period between nesting seasons) is two to five years (Hirth 1997, Seminoff et al. 2015). Nesting occurs primarily on beaches with intact dune structure, native vegetation, and appropriate incubation temperatures during the summer months.

Sea turtles are long-lived animals. Size and age at sexual maturity have been estimated using several methods, including mark-recapture, skeletochronology, and marked known-aged individuals. Skeletochronology analyzes growth marks in bones to obtain growth rates and age at sexual maturity estimates. Estimates vary widely among studies and populations, and methods continue to be developed and refined (Avens and Snover 2013). Early mark-recapture studies in

Florida estimated the age at sexual maturity 18-30 years (Frazer and Ehrhart 1985, Goshe et al. 2010, Mendonça 1981). More recent estimates of age at sexual maturity are as high as 35–50 years (Avens and Snover 2013, Goshe et al. 2010), with lower ranges reported from known age (15–19 years) turtles from the Cayman Islands (Bell et al. 2005) and Caribbean Mexico (12–20 years) (Zurita et al. 2012). A study of green turtles that use waters of the southeastern United States as developmental habitat found the age at sexual maturity likely ranges from 30 to 44 years (Goshe et al. 2010). Green turtles in the Northwestern Atlantic mature at 2.8-33+ ft. (85–100+ cm) straight carapace lengths (SCL) (Avens and Snover 2013).

Adult turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green sea turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Adult green turtles feed primarily on seagrasses and algae, although they also eat other invertebrate prey (Seminoff et al. 2015).

Population Dynamics

The North Atlantic DPS has a globally unique haplotype, which was a factor in defining the discreteness of the DPS. Evidence from mitochondrial DNA studies indicates that there are at least four independent nesting subpopulations in Florida, Cuba, Mexico, and Costa Rica (Seminoff et al. 2015). More recent genetic analysis indicates that designating a new western Gulf of Mexico management unit might be appropriate (Shamblin et al. 2016).

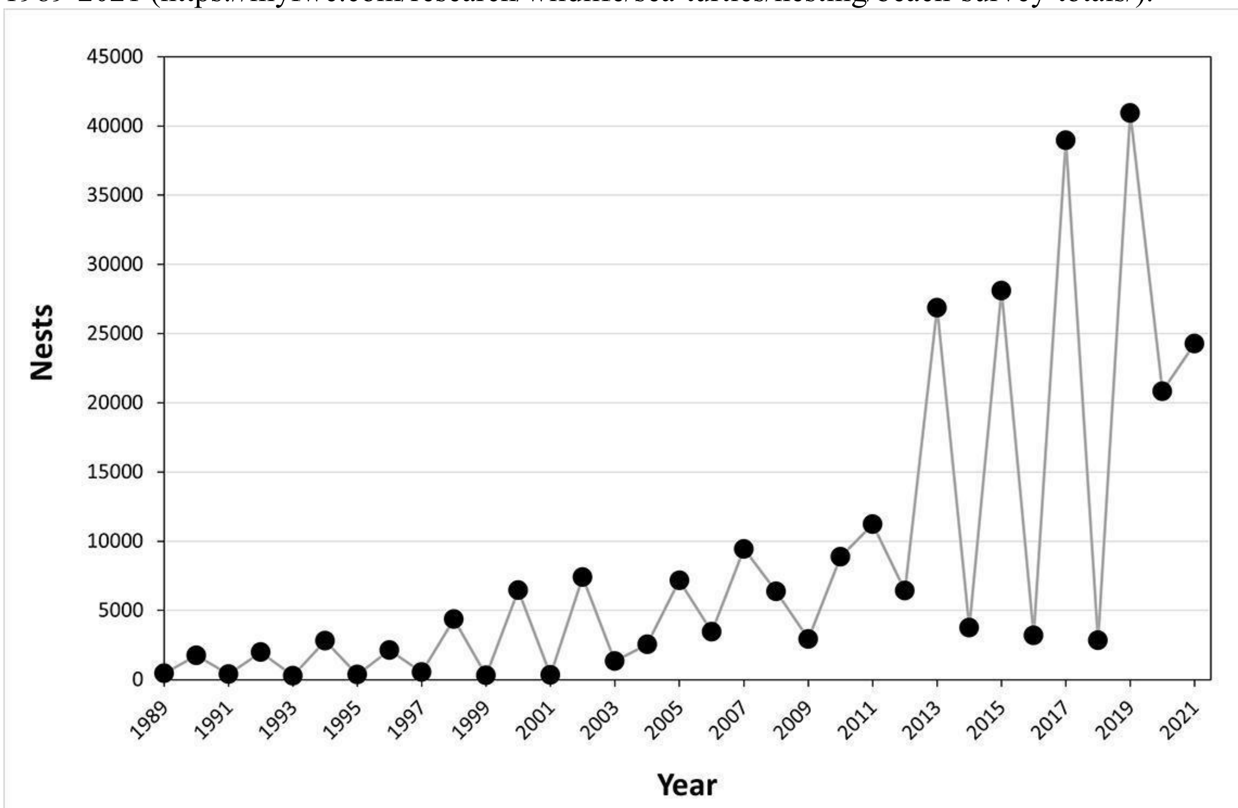
Compared to other DPSs, the North Atlantic DPS exhibits the highest nester abundance, with approximately 167,424 females at seventy-three nesting sites (using data through 2012), and available data indicated an increasing trend in nesting (Seminoff et al. 2015). Counts of nests and nesting females are commonly used as an index of abundance and population trends, even though there are doubts about the ability to estimate the overall population size.

There are no reliable estimates of population growth rate for the DPS as a whole, but estimates have been developed at a localized level. The status review for green sea turtles assessed population trends for seven nesting sites with more than10 years of data collection in the North Atlantic DPS. The results were variable with some sites showing no trend and others increasing. However, all major nesting populations (using data through 2011-2012) demonstrated increases in abundance (Seminoff et al. 2015).

Recent data is available for the southeastern United States. The FWRI monitors sea turtle nesting through the Statewide Nesting Beach Survey (SNBS) and Index Nesting Beach Survey (INBS). Since 1979, the SNBS has surveyed approximately 215 beaches to collect information on the distribution, seasonality, and abundance of sea turtle nesting in Florida. Since 1989, the INBS has been conducted on a subset of SNBS beaches to monitor trends through consistent effort and specialized training of surveyors. The INBS data uses a standardized data-collection protocol to allow for comparisons between years and is presented for green, loggerhead, and leatherback sea turtles. The index counts represent 27 core index beaches and do not represent Florida's total annual nest counts because they are collected only on a subset of Florida's beaches (27 out of 224 beaches) and only during a 109-day time window (15 May through 31 August). The index nest counts represent approximately 67% of known green turtle nesting in Florida (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/).

Green turtle nest counts have increased eightyfold since standardized nest counts began in 1989. In 2021, green turtle nest counts on the 27-core index beaches reached more than 24,000 nests recorded. Nesting green turtles tend to follow a two-year reproductive cycle and, typically, there are wide year-to-year fluctuations in the number of nests recorded. Green turtles set record highs in 2011, 2013, 2015, 2017, and 2019. The nest count in 2021 did not set another record high but was only marginally higher than 2020, an unusually high “low year.” FWRI reports that changes in the typical two-year cycle have been documented in the past as well (e.g., 2010-2011) and are not reason of concern.

Figure 4.2.2. Number of green sea turtle nests counted on core index beaches in Florida from 1989-2021 (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/).



Status
Historically, green sea turtles in the North Atlantic DPS were hunted for food, which was the principal cause of the population’s decline. Apparent increases in nester abundance for the North Atlantic DPS in recent years are encouraging but must be viewed cautiously, as the datasets represent a fraction of a green sea turtle generation, which is between 30 and 40 years (Seminoff et al. 2015). While the threats of pollution, habitat loss through coastal development, beachfront lighting, and fisheries bycatch continue, the North Atlantic DPS appears to be somewhat resilient to future perturbations.

Critical Habitat
Critical habitat for the North Atlantic DPS of green sea turtles surrounds Culebra Island, Puerto Rico (66 FR 20058, April 6, 2016), which is outside the action area.

Recovery Goals
The most recent Recovery Plan for the U.S. population of green sea turtles in the Atlantic was published in 1991. The goal of the 1991 Recovery Plan is to delist the species once the recovery criteria are met (NMFS and U.S.FWS 1991). The recovery plan includes criteria for delisting related to nesting activity, nesting habitat protection, and reduction in mortality.

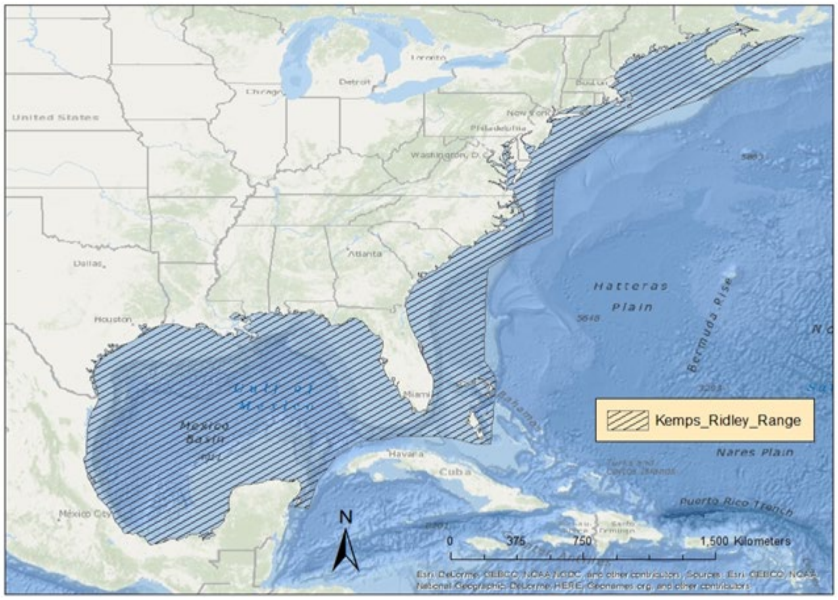
Priority actions to meet the recovery goals include:

1. Providing long-term protection to important nesting beaches.
2. Ensuring at least a 60% hatch rate success on major nesting beaches.
3. Implementing effective lighting ordinances/plans on nesting beaches.
4. Determining distribution and seasonal movements of all life stages in the marine environment.
5. Minimizing commercial fishing mortality.
6. Reducing threat to the population and foraging habitat from marine pollution.

4.2.2.2 Kemp's Ridley Sea Turtle (Lepidochelys kempii)
The range of Kemp's ridley sea turtles extends from the Gulf of Mexico to the Atlantic coast (Figure 4.2.3). They have occasionally been found in the Mediterranean Sea, which may be due to migration expansion or increased hatchling production (Tomás and Raga 2008). They are the smallest of all sea turtle species, with a nearly circular top shell and a pale yellowish bottom shell. The species was first listed under the Endangered Species Conservation Act (35 FR 18319, December 2, 1970) in 1970. The species has been listed as endangered under the ESA since 1973.

We used information available in the revised recovery plan (NMFS et al. 2011), the five-year review (NMFS and USFWS 2015), and published literature to summarize the life history, population dynamics and status of the species, as follows.

Figure 4.2.3. Range of the Kemp's ridley sea turtle.



Life History

Kemp's ridley nesting is essentially limited to the western Gulf of Mexico. Approximately 97% of the global population's nesting activity occurs on a 90-mile (146-km) stretch of beach that includes Rancho Nuevo in Mexico (Wibbels and Bevan 2019). In the United States, nesting occurs primarily in Texas and occasionally in Florida, Alabama, Georgia, South Carolina, and North Carolina (NMFS and USFWS 2015). Nesting occurs from April to July in large arribadas (synchronized large-scale nesting). The average remigration interval is two years, although intervals of 1 and 3 years are not uncommon (NMFS et al. 2011, TEWG 1998, 2000). Females lay an average of 2.5 clutches per season (NMFS et al. 2011). The annual average clutch size is 95 to 112 eggs per nest (NMFS and USFWS 2015). The nesting location may be particularly important because hatchlings can more easily migrate to foraging grounds in deeper oceanic waters, where they remain for approximately two years before returning to nearshore coastal habitats (Epperly et al. 2013, NMFS and USFWS 2015, Snover et al. 2007). Modeling indicates that oceanic-stage Kemp's ridley turtles are likely distributed throughout the Gulf of Mexico into the northwestern Atlantic (Putman et al. 2013). Kemp's ridley nearing the age when recruitment to nearshore waters occurs are more likely to be distributed in the northern Gulf of Mexico, eastern Gulf of Mexico, and the western Atlantic (Putman et al. 2013).

Several studies, including those of captive turtles, recaptured turtles of known age, mark-recapture data, and skeletochronology, have estimated the average age at sexual maturity for Kemp's ridleys between 5 to 12 years (captive only) (Bjorndal et al. 2014), 10 to 16 years (Chaloupka and Zug 1997, Schmid and Witzell 1997, Schmid and Woodhead 2000, Zug et al. 1997), 9.9 to 16.7 years (Snover et al. 2007), 10 and 18 years (Shaver and Wibbels 2007), 6.8 to 21.8 years (mean 12.9 years) (Avens et al. 2017).

During spring and summer, juvenile Kemp's ridleys generally occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida and along the U.S.

Atlantic coast from southern Florida to the Mid-Atlantic and New England. The NEFSC caught a juvenile Kemp's ridley during a research project in deep water south of Georges Bank (NEFSC, unpublished data). In the fall, most Kemp's ridleys migrate to deeper or more southern, warmer waters and remain there through the winter. As adults, many turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS et al. 2011). Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 feet (37 meters) deep (Seney and Landry 2008, Shaver et al. 2005, Shaver and Rubio 2008), although they can also be found in deeper offshore waters. As larger juveniles and adults, Kemp's ridleys forage on swimming crabs, fish, mollusks, and tunicates (NMFS et al. 2011).

Population Dynamics

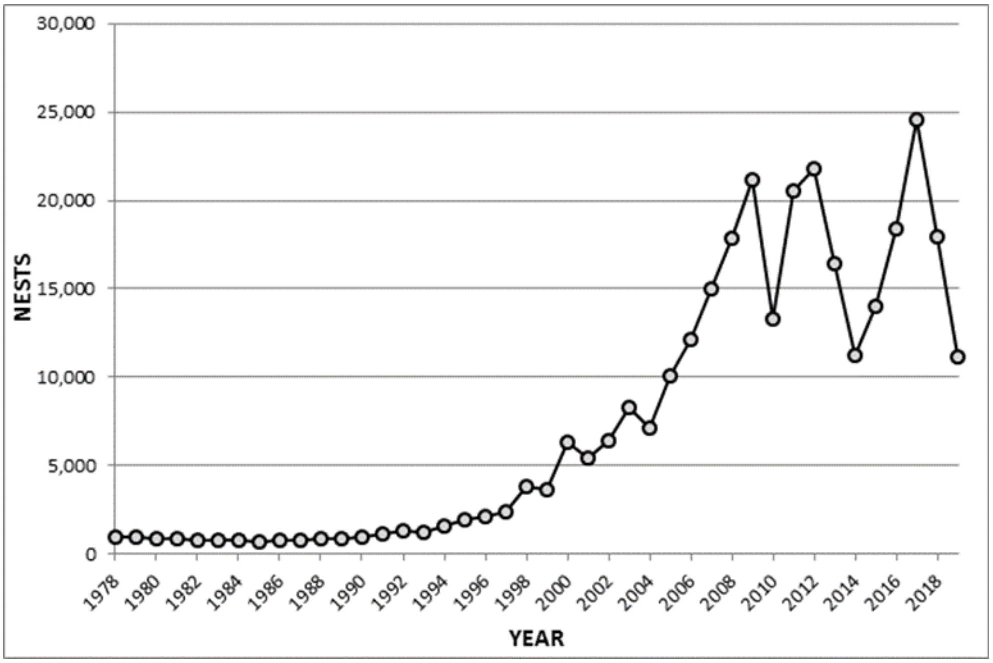
Of the sea turtles species in the world, the Kemp's ridley has declined to the lowest population level. Nesting aggregations at a single location (Rancho Nuevo, Mexico) were estimated at 40,000 females in 1947. By the mid-1980s, the population had declined to an estimated 300 nesting females. From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased at 15% annually (Heppell et al. 2005). However, due to recent declines in nest counts, decreased survival of immature and adult sea turtles, and updated population modeling, this rate is not expected to continue and the overall trend is unclear (Caillouet et al. 2018, NMFS and USFWS 2015). In 2019, there were 11,090 nests, a 37.61% decrease from 2018, and a 54.89% decrease from 2017, which had the highest number (24,587) of nests (Figure 4.2.4; unpublished data). The reason for this recent decline is uncertain. In 2021, 198 Kemp's ridley nests were found in Texas – the largest number recorded in Texas since 1978 was in 2017, when 353 nests were documented.

Using the standard IUCN protocol for sea turtle assessments, the number of mature individuals was recently estimated at 22,341 (Wibbels and Bevan 2019). The calculation took into account the average annual nests from 2016-2018 (21,156), a clutch frequency of 2.5 per year, a remigration interval of 2 years, and a sex ratio of 3.17 females: 1 male. Based on the data in their analysis, the assessment concluded the current population trend is unknown (Wibbels and Bevan 2019). Genetic variability in Kemp's ridley turtles is considered to be high, as measured by nuclear DNA analyses (i.e., microsatellites) (NMFS et al. 2011). If this holds true, rapid increases in population over one or two generations would likely prevent any negative consequences in the genetic variability of the species (NMFS et al. 2011). Additional analysis of the mtDNA taken from samples of Kemp's ridley turtles at Padre Island, Texas, showed six distinct haplotypes, with one found at both Padre Island and Rancho Nuevo (Dutton et al. 2006).

Status

The Kemp's ridley was listed as endangered in response to a severe population decline, primarily the result of egg collection. In 1973, legal ordinances in Mexico prohibited the harvest of sea turtles from May to August, and in 1990, the harvest of all sea turtles was prohibited by presidential decree. In 2002, Rancho Nuevo was declared a Sanctuary. Nesting beaches in Texas have been re-established. Fishery interactions are the main threat to the species. Other threats include habitat destruction, oil spills, dredging, disease, cold stunning, and climate change. The current population trend is uncertain. While the population has increased, recent nesting numbers have been variable. In addition, the species' limited range and low global abundance make it vulnerable to new sources of mortality as well as demographic and environmental randomness, all of which are often difficult to predict with any certainty. Therefore, its resilience to future perturbation affecting survival and nesting success is low.

Figure 4.2.4. Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2019).



Critical Habitat
Critical habitat has not been designated for Kemp's ridley sea turtles.

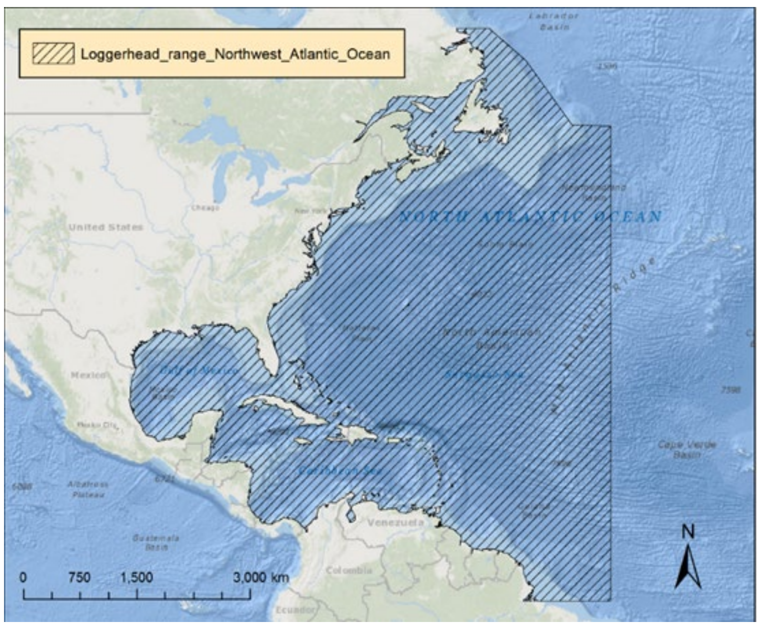
Recovery Goals
As with other recovery plans, the goal of the 2011 Kemp's ridley recovery plan (NMFS, USFWS, and SEMARNAT 2011) is to conserve and protect the species so that the listing is no longer necessary. The recovery criteria relate to the number of nesting females, hatchling recruitment, habitat protection, social and/or economic initiatives compatible with conservation, reduction of predation, Turtle Excluder Device (TED) or other protective measures in trawl gear, and improved information available to ensure recovery. In 2015, the bi-national recovery team published a number of recommendations including four critical actions (NMFS and USFWS 2015). These include: (a) continue funding by the major funding institutions at a level of support needed to run the successful turtle camps in the State of Tamaulipas, Mexico, in order to continue the high level of hatchling production and nesting female protection; (b) increase TED compliance in U.S. and MX shrimp fisheries; 3 (c) require TEDs in U.S. skimmer trawl fisheries and other trawl fisheries in coastal waters where fishing overlaps with the distribution of Kemp's ridleys; (d) assess bycatch in gillnets in the Northern Gulf of Mexico and State of Tamaulipas, Mexico, to determine whether modifications to gear or fishing practices are needed.

The most recent Five-Year Review was completed in 2015 (NMFS and USFWS 2015) with a recommendation that the status of Kemp's ridley sea turtles should remain as endangered. In the

Plan, the Services recommend that efforts continue towards achieving the major recovery actions in the 2015 plan with a priority for actions to address recent declines in the annual number of nests.

4.2.2.3 Loggerhead Sea Turtle (Caretta, Northwest Atlantic Ocean DPS)
Loggerhead sea turtles are circumglobal and are found in the temperate and tropical regions of the Indian, Pacific, and Atlantic Oceans. The loggerhead sea turtle is distinguished from other turtles by its reddish-brown carapace, large head and powerful jaws. The species was first listed as threatened under the Endangered Species Act in 1978 (43 FR 32800, July 28, 1978). On September 22, 2011, the NMFS and USFWS designated nine distinct population segments of loggerhead sea turtles, with the Northwest Atlantic Ocean DPS listed as threatened (76 FR 58868). The Northwest Atlantic Ocean DPS of loggerheads is found along eastern North America, Central America, and northern South America (Figure 4.2.5).

Figure 4.2.5. Range of the Northwest Atlantic Ocean DPS of loggerhead sea turtles.



We used information available in the 2009 Status Review (Conant et al. 2009), the final listing rule (76 FR 58868, September 22, 2011), the relevant literature, and recent nesting data from the FWRI to summarize the life history, population dynamics and status of the species, as follows.

Life History
Nesting occurs on beaches where warm, humid sand temperatures incubate the eggs. Northwest Atlantic females lay an average of five clutches per year. The annual average clutch size is 115 eggs per nest. Females do not nest every year. The average remigration interval is three years. There is a 54% emergence success rate (Conant et al. 2009). As with other sea turtles, temperature determines the sex of the turtle during the middle of the incubation period. Turtles spend the post-hatchling stage in pelagic waters. The juvenile stage is spent first in the oceanic zone and later in coastal waters. Some juveniles may periodically move between the oceanic

zone and coastal waters (Bolten 2003, Conant et al. 2009, Mansfield 2006, Morreale and Standora 2005, Witzell 2002). Coastal waters provide important foraging, inter-nesting, and migratory habitats for adult loggerheads. In both the oceanic zone and coastal waters, loggerheads are primarily carnivorous, although they do consume some plant matter as well (Conant et al. 2009). Loggerheads have been documented to feed on crustaceans, mollusks, jellyfish and salps, and algae (Bjorndal 1997, Donaton et al. 2019, Seney and Musick 2007). Avens et al. (2015) used three approaches to estimate age at maturation. Mean age predictions associated with minimum and mean maturation straight carapace lengths were 22.5-25 and 36-38 years for females and 26-28 and 37-42 years for males. Male and female sea turtles have similar post-maturation longevity, ranging from 4 to 46 (mean 19) years (Avens et al. 2015).

Loggerhead hatchlings from the western Atlantic disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. MtDNA evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71%-88%) of individuals found in foraging grounds throughout the western and eastern Atlantic: Nicaragua, Panama, Azores and Madeira, Canary Islands and Andalusia, Gulf of Mexico, and Brazil (Masuda 2010). LaCasalla et al. (2013) found that loggerheads, primarily juveniles, caught within the Northeast Distant (NED) waters of the North Atlantic mostly originated from nesting populations in the southeast United States and, in particular, Florida. They found that nearly all loggerheads caught in the NED came from the Northwest Atlantic DPS (mean = 99.2%), primarily from the large eastern Florida rookeries. There was little evidence of contributions from the South Atlantic, Northeast Atlantic, or Mediterranean DPSs (LaCasella et al. 2013). A more recent analysis assessed sea turtles captured in fisheries in the Northwest Atlantic and included samples from 850 (including 24 turtles caught during fisheries research) turtles caught from 2000-2013 in coastal and oceanic habitats (Stewart et al. 2019). The turtles were primarily captured in pelagic longline and bottom otter trawls. Other gears included bottom longline, hook and line, gillnet, dredge, and dip net. Turtles were identified from 19 distinct management units; the western Atlantic nesting populations were the main contributors with little representation from the Northeast Atlantic, Mediterranean, or South Atlantic DPSs (Stewart et al. 2019). There was a significant split in the distribution of small (≤ 2 ft. (63 cm) SCL) and large (> 2 ft. (63 cm) SCL) loggerheads north and south of Cape Hatteras, North Carolina. North of Cape Hatteras, large turtles came mainly from southeast Florida (44%±15%) and the northern United States management units (33%±16%); small turtles came from central east Florida (64%±14%). South of Cape Hatteras, large turtles came mainly from central east Florida (52%±20%) and southeast Florida (41%±20%); small turtles came from southeast Florida (56%±25%). The authors concluded that bycatch in the western North Atlantic would affect the Northwest Atlantic DPS almost exclusively (Stewart et al. 2019).

Population Dynamics

A number of stock assessments and similar reviews (Conant et al. 2009, Heppell et al. 2005, NMFS SEFSC 2001, 2009, Richards et al. 2011, TEWG 1998, 2000, 2009) have examined the stock status of loggerheads in the Atlantic Ocean, but none has been able to develop a reliable estimate of absolute population size. As with other species, counts of nests and nesting females are commonly used as an index of abundance and population trends, even though there are doubts about the ability to estimate the overall population size.

Based on genetic analysis of nesting subpopulations, the Northwest Atlantic Ocean DPS is divided into five recovery units: Northern, Peninsular Florida, Dry Tortugas, Northern Gulf of Mexico, and Greater Caribbean (Conant et al. 2009). A more recent analysis using expanded mtDNA sequences revealed that rookeries from the Gulf and Atlantic coasts of Florida are genetically distinct (Shamblin et al. 2014). The recent genetic analyses suggest that the Northwest Atlantic Ocean DPS should be considered as ten management units: (1) South Carolina and Georgia, (2) central eastern Florida, (3) southeastern Florida, (4) Cay Sal, Bahamas, (5) Dry Tortugas, Florida, (6) southwestern Cuba, (7) Quintana Roo, Mexico, (8) southwestern Florida, (9) central western Florida, and (10) northwestern Florida (Shamblin et al. 2012). The Northwest Atlantic Ocean's loggerhead nesting aggregation is considered the largest in the world (Casals and Tucker 2017). Using data from 2004-2008, the adult female population size of the DPS was estimated at 20,000 to 40,000 females (NMFS SEFSC 2009). More recently, Ceriani and Meylan (2017) reported a 5-year average (2009-2013) of more than 83,717 nests per year in the southeast United States and Mexico (excluding Cancun (Quintana Roo, Mexico)). These estimates included sites without long-term (≥10 years) datasets. When they used data from 86 index sites (representing 63.4% of the estimated nests for the whole DPS) with long-term datasets, they reported 53,043 nests per year. Trends at the different index nesting beaches ranged from negative to positive. In a trend analysis of the 86 index sites, the overall trend for the Northwest Atlantic DPS was positive (+2%) (Ceriani and Meylan 2017). Uncertainties in this analysis include, among others, using nesting females as proxies for overall population abundance and trends, demographic parameters, monitoring methodologies, and evaluation methods involving simple comparisons of early and later 5-year average annual nest counts. However, the authors concluded that the subpopulation is well monitored and the data evaluated represents 63.4 % of the total estimated annual nests of the subpopulation and, therefore, are representative of the overall trend (Ceriani and Meylan 2017).

About 80% of loggerhead nesting in the southeast United States occurs in six Florida counties (NMFS and USFWS 2008). The Peninsula Florida Recovery Unit and the Northern Recovery Unit represent approximately 87% and 10%, respectively of all nesting effort in the Northwest Atlantic DPS (Ceriani and Meylan 2017, NMFS and USFWS 2008). As described above, FWRI's INBS collects standardized nesting data. The index nest counts for loggerheads represent approximately 53% of known nesting in Florida. There have been three distinct intervals observed: increasing (1989-1998), decreasing (1998-2007), and increasing (2007-2021). At core index beaches in Florida, nesting totaled a minimum of 28,876 nests in 2007 and a maximum of 65,807 nests in 2016 (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). In 2019, more than 53,000 nests were documented. In 2020, loggerhead turtles had another successful nesting season with more than 49,100 nests documented. The nest counts in Figure 5.2.6 represent peninsular Florida and do not include an additional set of beaches in the Florida Panhandle and southwest coast that were added to the program in 1997. Nest counts at these Florida Panhandle index beaches have an upward trend since 2010 (Figure 4.2.7).

Figure 4.2.6. Annual nest counts of loggerhead sea turtles on Florida core index beaches in peninsular Florida, 1989-2021 (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/).

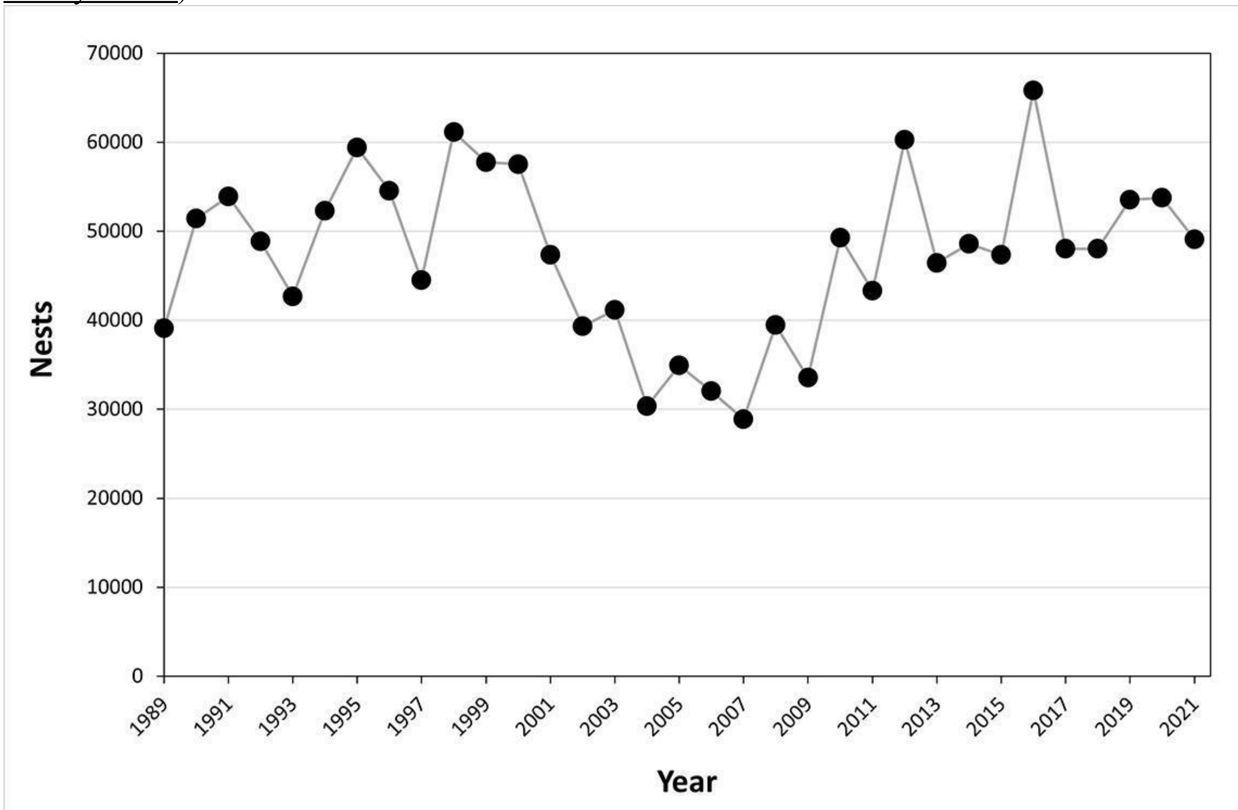
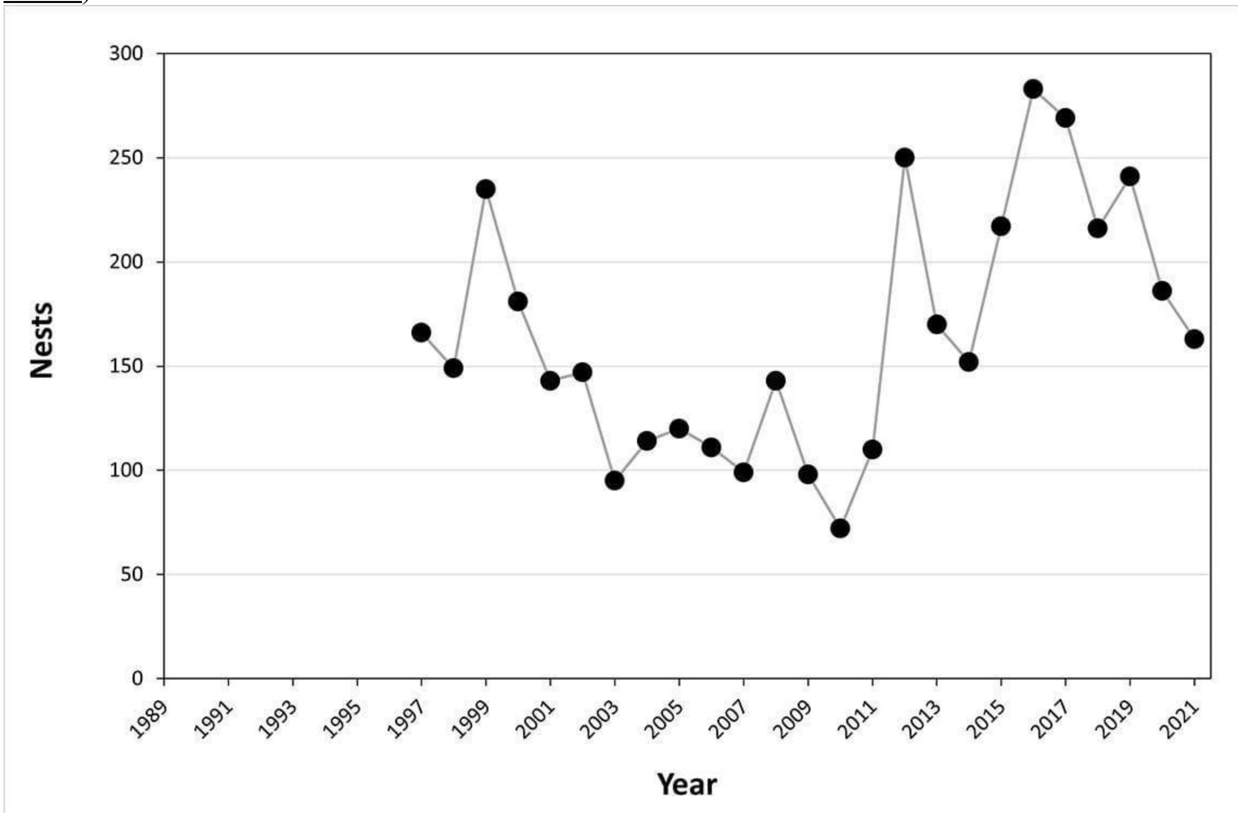


Figure 4.2.7. Annual nest counts of loggerhead sea turtles on index beaches in the Florida Panhandle, 1997-2021 (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/).



The annual nest counts on Florida's index beaches fluctuate widely, and we do not fully understand what drives these fluctuations. In assessing the population, Ceriani and Meylan (2017) and Bolten et al. (2019) looked at trends by recovery unit. Trends by recovery unit were variable.

The Peninsular Florida Recovery Unit extends from the Georgia-Florida border south and then north (excluding the islands west of Key West, Florida) through Pinellas County on the west coast of Florida. Annual nest counts from 1989 to 2018 ranged from a low of 28,876 in 2007 to a high of 65,807 in 1998 (Bolten et al. 2019). More recently (2008-2018), counts have ranged from 33,532 in 2009 to 65,807 in 2016 (Bolten et al. 2019). Nest counts taken at index beaches in Peninsular Florida showed a significant decline in loggerhead nesting from 1989 to 2007, most likely attributed to mortality of oceanic-stage loggerheads caused by fisheries bycatch (Witherington et al. 2009). Trend analyses have been completed for various periods. From 2009 through 2013, a 2% decrease for this recovery unit was reported (Ceriani and Meylan 2017). Using a longer time series from 1989-2018, there was no significant change in the number of annual nests (Bolten et al. 2019). It is important to recognize that an increase in the number of nests has been observed since 2007. The recovery team cautions that using short term trends in nesting abundance can be misleading and trends should be considered in the context of one generation (50 years for loggerheads) (Bolten et al. 2019).

The Northern Recovery Unit, ranging from the Florida-Georgia border through southern Virginia, is the second largest nesting aggregation in the DPS. Annual nest totals for this recovery unit from 1983 to 2019 have ranged from a low of 520 in 2004 to a high of 5,555 in 2019 (Bolten et al. 2019). From 2008 to 2019, counts have ranged from 1,289 nests in 2014 to 5,555 nests in 2019 (Bolten et al. 2019). Nest counts at loggerhead nesting beaches in North Carolina, South Carolina, and Georgia declined at 1.9% annually from 1983 to 2005 (NMFS and USFWS 2008). Recently, the trend has been increasing. Ceriani and Meylan (2017) reported a 35% increase for this recovery unit from 2009 through 2013. A longer-term trend analysis based on data from 1983 to 2019 indicates that the annual rate of increase is 1.3% (Bolten et al. 2019). The Dry Tortugas Recovery Unit includes all islands west of Key West, Florida. A census on Key West from 1995 to 2004 (excluding 2002) estimated a mean of 246 nests per year, or about 60 nesting females (NMFS and USFWS 2008). No trend analysis is available because there was not an adequate time series to evaluate the Dry Tortugas recovery unit (Ceriani et al. 2019, Ceriani and Meylan 2017), which accounts for less than 1% of the Northwest Atlantic DPS (Ceriani and Meylan 2017).

The Northern Gulf of Mexico Recovery Unit is defined as loggerheads originating from beaches in Franklin County on the northwest Gulf coast of Florida through Texas. From 1995 to 2007, there were an average of 906 nests per year on approximately 300 km of beach in Alabama and Florida, which equates to about 221 females nesting per year (NMFS and USFWS 2008). Annual nest totals for this recovery unit from 1997-2018 have ranged from a low of 72 in 2010 to a high of 283 in 2016 (Bolten et al. 2019). Evaluation of long-term nesting trends for the Northern Gulf of Mexico Recovery Unit is difficult because of changed and expanded beach coverage. However, there are now over 20 years of Florida index nesting beach survey data. A number of trend analyses have been conducted. From 1995 to 2005, the recovery unit exhibited a significant declining trend (Conant et al. 2009, NMFS, and USFWS 2008). Nest numbers have increased in recent years (Bolten et al. 2019) (see https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). In the 2009-2013 trend analysis by Ceriani and Meylan (2017), a 1% decrease for this recovery unit was reported, likely due to diminished nesting on beaches in Alabama, Mississippi, Louisiana, and Texas. A longer-term analysis from 1997-2018 found that there has been a non-significant increase of 1.7% (Bolten et al. 2019).

The Greater Caribbean Recovery Unit encompasses nesting subpopulations in Mexico to French Guiana, the Bahamas, and the lesser and Greater Antilles. The majority of nesting for this recovery unit occurs on the Yucatán Peninsula, in Quintana Roo, Mexico, with 903 to 2,331 nests annually (Zurita et al. 2003). Other significant nesting sites are found throughout the Caribbean, including Cuba, with approximately 250 to 300 nests annually (Ehrhart et al. 2003), and over 100 nests annually in Cay Sal in the Bahamas (NMFS and USFWS 2008). In the trend analysis by Ceriani and Meylan (2017), a 53% increase for this Recovery Unit was reported from 2009 through 2013.

Status

Fisheries bycatch is the highest threat to the Northwest Atlantic DPS of loggerhead sea turtles (Conant et al. 2009). Other threats include boat strikes, marine debris, coastal development, habitat loss, contaminants, disease, and climate change. Nesting trends for each of the loggerhead sea turtle recovery units in the Northwest Atlantic Ocean DPS are variable. Overall, short-term trends have shown increases, however, over the long-term the DPS is considered stable.

Critical Habitat
Critical habitat for the Northwest Atlantic DPS was designated in 2014 (79 FR 39855) and extends from offshore waters off of New Jersey and beaches in North Carolina south and through the Gulf of Mexico, all of which is outside the action area.

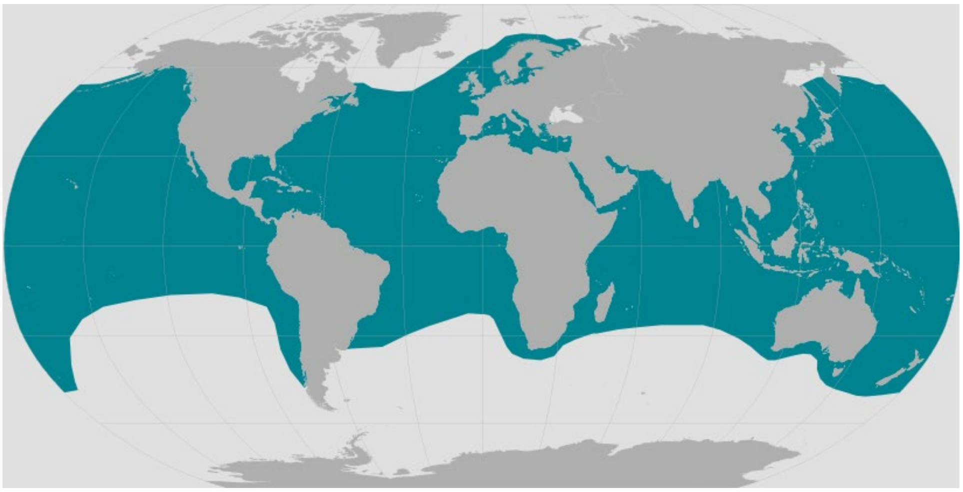
Recovery Goals
The recovery goal for the Northwest Atlantic loggerhead is to ensure that each recovery unit meets its recovery criteria, alleviating threats to the species so that protection under the ESA is not needed. The recovery criteria relate to the number of nests and nesting females, trends in abundance on the foraging grounds, and trends in neritic strandings relative to in-water abundance. The 2008 Final Recovery Plan for the Northwest Atlantic Population of Loggerheads includes the complete downlisting/delisting criteria (NMFS and U.S. FWS 2008). The recovery objectives to meet these goals include:

1. Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females.
2. Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.
3. Manage sufficient nesting beach habitat to ensure successful nesting.
4. Manage sufficient feeding, migratory and internesting marine habitats to ensure successful growth and reproduction.
5. Eliminate legal harvest.
6. Implement scientifically based nest management plans.
7. Minimize nest predation.
8. Recognize and respond to mass/unusual mortality or disease events appropriately.
9. Develop and implement local, state, federal and international legislation to ensure long-term protection of loggerheads and their terrestrial and marine habitats.
10. Minimize bycatch in domestic and international commercial and artisanal fisheries.
11. Minimize trophic changes from fishery harvest and habitat alteration.
12. Minimize marine debris ingestion and entanglement.
13. Minimize vessel strike mortality.

4.2.2.4 Leatherback Sea Turtle (Deromchelys coriacea)

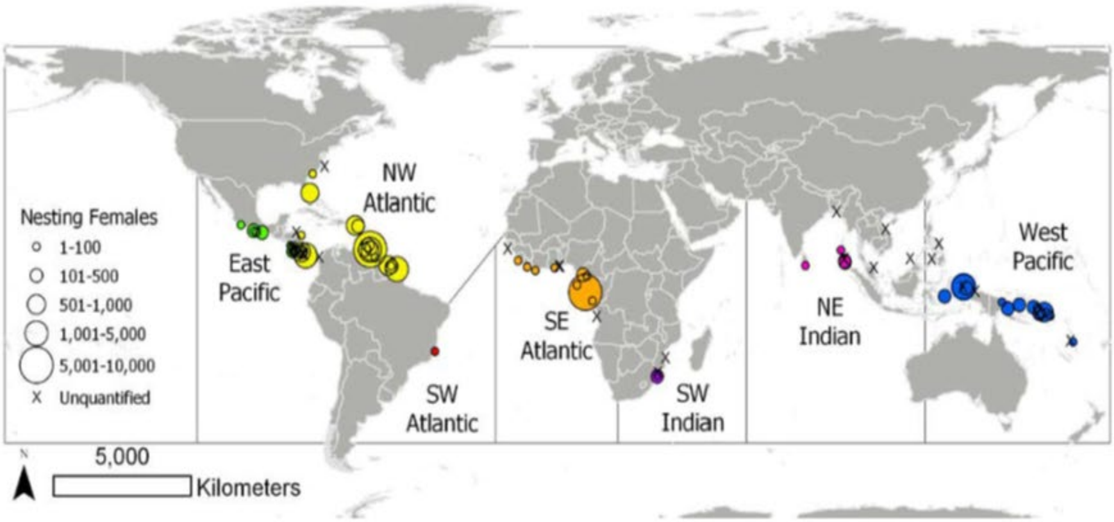
The leatherback sea turtle is unique among sea turtles for its large size, wide distribution (due to thermoregulatory systems and behavior), and lack of a hard, bony carapace. It ranges from tropical to subpolar latitudes, worldwide (Figure 4.2.8).

Figure 4.2.8. Range of the leatherback sea turtle.



Leatherbacks are the largest living turtle, reaching lengths of six feet long, and weighing up to one ton. Leatherback sea turtles have a distinct black leathery skin covering their carapace with pinkish white skin on their plastron. The species was first listed under the Endangered Species Conservation Act (35 FR 8491, June 2, 1970) and has been listed as endangered under the ESA since 1973. In 2020, seven leatherback populations that met the discreteness and significance criteria of the distinct population segment policy were identified (NMFS and USFWS 2020). The population found within the action area is the Northwest Atlantic population segment (NW Atlantic) (Figure 4.2.9). NMFS and USFWS concluded that the seven populations, which met the criteria for DPSs, all met the definition of an endangered species. However, NMFS and USFWS determined that the listing of DPSs was not warranted; leatherbacks continue to be listed at the global level (85 FR 48332, August 10, 2020). Therefore, information is presented on the range-wide status. We used information available in the five-year review (NMFS and USFWS 2013), the critical habitat designation (44 FR 17710, March 23, 1979), the most recent status review (NMFS and USFWS 2020), relevant literature, and recent nesting data from the Florida FWRI to summarize the life history, population dynamics and status of the species, as follows.

Figure 4.2.9. Leatherback sea turtle DPSs and nesting beaches (NMFS and USFWS 2020).



Life History
Leatherbacks are a long-lived species. Preferred nesting grounds are in the tropics; though, nests span latitudes from 34 °S in Western Cape, South Africa to 38 °N in Maryland (Eckert et al. 2012, Eckert et al. 2015). Females lay an average of five to seven clutches (range: 1-14 clutches) per season, with 20 to over 100 eggs per clutch (Eckert et al. 2012, Reina et al. 2002, Wallace et al. 2007). The average clutch frequency for the NW Atlantic population segment is 5.5 clutches per season (NMFS and USFWS 2020). In the western Atlantic, leatherbacks lay about 82 eggs per clutch (Sotherland et al. 2015). Remigration intervals are 2-4 years for most populations (range 1-11 years) (Eckert et al. 2015, NMFS and USFWS 2020); the remigration interval for the NW Atlantic population segment is approximately 3 years (NMFS and USFWS 2020). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergence success) is approximately 50% worldwide (Eckert et al. 2012).

Age at sexual maturity has been challenging to obtain given the species physiology and habitat use (Avens et al. 2019). Past estimates ranged from 5-29 years (Avens et al. 2009, Spotila et al. 1996). More recently, Avens et al. (2020) used refined skeletochronology to assess the age at sexual maturity for leatherback sea turtles in the Atlantic and the Pacific. In the Atlantic, the mean age at sexual maturity was 19 years (range 13-28) and the mean size at sexual maturity was 4.2 ft. (129.2 cm) curved carapace length (CCL) (range (3.7-5 ft. (112.8-153.8 cm))). In the Pacific, the mean age at sexual maturity was 17 years (range 12-28) and the mean size at sexual maturity was 4.2 ft. (129.3 cm) CCL (range 3.6- 5 ft. (110.7-152.3 cm)) (Avens et al. 2019).

Leatherbacks have a greater tolerance for colder waters compared to all other sea turtle species due to their thermoregulatory capabilities (Paladino et al. 1990, Shoop and Kenney 1992, Wallace and Jones 2008). Evidence from tag returns, satellite telemetry, and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between temperate/boreal and tropical waters (Bond and James 2017, Dodge et al. 2015, Eckert et al. 2006, Fossette et al. 2014, James et al. 2005a, James et al. 2005b, James et al. 2005c, NMFS and USFWS 1992). Tagging studies collectively show a clear separation of leatherback movements between the North and South Atlantic Oceans (NMFS and USFWS 2020).

Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage, primarily on jellyfish and tunicates. These gelatinous prey are relatively nutrient-poor, such that leatherbacks must consume large quantities to support their body weight. Leatherbacks weigh about 33% more on their foraging grounds than at nesting, indicating that they probably catabolize fat reserves to fuel migration and subsequent reproduction (James et al. 2005c, Wallace et al. 2006). Studies on the foraging ecology of leatherbacks in the North Atlantic show that leatherbacks off Massachusetts primarily consumed lion's mane, sea nettles, and ctenophores (Dodge et al. 2011). Juvenile and small sub-adult leatherbacks may spend more time in oligotrophic (relatively low plant nutrient usually accompanied by high dissolved oxygen) open ocean waters where prey is more difficult to find (Dodge et al. 2011). Sea turtles must meet an energy threshold before returning to nesting beaches. Therefore, their remigration intervals are dependent upon foraging success and duration (Hays 2000, Price et al. 2004).

Population Dynamics
The distribution is global, with nesting beaches in the Pacific, Atlantic, and Indian Oceans. Leatherbacks occur throughout marine waters, from nearshore habitats to oceanic environments (NMFS and USFWS 2020, Shoop and Kenney 1992). Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features that concentrate prey, such as frontal systems, eddy features, current boundaries, and coastal retention areas (Benson et al. 2011).

Analyses of mtDNA from leatherback sea turtles indicates a low level of genetic diversity (Dutton et al. 1999). Further analysis of samples taken from individuals from rookeries in the Atlantic and Indian Oceans suggest that each of the rookeries represent demographically independent populations (NMFS and USFWS 2013). Using genetic data, combined with nesting, tagging, and tracking data, researchers identified seven global regional management units (RMU) or subpopulations: Northwest Atlantic, Southeast Atlantic, Southwest Atlantic, Northwest Indian, Southwest Indian, East Pacific, and West Pacific (Wallace et al. 2010). The status review concluded that the RMUs identified by Wallace et al. (2010) are discrete populations and, then, evaluated whether any other populations exhibit this level of genetic discontinuity (NMFS and USFWS 2020).

To evaluate the RMUs and fine-scale structure in the Atlantic, Dutton et al. (2013) conducted a comprehensive genetic re-analysis of rookery stock structure. Samples from eight nesting sites in the Atlantic and one in the southwest Indian Ocean identified seven management units in the Atlantic and revealed fine scale genetic differentiation among neighboring populations. The mtDNA analysis failed to find significant differentiation between Florida and Costa Rica or between Trinidad and French Guiana/Suriname (Dutton et al. 2013). While Dutton et al. (2013) identified fine-scale genetic partitioning in the Atlantic Ocean, the differences did not rise to the level of marked separation or discreteness (NMFS and USFWS 2020). Other genetic analyses corroborate the conclusions of Dutton et al. (2013). These studies analyzed nesting sites in French Guiana (Molfetti et al. 2013), nesting and foraging areas in Brazil (Vargas et al. 2019), and nesting beaches in the Caribbean (Carreras et al. 2013). These studies all support three discrete populations in the Atlantic (NMFS and USFWS 2020). While these studies detected fine-scale genetic differentiation in the NW, SW, and SE Atlantic populations, the status review team determined that none indicated that the genetic differences were sufficient to be considered marked separation (NMFS and USFWS 2020).

Population growth rates for leatherback sea turtles vary by ocean basin. An assessment of leatherback populations through 2010 found a global decline overall (Wallace et al. 2013). Using datasets with abundance data series that are 10 years or greater, they estimated that leatherback populations have declined from 90,599 nests per year to 54,262 nests per year over three generations ending in 2010 (Wallace et al. 2013).

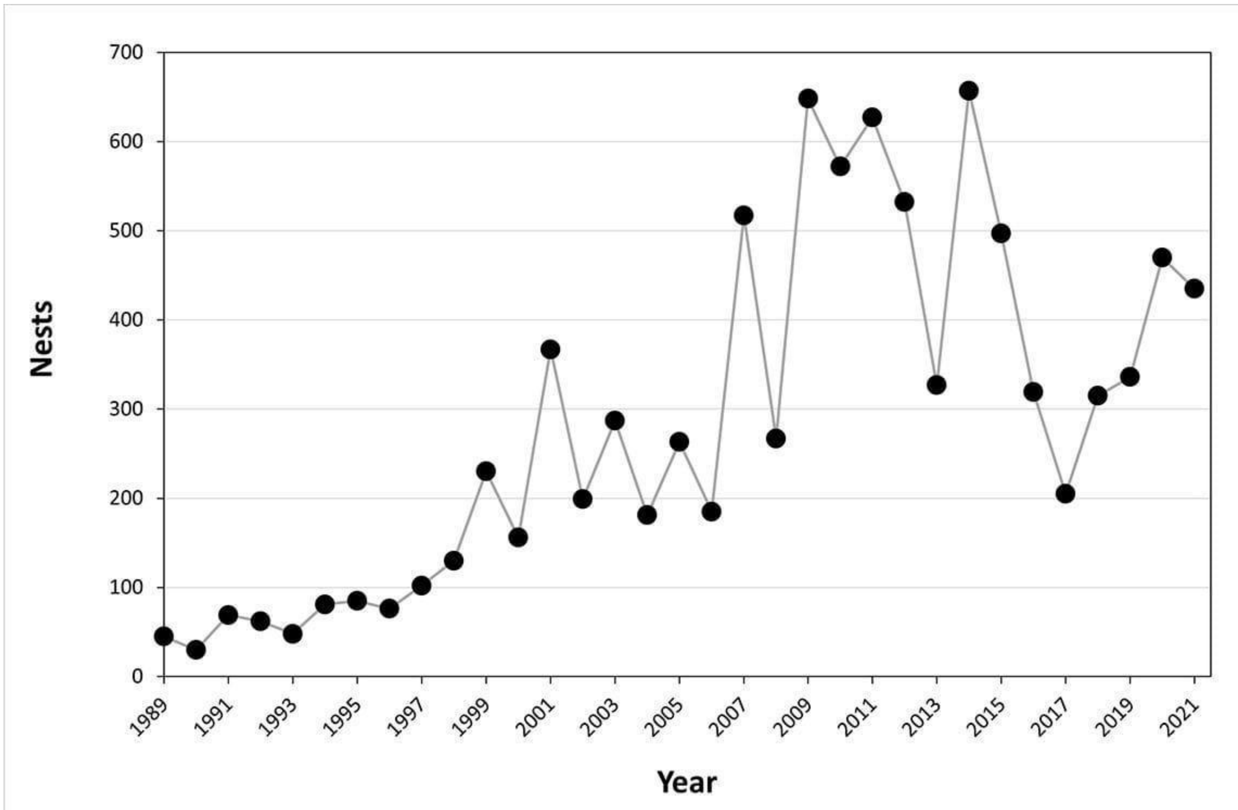
Several more recent assessments have been conducted. The Northwest Atlantic Leatherback Working Group was formed to compile nesting abundance data, analyze regional trends, and provide conservation recommendations. The most recent, published IUCN Red List assessment for the NW Atlantic Ocean subpopulation estimated 20,000 mature individuals and approximately 23,000 nests per year (estimate to 2017) (Northwest Atlantic Leatherback Working Group 2019). Annual nest counts show high inter-annual variability within and across nesting sites (Northwest Atlantic Leatherback Working Group 2018). Using data from 24 nesting sites in 10 nations within the NW Atlantic population segment, the leatherback status review estimated that the total index of nesting female abundance for the NW Atlantic population segment is 20,659 females (NMFS and USFWS 2020). This estimate only includes nesting data from recently and consistently monitored nesting beaches. An index (rather than a census) was developed given that the estimate is based on the number of nests on main nesting beaches with recent and consistent data and assumes a 3-year remigration interval. This index provides a minimum estimate of nesting female abundance (NMFS and USFWS 2020). This index of nesting female abundance is similar to other estimates. The Turtle Expert Working Group (TEWG) estimated approximately 18,700 (range 10,000 to 31,000) adult females using nesting data from 2004 and 2005 (TEWG 2007). As described above, the IUCN Red List Assessment estimated 20,000 mature individuals (male and female). The estimate in the status review is higher than the estimate for the IUCN Red List assessment, likely due to a different remigration interval, which has been increasing in recent years (NMFS and USFWS 2020).

Previous assessments of leatherbacks concluded that the Northwest Atlantic population was stable or increasing (TEWG 2007, Tiwari et al. 2013b). However, based on more recent analyses, leatherback nesting in the Northwest Atlantic is showing an overall negative trend, with the most notable decrease occurring during the most recent period of 2008-2017 (Northwest Atlantic Leatherback Working Group 2018). The analyses for the IUCN Red List assessment indicate that the overall regional, abundance-weighted trends are negative (Northwest Atlantic Leatherback Working Group 2018, 2019). The dataset for trend analyses included 23 sites across 14 countries/territories. Three periods were used for the trend analysis: long-term (1990-2017), intermediate (1998-2017), and recent (2008-2017) trends. Overall, regional, abundance-weighted trends were negative across the periods and became more negative as the time-series became shorter. At the stock level, the Working Group evaluated the NW Atlantic – Guianas-Trinidad, Florida, Northern Caribbean, and the Western Caribbean. The NW Atlantic – Guianas-Trinidad stock is the largest stock and declined significantly across all periods, which was attributed to an exponential decline in abundance at Awala-Yalimapo, French Guiana as well as declines in Guyana, Suriname, Cayenne, and Matura. Declines in Awala-Yalimapo were attributed, in part, due to beach erosion and a loss of nesting habitat (Northwest Atlantic Leatherback Working Group 2018). The Florida stock increased significantly over the long-term, but declined from 2008-2017. The Northern Caribbean and Western Caribbean stocks also declined over all three periods. The Working Group report also includes trends at the site-level, which varied depending on the site and time period, but were generally negative especially in the recent time period. The Working Group identified anthropogenic sources (fishery bycatch, vessel strikes), habitat loss, and changes in life history parameters as possible drivers of nesting abundance declines (Northwest Atlantic Leatherback Working Group 2018). Fisheries bycatch is a well-documented threat to leatherback turtles. The Working Group discussed entanglement in vertical line fisheries off New England and Canada as potentially important mortality sinks. They also noted that vessel strikes result in mortality annually in feeding habitats off New England. Off nesting beaches in Trinidad and the Guianas, net fisheries take leatherbacks in high numbers (~3,000/yr.) (Eckert 2013, Lum 2006, Northwest Atlantic Leatherback Working Group 2018).

Similarly, the leatherback status review concluded that the NW Atlantic population segment exhibits decreasing nest trends at nesting aggregations with the greatest indices of nesting female abundance. Significant declines have been observed at nesting beaches with the greatest historical or current nesting female abundance, most notably in Trinidad and Tobago, Suriname, and French Guiana. Though some nesting aggregations (see status review document for information on specific nesting aggregations) indicated increasing trends, most of the largest ones are declining. The declining trend is considered to be representative of the population segment (NMFS and USFWS 2020). The status review found that fisheries bycatch is the primary threat to the NW Atlantic population (NMFS and USFWS 2020).

Leatherback sea turtles nest in the southeastern United States. From 1989-2019, leatherback nests at core index beaches in Florida have varied from a minimum of 30 nests in 1990 to a maximum of 657 in 2014 (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). Leatherback nest numbers reached a peak in 2014 followed by a steep decline (2015-2017) and a promising increase (2018-2021) (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/) (Figure 4.2.10). The status review found that the median trend for Florida from 2008-2017 was a decrease of 2.1% annually (NMFS and USFWS 2020). Surveyors counted 435 leatherback nests on the 27 core index beaches in 2021. These counts do not include leatherback nesting at the beginning of the season (before May 15), nor do they represent all the beaches in Florida where leatherbacks nest; however, the index provided by these counts remains a representative reflection of trends. However, while green turtle nest numbers on Florida's index beaches continue to rise, Florida hosts only a few hundred nests annually and leatherbacks can lay as many as 11 clutches during a nesting season. Thus, fluctuations in nest count may be the result of a small change in number of females. More years of standardized nest counts are needed to understand whether the fluctuation is natural or warrants concern.

Figure 4.2.10. Number of leatherback sea turtle nests on core index beaches in Florida from 1989-2021 (https://myfwc.com/research/wildlife/sea-turtles/nesting/).



For the SW Atlantic population segment, the status review estimates the total index of nesting female abundance at approximately 27 females (NMFS and USFWS 2020). This is similar to the IUCN Red List assessment that estimated 35 mature individuals (male and female) using nesting data since 2010. Nesting has increased since 2010 overall, though the 2014-2017 estimates were lower than the previous three years. The trend is increasing, though variable (NMFS and USFWS 2020). The SE Atlantic population segment has an index of nesting female abundance of 9,198 females and demonstrates a declining nest trend at the largest nesting aggregation (NMFS and USFWS 2020). The SE population segment exhibits a declining nest trend (NMFS and USFWS 2020).

Populations in the Pacific have shown dramatic declines at many nesting sites (Mazaris et al. 2017, Santidrián Tomillo et al. 2017, Santidrián Tomillo et al. 2007, Sarti Martínez et al. 2007, Tapilatu et al. 2013). For an IUCN Red List evaluation, datasets for nesting at all index beaches for the West Pacific population were compiled (Tiwari et al. 2013a). This assessment estimated the number of total mature individuals (males and females) at Jamursba-Medi and Wermon beaches to be 1,438 turtles (Tiwari et al. 2013a). Counts of leatherbacks at nesting beaches in the western Pacific indicate that the subpopulation declined at a rate of almost 6% per year from 1984 to 2011 (Tapilatu et al. 2013). More recently, the leatherback status review estimated the total index of nesting female abundance of the West Pacific population segment at 1,277 females, and the population exhibits low hatchling success (NMFS and USFWS 2020). The total index of nesting female abundance for the East Pacific population segment is 755 nesting females. It has exhibited a decreasing trend since monitoring began with a 97.4% decline since the 1980s or 1990s, depending on nesting beach (Wallace et al. 2013). The low productivity parameters, drastic reductions in nesting female abundance, and current declines in nesting place the population segment at risk (NMFS and USFWS 2020).

Population abundance in the Indian Ocean is difficult to assess due to lack of data and inconsistent reporting. Available data from southern Mozambique show that approximately 10 females nest per year from 1994 to 2004, and about 296 nests per year were counted in South Africa (NMFS and USFWS 2013). A 5-year status review in 2013 found that, in the southwest Indian Ocean, populations in South Africa are stable (NMFS and USFWS 2013). More recently, the 2020 status review estimated that the total index of nesting female abundance for the SW Indian population segment is 149 females and that the population is exhibiting a slight decreasing nest trend (NMFS and USFWS 2020). While data on nesting in the NE Indian Ocean populations segment is limited, the population is estimated at 109 females. This population has exhibited a drastic population decline with extirpation of the largest nesting aggregation in Malaysia (NMFS and USFWS 2020).

Status

The leatherback sea turtle is an endangered species whose once large nesting populations have experienced steep declines in recent decades. There has been a global decline overall. For all population segments, including the NW Atlantic population, fisheries bycatch is the primary threat to the species (NMFS and USFWS 2020). Leatherback turtle nesting in the Northwest Atlantic showed an overall negative trend through 2017, with the most notable decrease occurring during the most recent time frame of 2008 to 2017 (Northwest Atlantic Leatherback Working Group 2018). Though some nesting aggregations indicated increasing trends, most of the largest ones are declining. Therefore, the leatherback status review in 2020 concluded that the NW Atlantic population exhibits an overall decreasing trend in annual nesting activity (NMFS and USFWS 2020). Threats to leatherback sea turtles include loss of nesting habitat, fisheries bycatch, vessel strikes, harvest of eggs, and marine debris, among others (Northwest Atlantic Leatherback Working Group 2018). Because of the threats, once large nesting areas in the Indian and Pacific Oceans are now functionally extinct (Tiwari et al. 2013a) and there have been range-wide reductions in population abundance. The species' resilience to additional perturbation both within the NW Atlantic and worldwide is low.

Critical Habitat

Critical habitat has been designated for leatherback sea turtles in the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands (44 FR 17710, March 23, 1979) and along the U.S. West Coast (77 FR 4170, January 26, 2012), both of which are outside the action area.

Recovery Goals

There are separate recovery plans for the U.S. Caribbean, Gulf of Mexico, and Atlantic (NMFS and USFWS 1992) and the U.S. Pacific (NMFS and USFWS 1998) populations of leatherback sea turtles. Neither plan has been recently updated. As with other sea turtle species, the recovery plans for leatherbacks include criteria for considering delisting. These criteria relate to increases in the populations, nesting trends, nesting beach and habitat protection, and implementation of priority actions. Criteria for delisting in the recovery plan for the U.S. Caribbean, Gulf of Mexico, and Atlantic are described here.

Delisting criteria

1. Adult female population increases for 25 years after publication of the recovery plan, as evidenced by a statistically significant trend in nest numbers at Culebra, Puerto Rico; St. Croix, U.S. Virgin Islands; and the east coast of Florida.
2. Nesting habitat encompassing at least 75% of nesting activity in the U.S. Virgin Islands, Puerto Rico, and Florida is in public ownership.
3. All priority-one tasks have been successfully implemented (see the recovery plan for a list of priority one tasks).

Major recovery actions in the U.S. Caribbean, Gulf of Mexico, and Atlantic include actions to:

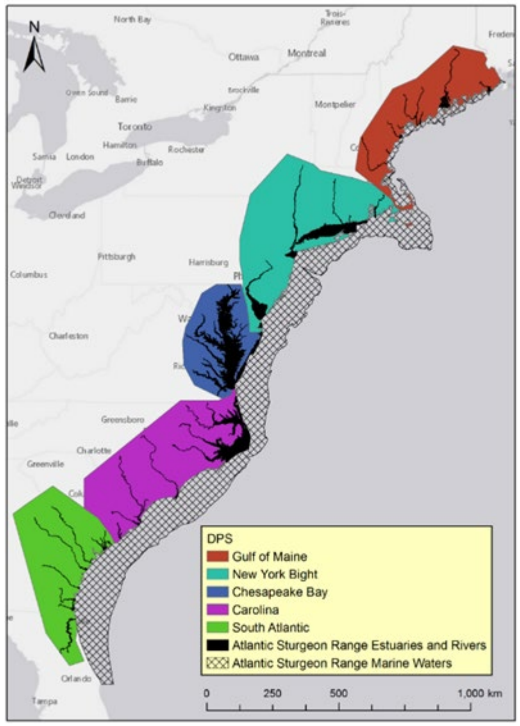
1. Protect and manage terrestrial and marine habitats.
2. Protect and manage the population.
3. Inform and educate the public.
4. Develop and implement international agreements.

The 2013 Five-Year Review (NMFS and USFWS 2013) concluded that the leatherback turtle should not be delisted or reclassified and notes that the 1991 and 1998 recovery plans are dated and do not address the major, emerging threat of climate change.

4.2.3 Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus)

An estuarine-dependent anadromous species, Atlantic sturgeon occupy ocean and estuarine waters, including sounds, bays, and tidal-affected rivers from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (77 FR 5880, April 6, 2012) (Figure 4.3.1). On February 6, 2012, NMFS listed five DPSs of Atlantic sturgeon under the ESA: Gulf of Maine (GOM), New York Bight (NYB), Chesapeake Bay (CB), Carolina, and South Atlantic (77 FR 5880 and 77 FR 5914). The Gulf of Maine DPS is listed as threatened, and the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are listed as endangered. Critical habitat has been designated for the five DPSs of Atlantic sturgeon (82 FR 39160, August 17, 2017) in rivers of the eastern United States. The conservation objective identified in the final rule is to increase the abundance of each DPS by facilitating increased successful reproduction and recruitment to the marine environment.

Figure 4.3.1. Representative distribution of rivers of orgin for ESA listed Atlantic sturgeon DPSs.



Information available from the 2007 Atlantic sturgeon status review (ASSRT 2007), 2017 Atlantic States Marine Fishery Commission (ASMFC) benchmark stock assessment (ASMFC 2017), final listing rules (77 FR 5880 and 77 FR 5914; February 6, 2012), material supporting the designation of Atlantic sturgeon critical habitat (NMFS 2017a), and Five-Year Reviews completed for the Gulf of Maine, New York Bight, and Chesapeake Bay DPSs (NMFS 2022a, b, c) and Carolina and South Atlantic DPSs (NMFS 2023a, 2023b) were used to summarize the life history, population dynamics, and status of the species.

Life History

Atlantic sturgeon are a late maturing, anadromous species (ASSRT 2007, Balazik et al. 2010, Hilton et al. 2016, Sulak and Randall 2002). Sexual maturity is reached between the ages of 5 to 34 years. Sturgeon originating from rivers in lower latitudes (e.g., South Carolina rivers) mature faster than those originating from rivers located in higher latitudes (e.g., Saint Lawrence River) (NMFS 2017a).

Atlantic sturgeon spawn in freshwater (ASSRT 2007, NMFS 2017b) at sites with flowing water and hard bottom substrate (Bain et al. 2000, Balazik et al. 2012b, Gilbert 1989, Greene et al. 2009, Hatin et al. 2002, Mohler 2003, Smith and Clugston 1997, Vladykov and Greeley 1963). Water depths of spawning sites are highly variable, but may be up to 88.5 ft. (27 m) (Bain et al. 2000, Crance 1987, Leland 1968, Scott and Crossman 1973). Based on tagging records, Atlantic sturgeon return to their natal rivers to spawn (ASSRT 2007), with spawning intervals ranging from one to five years in males (Caron et al. 2002, Collins et al. 2000b, Smith 1985) and two to five years in females (Stevenson and Secor 1999, Van Eenennaam et al. 1996, Vladykov and Greeley 1963). Some Atlantic sturgeon river populations may have up to two spawning seasons comprised of different spawning adults (Balazik and Musick 2015, Collins et al. 2000b), although the majority likely have just one, either in the spring or fall.[16] There is evidence of spring and fall spawning for the South Atlantic DPS (77 FR 5914, February 6, 2012, Collins et al. 2000b, NMFS and USFWS 1998b, NMFS and USFWS 1998), spring spawning for the Gulf of Maine and New York Bight DPSs (NMFS 2017a), and fall spawning for the Chesapeake and Carolina DPSs (Balazik et al. 2012a, Smith et al. 1984, NMFS 2022c). Telemetry and empirical data suggest that there may be two potential spawning runs in the James River: a spring run from late March to early May and a fall run around September after an extended staging period in the lower river (Balazik et al. 2012a, Balazik and Musick 2015, Balazik et al. 2017a).

Following spawning, males move downriver to the lower estuary and remain there until outmigration in the fall (Bain 1997, Bain et al. 2000, Balazik et al. 2012a, Breece et al. 2013, Dovel and Berggren 1983a, Greene et al. 2009, Hatin et al. 2002, Ingram et al. 2019, Smith 1985, Smith et al. 1982). Females move downriver and may leave the estuary and travel to other coastal estuaries until outmigration to marine waters in the fall (Bain 1997, Bain et al. 2000, Balazik et al. 2012a, Breece et al. 2013, Dovel and Berggren 1983a, Greene et al. 2009, Hatin et al. 2002, NMFS 2017a, Smith 1985, Smith et al. 1982). Atlantic sturgeon deposit eggs on hard bottom substrate. They hatch into the yolk sac larval stage approximately 94 to 140 hours after deposition (Mohler 2003, Murawski and Pacheco 1977, Smith et al. 1980, Van Den Avyle 1984, Vladykov and Greeley 1963). Once the yolk sac is absorbed (eight to twelve days post-hatching), sturgeon are larvae. Shortly after, they become young of year and then juveniles. The juvenile stage can last months to years in the brackish waters of the natal estuary (ASSRT 2007, Calvo et al. 2010, Collins et al. 2000a, Dadswell 2006, Dovel and Berggren 1983b, Greene et al. 2009, Hatin et al. 2007, Holland and Yelverton 1973, Kynard and Horgan 2002, Mohler 2003, Schueller and Peterson 2010, Secor et al. 2000, Waldman et al. 1996). Upon reaching the sub-adult phase, individuals enter the marine environment, mixing with adults and sub-adults from other river systems (Bain 1997, Dovel and Berggren 1983a, Hatin et al. 2007, McCord et al. 2007, NMFS 2017a). Once sub-adult Atlantic sturgeon have reached maturity/the adult stage, they will remain in marine or estuarine waters, only returning far upstream to the spawning areas when they are ready to spawn (ASSRT 2007, Bain 1997, Breece et al. 2016, Dunton et al. 2012, Dunton et al. 2015, Savoy and Pacileo 2003).

The life history of Atlantic sturgeon can be divided up into seven general categories as described in Table 4.3.1 below (adapted from ASSRT 2007). Depending on life stage, sturgeon may be present in freshwater, marine and estuarine ecosystems.

[16] Although referred to as spring spawning and fall spawning, the actual time of Atlantic sturgeon spawning may not occur during the astronomical spring or fall season (Balazik and Musick 2015).

Table 4.3.1. General descriptions of typical/representative Atlantic sturgeon life history stages.

Age Class	Typical Size	General Duration	Represenative Description
Egg	~2 mm – 3 mm diameter (Van Eenennaam et al. 1996)(p. 773)	Hatching occurs ~3-6 days after egg deposition and fertilization (ASSRT 2007)(p. 4))	Fertilized or unfertilized
Yolk-sac larvae (YSL)	~6mm – 14 mm (Bath et al. 1981)(pp. 714-715))	8-12 days post hatch (ASSRT 2007)(p. 4))	Negative photo-taxic, nourished by yolk sac
Post yolk-sac larvae (PYSL)	~14mm – 37mm (Bath et al. 1981)(pp. 714-715))	12-40 days post hatch	Free swimming; feeding; Silt/sand bottom, deep channel; fresh water
Young of Year (YOY)	0.3 grams <410mm TL	From 40 days to 1 year	Fish that are > 40 days and < one year; capable of capturing and consuming live food
Juveniles	>410mm and <760mm TL	1 year to time at which first coastal migration is made	Fish that are at least age 1 and are not sexually mature and do not make coastal migrations.
Subadults	>760 mm and <1500 mm TL	From first coastal migration to sexual maturity	Fish that are not sexually mature but make coastal migrations
Adults	>1500 mm TL	Post-maturation	Sexually mature fish

Population Dynamics

An index of population abundances for Atlantic sturgeon in oceanic waters off the Northeast coast of the U.S. during 2006-2011 was developed by Kocik et al. 2013. The report includes annual swept area abundance estimates of Atlantic sturgeon in nearshore areas derived from Northeast Area Monitoring and Assessment Program surveys conducted during 2007-2012.[17] For this Opinion, we are relying on the population estimates derived from the NEAMAP swept area biomass assuming a 50% catchability (i.e., net efficiency x availability) rate. We consider that the NEAMAP surveys sample an area utilized by Atlantic sturgeon but do not sample all the locations and times where Atlantic sturgeon are present. We also consider that the trawl net captures some, but likely not all, of the Atlantic sturgeon present in the sampling area. Therefore,

[17] Since fall 2007, NEAMAP trawl surveys (spring and fall) have been conducted from Cape Cod, Massachusetts to Cape Hatteras, North Carolina in nearshore waters at depths up to 60 ft. (18.3 m). Each survey employs a spatially stratified random design with a total of 35 strata and 150 stations.

we assume that net efficiency and the fraction of the population exposed to the NEAMAP surveys in combination result in a 50% catchability (NMFS 2013). The 50% catchability assumption reasonably accounts for the robust, yet not complete, sampling of the Atlantic sturgeon oceanic temporal and spatial ranges and the documented high rates of encounter with NEAMAP survey gear. As these estimates are derived directly from empirical data with fewer assumptions than have been required to model Atlantic sturgeon populations to date, we believe these estimates continue to serve as the best available information. Based on the above approach, the overall abundance of Atlantic sturgeon in U.S. Atlantic waters is estimated to be 67,776 fish (see table 16 in Kocik et al. 2013). Based on genetic frequencies of occurrence in the sampled area, this overall population estimate was subsequently partitioned by DPS (Table 4.3.2). Given the proportion of adults to sub-adults in the NMFS NEFSC observer data (approximate ratio of 1:3), we have also estimated the number of adults and sub-adults originating from each DPS. However, this cannot be considered an estimate of the total number of sub-adults because it only considers those sub-adults that are of a size that are present and vulnerable to capture in commercial trawl and gillnet gear in the marine environment.

It is important to note, the NEAMAP-based estimates do not include young-of-the-year (YOY) fish and juveniles in the rivers; therefore, the NEAMAP-based estimates underestimate the total population size as they do not account for multiple year classes of Atlantic sturgeon that do not occur in the marine environment where the NEAMAP surveys take place. The NEAMAP surveys are conducted in waters that include the preferred depth ranges of sub-adult and adult Atlantic sturgeon and take place during seasons that coincide with known Atlantic sturgeon coastal migration patterns in the ocean. However, the estimated number of sub-adults in marine waters is a minimum count because it only considers those sub-adults that are captured in a portion of the action area and are present in the marine environment, which is only a fraction of the total number of sub-adults. In regards to adult Atlantic sturgeon, the estimated population in marine waters is also a minimum count as the NEAMAP surveys sample only a portion of the action area, and therefore a portion of the Atlantic sturgeon's range.

Table 4.3.2. Calculated population estimates based upon the NEAMAP survey swept area model, assuming 50% efficiency.

DPS	Estimated Ocean Population Abundance	Estimated Ocean Population of Adults	Estimated Ocean Population of Sub-adults (of size vulnerable to capture in fisheries)
GOM	7,455	1,864	5,591
NYB	34,566	8,642	25,925
CB	8,811	2,203	6,608
Carolina	1,356	339	1,017
SA	14,911	3,728	11,183
***Canada** (outside of the 5 ESA listed DPSs)*	*678*	*170*	*509*

Precise estimates of population growth rate (intrinsic rates) are unknown for the five listed DPSs of Atlantic sturgeon due to a lack of long-term abundance data. The ASMFC's2017 stock assessment referenced a population viability assessment (PVA) that was done to determine population growth rates for the five DPSs based on a few long-term survey programs, but most results were statistically insignificant or utilized a model for which the available did not or poorly fit. In any event, the population growth rates reported from that PVA ranged from -1.8% to 4.9% (ASMFC 2017).

The genetic diversity of Atlantic sturgeon throughout its range has been well-documented (ASSRT 2007, Bowen and Avise 1990, O'Leary et al. 2014, Ong et al. 1996, Waldman et al. 1996, Waldman and Wirgin 1998, Kazyak et al. 2021, White et al. 2021). Overall, these studies have consistently found populations to be genetically diverse, and the majority can be readily differentiated. Relatively low rates of gene flow reported in population genetic studies (Fritts et al. 2016, Savoy et al. 2017, Wirgin et al. 2002) indicate that Atlantic sturgeon return to their natal river to spawn, despite extensive mixing in coastal waters.

The marine range of U.S. Atlantic sturgeon extends from Labrador, Canada, to Cape Canaveral, Florida. As Atlantic sturgeon travel long distances in these waters, all five DPSs of Atlantic sturgeon have the potential to be anywhere in this marine range. Based on a recent genetic mixed stock analysis (Kazyak et al. 2021), we expect Atlantic sturgeon in the portions of the action area north of Atlantic City to originate from the five DPSs at the following frequencies: New York Bight (55.3%), Chesapeake (22.9%), South Atlantic (13.6%), Carolina (5.8%), and Gulf of Maine (1.6%) DPSs. It is possible that a small fraction (0.7%) of Atlantic sturgeon in the area may be Canadian origin (Kazyak et al. 2021); Canadian-origin Atlantic sturgeon are not listed under the ESA. This represents the best available information on the likely genetic makeup of individuals occurring in the lease area, the cable routes and vessel transit routes north the southernmost reach of the project action area.

Based on fishery-independent, fishery dependent, tracking, and tagging data, Atlantic sturgeon appear to primarily occur inshore of the 164 ft. (50 m) depth contour (Dunton et al. 2012, Dunton et al. 2010, Erickson et al. 2011, Laney et al. 2007, O'Leary et al. 2014, Stein et al. 2004a, b, Waldman et al. 2013, Wirgin et al. 2015a, Wirgin et al. 2015b). However, they are not restricted to these depths and excursions into deeper (e.g., 250 ft. (75 m)) continental shelf waters have been documented (Colette and Klein-MacPhee 2002, Collins and Smith 1997, Erickson et al. 2011, Stein et al. 2004b, Timoshkin 1968). Data from fishery-independent surveys and tagging and tracking studies also indicate that some Atlantic sturgeon may undertake seasonal movements along the coast (Dunton et al. 2010, Erickson et al. 2011, Hilton et al. 2016, Oliver et al. 2013, Post et al. 2014, Wippelhauser 2012). For instance, studies found that satellite-tagged adult sturgeon from the Hudson River concentrated in the southern part of the Mid-Atlantic Bight, at depths greater than 66 ft. (20 m), during winter and spring; while, in the summer and fall, Atlantic sturgeon concentrations shifted to the northern portion of the Mid-Atlantic Bight at depths less than 66 ft. (20 m) (Erickson et al. 2011).

In the marine range, several marine aggregation areas occur adjacent to estuaries and/or coastal features formed by bay mouths and inlets along the U.S. eastern seaboard (i.e., waters off North Carolina; Chesapeake Bay; Delaware Bay; New York Bight; Massachusetts Bay; Long Island

Sound; and Connecticut and Kennebec River Estuaries). Depths in these areas are generally no greater than 82 ft. (25 m) (Bain et al. 2000, Dunton et al. 2010, Erickson et al. 2011, Laney et al. 2007, O'Leary et al. 2014, Oliver et al. 2013, Savoy and Pacileo 2003, Stein et al. 2004b, Waldman et al. 2013, Wippelhauser 2012, Wippelhauser and Squiers 2015). Although additional studies are still needed to clarify why Atlantic sturgeon aggregate at these sites, there is some indication that they may serve as thermal refugia, wintering sites, or marine foraging areas (Dunton et al. 2010, Erickson et al. 2011, Stein et al. 2004b).

Status
Atlantic sturgeon were once present in 38 river systems and, of these, spawned in 35 (ASSRT 2007). They are currently present in 36 rivers and are probably present in additional rivers that provide sufficient forage base, depth, and access (ASSRT 2007). The benchmark stock assessment evaluated evidence for spawning tributaries and sub-populations of U.S. Atlantic sturgeon in 39 rivers. They confirmed (eggs, embryo, larvae, or YOY observed) spawning in ten rivers, considered spawning highly likely (adults expressing gametes, discrete genetic composition) in nine rivers, and suspected (adults observed in upper reaches of tributaries, historical accounts, presence of resident juveniles) spawning in six rivers. Spawning in the remaining rivers was unknown (ten) or suspected historical (four) (ASMFC 2017). The decline in abundance of Atlantic sturgeon has been attributed primarily to the large U.S. commercial fishery, which existed for the Atlantic sturgeon through the mid-1990s. Based on management recommendations in the ISFMP, adopted by the ASMFC in 1990, commercial harvest in Atlantic coastal states was severely restricted and ultimately eliminated from most coastal states (ASMFC 1998a). In 1998, the ASMFC placed a moratorium on all Atlantic sturgeon fisheries until the spawning stocked could be restored to a level where 20 subsequent year classes of adult females were protected (ASMFC 1998a, b). In 1999, NMFS closed the U.S. EEZ to Atlantic sturgeon retention, pursuant to the ACA (64 FR 9449; February 26, 1999). However, many state fisheries for sturgeon were closed prior to this.

As described in the listing rules and in the 2022 and 2023 5-year reviews, the most significant threats to Atlantic sturgeon are incidental catch, dams that block access to spawning habitat in southern rivers, poor water quality, impacts to habitat including dredging of spawning areas, water withdrawals from rivers, and vessel strikes. Climate change related impacts on water quality (e.g., temperature, salinity, dissolved oxygen, contaminants) also have the potential to affect Atlantic sturgeon populations using impacted river systems.

The ASMFC released a new benchmark stock assessment for Atlantic sturgeon in October 2017 (ASMFC 2017). Based on historic removals and estimated effective population size, the 2017 stock assessment concluded that all five Atlantic sturgeon DPSs are depleted relative to historical levels. However, the 2017 stock assessment does provide some evidence of population recovery at the coastwide scale, and mixed population recovery at the DPS scale (ASMFC 2017). The 2017 stock assessment also concluded that a variety of factors (i.e., bycatch, habitat loss, and vessel strikes) continue to impede the recovery rate of Atlantic sturgeon (ASMFC 2017).

Despite the depleted status, the ASFMC's assessment did include signs that the coastwide index is above the 1998 value (95% probability). Total mortality from the tagging model was very low at the coastwide level. Small sample sizes made mortality estimates at the DPS level more difficult. By DPS, the assessment concluded that there was a 51% probability that the Gulf of Maine DPS abundance has increased since 1998 but a 74% probability that mortality for this DPS exceeds the mortality threshold used for the assessment. There is a relatively high (75%) probability that the New York Bight DPS abundance has increased since 1998, and a 31% probability that mortality exceeds the mortality threshold used for the assessment. There is also a relatively high (67%) probability that the Carolina DPS abundance has increased since 1998, and a relatively high probability (75%) that mortality for this DPS exceeds the mortality threshold used in the assessment. However, the index from the Chesapeake Bay DPS (highlighted red) only had a 36% chance of being above the 1998 value and a 30% probability that the mortality for this DPS exceeds the mortality threshold for the assessment. There was not enough information available to assess the abundance for the South Atlantic DPS relative to the 1998 moratorium, but the assessment did conclude that there was 40% probability that the mortality for this DPS exceeds the mortality threshold used in the assessment (ASMFC 2017). 5-Year reviews for each DPS, completed by NMFS in 2022 and 2023, summarize information that has become available since the listing. No changes to the classification for any DPS is recommended in the 5-year reviews (NMFS 2022 a, b, and c, NMFS 2023 a, b).

4.2.3.1 Gulf of Maine DPS

The Gulf of Maine DPS includes the following: all anadromous Atlantic sturgeons that are spawned in the watersheds from the Maine/Canadian border and, extending southward, all watersheds draining into the Gulf of Maine as far south as Chatham, MA. Within this range, Atlantic sturgeon historically spawned in the Androscoggin, Kennebec, Merrimack, Penobscot, and Sheepscot Rivers (ASSRT, 2007). Spawning occurs in the Kennebec River and may also at least occasionally occur in the Androscoggin River below the Brunswick Dam (Wippelhauser et al. 2017). Despite the presence of suitable spawning habitat in a number of other rivers, there is no evidence of recent spawning in the remaining rivers. Atlantic sturgeons that are spawned elsewhere continue to use habitats within all of these rivers as part of their overall marine range (ASSRT, 2007). The movement of subadult and adult sturgeon between rivers, including to and from the Kennebec River and the Penobscot River, demonstrates that coastal and marine migrations are key elements of Atlantic sturgeon life history for the Gulf of Maine DPS (ASSRT, 2007; Fernandes, et al., 2010).

The current status of the Gulf of Maine DPS is affected by historical and modern fisheries dating as far back as the 1800s (Squiers et al., 1979; Stein et al., 2004; ASMFC 2007). Incidental capture of Atlantic sturgeon in state and Federal fisheries continues today. As explained above, we have estimates of the number of subadults and adults that are killed as a result of bycatch in fisheries authorized under Northeast Fishery Management Plans. At this time, we are not able to quantify the impacts from other threats or estimate the number of individuals killed as a result of other anthropogenic threats. Habitat disturbance and direct mortality from anthropogenic sources are the primary concerns.

Some of the impacts from the threats that contributed to the decline of the Gulf of Maine DPS have been removed (e.g., directed fishing), or reduced as a result of improvements in water quality and removal of dams (e.g., the Edwards Dam on the Kennebec River in 1999, the Veazie Dam on the Penobscot River). There are strict regulations on the use of fishing gear in Maine state waters that incidentally catch sturgeon. In addition, there have been reductions in fishing effort in state and federal waters, which most likely would result in a reduction in bycatch mortality of Atlantic sturgeon. A significant amount of fishing in the Gulf of Maine is conducted using trawl gear, which is known to have a much lower mortality rate for Atlantic sturgeon caught in the gear compared to sink gillnet gear (ASMFC, 2007). Atlantic sturgeon from the GOM DPS are not commonly taken as bycatch in areas south of Chatham, MA, with only 8% (e.g., 7 of the 84 fish) of interactions observed in the Mid Atlantic/Carolina region being assigned to the Gulf of Maine DPS (Wirgin and King, 2011). Tagging results also indicate that Gulf of Maine DPS fish tend to remain within the waters of the Gulf of Maine and only occasionally venture to points south. However, data on Atlantic sturgeon incidentally caught in trawls and intertidal fish weirs fished in the Minas Basin area of the Bay of Fundy (Canada) indicate that approximately 35 percent originated from the Gulf of Maine DPS (Wirgin et al., in draft).

As noted previously, studies have shown that in order to rebuild, Atlantic sturgeon can only sustain low levels of bycatch and other anthropogenic mortality (Boreman, 1997; ASMFC, 2007; Kahnle et al., 2007; Brown and Murphy, 2010). NMFS has determined that the Gulf of Maine DPS is at risk of becoming endangered in the foreseeable future throughout all of its range (i.e., is a threatened species) based on the following: (1) significant declines in population sizes and the protracted period during which sturgeon populations have been depressed; (2) the limited amount of current spawning; and, (3) the impacts and threats that have and will continue to affect recovery.

In 2018, we announced the initiation of a 5-year review for the Gulf of Maine DPS. We reviewed and considered new information for the Gulf of Maine DPS that has become available since this DPS was listed as threatened in February 2012. We completed the 5-year review for the Gulf of Maine DPS in February 2022 (NMFS 2022a); the review includes a summary of additional information available since the listing determination, including information on life history and threats. Based on the best scientific and commercial data available at the time of the review, we concluded that no change to the listing status is warranted.

4.2.3.2 New York Bight DPS

The New York Bight DPS includes the following: all anadromous Atlantic sturgeon spawned in the watersheds that drain into coastal waters from Chatham, MA to the Delaware-Maryland border on Fenwick Island. Within this range, Atlantic sturgeon historically spawned in the Connecticut, Delaware, Hudson, and Taunton Rivers (Murawski and Pacheco, 1977; Secor, 2002; ASSRT, 2007). Spawning still occurs in the Delaware and Hudson Rivers. There is no recent evidence (within the last 15 years) of spawning in the Taunton River (ASSRT, 2007). Atlantic sturgeon that are spawned elsewhere continue to use habitats within the Connecticut and Taunton Rivers as part of their overall marine range (ASSRT, 2007; Savoy, 2007; Wirgin and King, 2011).

In 2014, several presumed age-0 Atlantic sturgeon were captured in the Connecticut River; the available information indicates that successful spawning took place in 2013 by a small number of adults. Genetic analysis of the juveniles indicates that the adults were likely migrants from the South Atlantic DPS (Savoy et al. 2017). As noted by the authors, this conclusion is counter to prevailing information regarding straying of adult Atlantic sturgeon. As these captures represent the only contemporary records of possible natal Atlantic sturgeon in the Connecticut River and the genetic analysis is unexpected, more information is needed to establish the frequency of spawning in the Connecticut River and whether there is a unique Connecticut River population of Atlantic sturgeon. At this time, we are not able to conclude whether the juvenile sturgeon detected are indicative of sustained spawning in the river or whether they were the result of a single spawning event due to unique straying of the adults from the South Atlantic DPS's spawning rivers (see additional explanation in NMFS 2022b).

There are no abundance estimates for the entire New York Bight DPS or for the entirety of the (i.e., all age classes) Hudson River or Delaware River populations. The abundance of the Hudson River Atlantic sturgeon riverine population prior to the onset of expanded exploitation in the 1800s is unknown but has been conservatively estimated at 10,000 adult females (Secor, 2002). Current abundance is likely at least one order of magnitude smaller than historical levels (Secor, 2002; ASSRT, 2007; Kahnle et al., 2007). As described above, an estimate of the mean annual number of mature adults (863 total; 596 males and 267 females) was calculated for the Hudson River riverine population based on fishery-dependent data collected from 1985-1995 (Kahnle et al., 2007). Kahnle et al. (1998; 2007) also showed that the level of fishing mortality from the Hudson River Atlantic sturgeon fishery during the period of 1985-1995 exceeded the estimated sustainable level of fishing mortality for the riverine population and may have led to reduced recruitment. A decline in the abundance of young Atlantic sturgeon appeared to occur in the mid to late 1970s followed by a secondary drop in the late 1980s (Kahnle et al., 1998; Sweka et al., 2007; ASMFC, 2010). At the time of listing, catch-per-unit-effort (CPUE) data suggested that recruitment remained depressed relative to catches of juvenile Atlantic sturgeon in the estuary during the mid-late 1980s (Sweka et al., 2007; ASMFC, 2010). In examining the CPUE data from 1985-2007, there are significant fluctuations during this time. There appears to be a decline in the number of juveniles between the late 1980s and early 1990s while the CPUE is generally higher in the 2000s as compared to the 1990s. Recent analyses suggest that the abundance of juvenile Atlantic sturgeon belonging to the Hudson River spawning population has increased, with double the average catch rate for the period from 2012-2019 compared to the previous eight years, from 2004-2011 (Pendleton and Adams 2021).

There is limited new information on the spawning population abundance in the Hudson River since the time of listing; Kazyak et al. (2020) used side scan sonar technology in conjunction with detections of previously tagged Atlantic sturgeon to estimate a Hudson River spawning run size of 466 sturgeon (95% CRI = 310-745) in 2014. Another method for assessing the number of spawning adults is through determinations of effective population size (the number of individuals that effectively participates in producing the next generation, see NMFS 2022b for more information). The estimates of effective population size for the Hudson River spawning population from separate studies and based on different age classes are relatively similar to each other: 198 (95% CI=171.7-230.7) based on sampling of subadults captured off of Long Island across multiple years, 156 (95% CI=138.3-176.1) based on sampling of natal juveniles in multiple years (O'Leary et al. 2014; Waldman et al. 2019), and 144.2 (95% CI=82.9-286.6) based on samples from a combination of juveniles and adults (ASMFC 2017).

As described in the Status Review and listing rule, in addition to capture in fisheries operating in Federal waters, bycatch and mortality also occur in state fisheries; however, the primary fishery (shad) that impacted juvenile sturgeon in the Hudson River, has now been closed and there is no indication that it will reopen soon. In the Hudson River, sources of potential mortality include vessel strikes and entrainment in dredges. Impingement at water intakes, including the Danskammer, Roseton, and Indian Point power plants has been documented in the past; all three of these facilities have recently shut down. Recent information from surveys of juveniles (see above) indicates that the number of young Atlantic sturgeon in the Hudson River is increasing compared to recent years, but is still low compared to the 1970s. There is currently not enough information regarding any life stage to establish a trend for the entire Hudson River population.

There is no total abundance estimate for the Delaware River population of Atlantic sturgeon. Harvest records from the 1800s indicate that this was historically a large population with an estimated 180,000 adult females prior to 1890 (Secor and Waldman, 1999; Secor, 2002). Sampling in 2009 to target young-of- the year (YOY) Atlantic sturgeon in the Delaware River (i.e., natal sturgeon) resulted in the capture of 34 YOY, ranging in size from 178 to 349 mm TL (Fisher, 2009) and the collection of 32 YOY Atlantic sturgeon in a separate study (Brundage and O'Herron in Calvo et al., 2010). Genetics information collected from 33 of the 2009-year class YOY indicates that at least three females successfully contributed to the 2009-year class (Fisher, 2011). Therefore, while the capture of YOY in 2009 provides evidence that successful spawning is still occurring in the Delaware River, the relatively low numbers suggest the existing riverine population is limited in size. The Delaware Division of Fish and Wildlife (DFW) has conducted juvenile abundance surveys in the Delaware River in most years since 2010. The estimated abundance in 2014 was 3,656 (95% CI = 1,935–33,041) age 0-1 juvenile Atlantic (Hale et al. 2016). Estimates for the Delaware River spawning population by the same authors and using the same methods as described above for the Hudson River were: 108.7 (95% CI=74.7-186.1) and 40 (95% CI=34.7-46.2) for samples from subadults and natal juveniles, respectively (O'Leary et al. 2014; Waldman et al. 2019), and 56.7 (95% CI=42.5-77.0) based on samples from a combination of juveniles and adults (ASMFC 2017).

Some of the impacst 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, continued bycatch in state and federally managed fisheries, and vessel strikes remain significant threats to the New York Bight DPS.

In the marine range, New York Bight DPS Atlantic sturgeon are incidentally captured in federal and state managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein et al., 2004; ASMFC 2007). As explained above, currently available estimates indicate that at least 4% of adults may be killed as a result of bycatch in fisheries authorized under federal Northeast FMPs. Based on mixed stock analysis results presented by Wirgin and King (2011), over 40 percent of the Atlantic sturgeon bycatch interactions in the Mid Atlantic Bight region were sturgeon from the New York Bight DPS. Individual-based assignment and mixed stock analysis of samples collected from sturgeon captured in Canadian fisheries in the Bay of Fundy indicated that approximately 1-2% were from the New York Bight DPS. At this time, we are not able to quantify the impacts from other threats or estimate the number of individuals killed as a result of other anthropogenic threats.

Riverine habitat may be impacted by dredging and other in-water activities, disturbing spawning habitat, and altering the benthic forage base. Both the Hudson and Delaware rivers have navigation channels that are maintained by dredging. Dredging is also used to maintain channels in the nearshore marine environment. Dredging outside of Federal channels and in-water construction occurs throughout the New York Bight region. While some dredging projects operate with observers present to document fish mortalities many do not. We have reports of one Atlantic sturgeon entrained during hopper dredging operations in Ambrose Channel, New Jersey, and a number of Atlantic sturgeon have been killed during Delaware River channel maintenance and deepening activities.

In the Hudson and Delaware Rivers, dams do not block access to historical habitat. The Holyoke Dam on the Connecticut River blocks further upstream passage; however, the extent that Atlantic sturgeon would historically have used habitat upstream of Holyoke is unknown. Connectivity may be disrupted by the presence of dams on several smaller rivers in the New York Bight region. Because no Atlantic sturgeon occur upstream of any hydroelectric projects in the New York Bight region, passage over hydroelectric dams or through hydroelectric turbines is not a source of injury or mortality in this area.

New York Bight DPS Atlantic sturgeon may also be affected by degraded water quality. In general, water quality has improved in the Hudson and Delaware over the past decades (Lichter et al. 2006; EPA, 2008). Both the Hudson and Delaware rivers, as well as other rivers in the New York Bight region, were heavily polluted in the past from industrial and sanitary sewer discharges. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment. This can be particularly problematic if pollutants are present on spawning and nursery grounds as developing eggs and larvae are particularly susceptible to exposure to contaminants.

Vessel strikes occur in the Delaware and Hudson rivers. A summary of recently available information is included in NMFS 2022 b. 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. New research, including a study that intentionally placed Atlantic sturgeon carcasses along the Delaware River in areas used by the public, suggests that most Atlantic sturgeon carcasses are not found and, when found, many are not reported to NMFS or to our sturgeon salvage coinvestigators (Balazik et al. 2012b, Balazik, pers. comm. in ASMFC 2017; Fox et al. 2020). Based on the reporting rates in their study, Fox et al. estimated that a total of 199 and 213 carcasses were present along the Delaware Estuary shoreline in 2018 and 2019, respectively. Delaware State University (DSU) collaborated with the Delaware Division of Fish and Wildlife (DDFW) in an effort to document vessel strikes in 2005. Approximately 200 reported carcasses with over half being attributed to vessel strikes based on a gross examination of wounds have been documented through 2019 (DiJohnson 2019). One hundred thirty-eight (138) sturgeon carcasses were observed on the Hudson River and reported to the NYSDEC between 2007 and 2015. Of these, 69 are suspected of having been killed by vessel strike. Genetic analysis has not been completed on any of these individuals to date, given that the majority of Atlantic sturgeon in the Hudson River belong to the New York Bight DPS; we assume that the majority of the dead sturgeon reported to NYSDEC belonged to the New York Bight DPS. Given the time of year in which the fish were observed (predominantly May through July), it is likely that many of the adults were migrating through the river to the spawning grounds.

Studies have shown that to rebuild, Atlantic sturgeon can only sustain low levels of anthropogenic mortality (Boreman, 1997; ASMFC, 2007; Kahnle et al., 2007; Brown and Murphy, 2010). There are no empirical abundance estimates of the number of Atlantic sturgeon in the New York Bight DPS. We determined that the New York Bight DPS is currently at risk of extinction due to: (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and (3) the impacts and threats that have and will continue to affect population recovery.

In 2018, we announced the initiation of a 5-year review for the New York Bight DPS. We reviewed and considered new information for the New York Bight DPS that has become available since this DPS was listed as endangered in February 2012. We completed the 5-year review for the DPS in February 2022 (NMFS 2022b); the review includes a summary of additional information available since the listing determination, including information on life history and threats. Based on the best scientific and commercial data available at the time of the review, we concluded that no change to the listing status is warranted.

4.2.3.3 Chesapeake Bay DPS

The Chesapeake Bay (CB) DPS includes the following: all anadromous Atlantic sturgeon that spawn or are spawned in the watersheds that drain into the Chesapeake Bay and into coastal waters from the Delaware-Maryland border on Fenwick Island to Cape Henry, Virginia. The marine range of Atlantic sturgeon from the CB DPS extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the CB DPS and the adjacent portion of the marine range are shown in Figure 4.3.1. Within this range, Atlantic sturgeon historically spawned in the Susquehanna, Potomac, James, York (tributaries), Rappahannock, and Nottoway Rivers (ASSRT 2007). Based on the review by Oakley (2003), 100% of Atlantic sturgeon habitat is currently accessible in these rivers since most of the barriers to passage (i.e., dams) are located upriver of where spawning is expected to have historically occurred (ASSRT 2007).

At the time of listing, the James River was the only known spawning river for the Chesapeake Bay DPS (ASSRT, 2007; Hager, 2011; Balazik et al., 2012). Since the listing, evidence has been provided of both spring and fall spawning populations for the James River, as well as fall spawning in the Pamunkey River, a tributary of the York River, and fall spawning in Marshyhope Creek, a tributary of the Nanticoke River (Hager et al., 2014; Kahn et al., 2014; Balazik and Musick, 2015; Richardson and Secor, 2016). Detections of acoustically-tagged adult Atlantic sturgeon along with historical evidence suggests that Atlantic sturgeon belonging to the Chesapeake Bay DPS may be spawning in the Mattaponi and Rappahannock rivers as well (Hilton et al. 2016; ASMFC 2017a; Kahn et al. 2019). However, information for these populations is limited and the research is ongoing.

Several threats play a role in shaping the current status of CB DPS Atlantic sturgeon. Historical records provide evidence of the large-scale commercial exploitation of Atlantic sturgeon from the James River and Chesapeake Bay in the 19th century (Hildebrand and Schroeder 1928; Vladykov and Greeley 1963; ASMFC 1998b; Secor 2002; Bushnoe et al. 2005; ASSRT 2007) as well as subsistence fishing and attempts at commercial fisheries as early as the 17th century (Secor 2002; Bushnoe et al. 2005; ASSRT 2007; Balazik et al. 2010). Habitat disturbance caused by in-river work, such as dredging for navigational purposes, is thought to have reduced available spawning habitat in the James River (Holton and Walsh 1995; Bushnoe et al. 2005; ASSRT 2007). At this time, we do not have information to quantify this loss of spawning habitat.

Decreased water quality also threatens Atlantic sturgeon of the CB DPS, especially since the Chesapeake Bay system is vulnerable to the effects of nutrient enrichment due to a relatively low tidal exchange and flushing rate, large surface-to-volume ratio, and strong stratification during the spring and summer months (Pyzik et al. 2004; ASMFC 1998a; ASSRT 2007; EPA 2008). These conditions contribute to reductions in dissolved oxygen levels throughout the Bay. The availability of nursery habitat, in particular, may be limited given the recurrent hypoxia (low dissolved oxygen) conditions within the Bay (Niklitschek and Secor 2005, 2010). Heavy industrial development during the 20th century in rivers inhabited by sturgeon impaired water quality and impeded these species' recovery.

Although there have been improvements in some areas of the Bay's health, the ecosystem remains in poor condition. At this time, we do not have sufficient information to quantify the extent that degraded water quality affects habitat or individuals in the Chesapeake Bay watershed.

More than 100 Atlantic sturgeon carcasses have been salvaged in the James River since 2007 and additional carcasses were reported but could not be salvaged (Greenlee et al. 2019). Many of the salvaged carcasses had evidence of a fatal vessel strike. In addition, vessel struck Atlantic sturgeon have been found in other parts of the Chesapeake Bay DPS's range including in the York and Nanticoke river estuaries, within Chesapeake Bay, and near the mouth of the Bay since the DPS was listed as endangered (NMFS Sturgeon Salvage Permit Reporting; Secor et al. 2021).

In the marine and coastal range of the CB DPS from Canada to Florida, fisheries bycatch in federally and state-managed fisheries poses a threat to the DPS, reducing survivorship of subadults and adults and potentially causing an overall reduction in the spawning population (Stein et al. 2004b; ASMFC TC 2007; ASSRT 2007).

Areas with persistent, degraded water quality, habitat impacts from dredging, continued bycatch in U.S. state and federally managed fisheries, Canadian fisheries, and vessel strikes remain significant threats to the CB DPS of Atlantic sturgeon. Of the 35% of Atlantic sturgeon incidentally caught in the Bay of Fundy, about 1% were CB DPS fish (Wirgin et al. 2012). Studies have shown that Atlantic sturgeon can only sustain low levels of bycatch mortality (Boreman 1997; ASMFC TC 2007; Kahnle et al. 2007). The CB DPS is currently at risk of extinction given (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and, (3) the impacts and threats that have and will continue to affect the potential for population recovery.

In 2018, we announced the initiation of a 5-year review for the Chesapeake Bay DPS. We reviewed and considered new information for the Chesapeake Bay DPS that has become available since this DPS was listed as endangered in February 2012. We completed the 5-year review for the Chesapeake Bay DPS in February 2022 (NMFS 2022c); the review includes a summary of additional information available since the listing determination, including information on life history and threats. Based on the best scientific and commercial data available at the time of the review, we concluded that no change to the listing status is warranted.

4.2.3.4 Carolina DPS

The Carolina DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) from Albemarle Sound southward along the southern Virginia, North Carolina, and South Carolina coastal areas to Charleston Harbor. The marine range of Atlantic sturgeon from the Carolina DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida.

Rivers in the Carolina DPS considered to be spawning rivers include the Neuse, Roanoke, Tar-Pamlico, Cape Fear, and Northeast Cape Fear rivers, and the Santee-Cooper and Pee Dee river (Waccamaw and Pee Dee rivers) systems. Historically, both the Sampit and Ashley Rivers were documented to have spawning populations at one time. However, the spawning population in the Sampit River is believed to be extirpated and the current status of the spawning population in the Ashley River is unknown. We have no information, current or historical, of Atlantic sturgeon using the Chowan and New Rivers in North Carolina. Recent telemetry work by Post et al. (2014) indicates that Atlantic sturgeon do not use the Sampit, Ashley, Ashepoo, and Broad-Coosawhatchie Rivers in South Carolina. These rivers are short, coastal plains rivers that most likely do not contain suitable habitat for Atlantic sturgeon. Fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions.

Historical landings data indicate that between 7,000 and 10,500 adult female Atlantic sturgeon were present in North Carolina prior to 1890 (Armstrong and Hightower 2002, Secor 2002). Secor (2002) estimates that 8,000 adult females were present in South Carolina during that same period. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the Carolina DPS. Currently, the Atlantic sturgeon spawning population in at least one river system within the Carolina DPS has been extirpated, with a potential extirpation in an additional system. The ASSRT estimated the remaining river populations within the DPS to have fewer than 300 spawning adults; this is thought to be a small fraction of historic population sizes (ASSRT 2007).

The Carolina DPS was listed as endangered under the ESA as a result of a combination of habitat curtailment and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

The modification and curtailment of Atlantic sturgeon habitat resulting from dams, dredging, and degraded water quality is contributing to the status of the Carolina DPS. Dams have curtailed Atlantic sturgeon spawning and juvenile developmental habitat by blocking over 60 percent of the historical sturgeon habitat upstream of the dams in the Cape Fear and Santee-Cooper River systems. Water quality (velocity, temperature, and dissolved oxygen (DO)) downstream of these dams, as well as on the Roanoke River, has been reduced, which modifies and curtails the extent of spawning and nursery habitat for the Carolina DPS. Dredging in spawning and nursery grounds modifies the quality of the habitat and is further curtailing the extent of available habitat in the Cape Fear and Cooper Rivers, where Atlantic sturgeon habitat has already been modified and curtailed by the presence of dams. Reductions in water quality from terrestrial activities have modified habitat utilized by the Carolina DPS. In the Pamlico and Neuse systems, nutrient-loading and seasonal anoxia are occurring, associated in part with concentrated animal feeding operations (CAFOs). Heavy industrial development and CAFOs have degraded water quality in the Cape Fear River. Water quality in the Waccamaw and Pee Dee rivers have been affected by industrialization and riverine sediment samples contain high levels of various toxins, including dioxins. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the Carolina DPS. The removal of large amounts of water from the system will alter flows, temperature, and DO. Existing water allocation issues will likely be compounded by population growth and potentially, by climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower DO, all of which are current stressors to the Carolina DPS.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the Carolina DPS. Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

As a wide-ranging anadromous species, Carolina DPS Atlantic sturgeon are subject to numerous Federal (U.S. and Canadian), state and provincial, and inter-jurisdictional laws, regulations, and agency activities. While these mechanisms have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently no mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch. Though statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species, such as Atlantic sturgeon, and their habitat, these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Further, water quality continues to be a problem in the Carolina DPS, even with existing controls on some pollution sources. Current regulatory regimes are not necessarily effective in controlling water allocation issues (e.g., no restrictions on interbasin water transfers in South Carolina, the lack of ability to regulate non-point source pollution, etc.)

In the 2023 5-year review for the Carolina DPS, NMFS SERO reviewed and considered new information for the DPS that has become available since this DPS was listed as endangered in February 2012. In the review, NMFS concluded that the Carolina DPS's demographic risk is "High" because of its productivity (i.e., relatively few adults compared to historical levels and irregular spawning success), abundance (i.e., riverine populations vary significantly and abundance is generally low in the DPS, overall), and spatial distribution (i.e., riverine populations and connectivity vary, creating inconsistent population coverage across the DPS and potentially limited ability to repopulate extirpated river populations). However, NMFS also concluded that the Carolina DPS' potential to recover is 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, dams blocking access to spawning habitat, dredging, 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 even if they require further testing (e.g., gear modifications to minimize dredge or fishing gear interactions).The review includes a summary of additional information available since the listing determination, including information on life history and threats. Based on the best scientific and commercial data available at the time of the review, the review concluded that no change to the listing status is warranted. (NMFS 2023a).

4.2.3.5 South Atlantic DPS

The South Atlantic DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto Rivers (ACE) Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida.

Rivers known to have current spawning populations within the range of the South Atlantic DPS include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, St. Marys, and Satilla Rivers. Recent telemetry work by Post et al. (2014) indicates that Atlantic sturgeon do not use the Sampit, Ashley, Ashepoo, and Broad-Coosawhatchie Rivers in South Carolina. These rivers are short, coastal plains rivers that most likely do not contain suitable habitat for Atlantic sturgeon. Post et al. (2014) also found Atlantic sturgeon only use the portion of the Waccamaw River downstream of Bull Creek. Due to manmade structures and alterations, spawning areas in the St. Johns River are not accessible and therefore do not support a reproducing population.

Secor (2002) estimates that 8,000 adult females were present in South Carolina prior to 1890. Prior to the collapse of the fishery in the late 1800s, the sturgeon fishery was the third largest fishery in Georgia. Secor (2002) estimated from U.S. Fish Commission landing reports that approximately 11,000 spawning females were likely present in the state prior to 1890. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the South Atlantic DPS. Currently, the Atlantic sturgeon spawning population in at least one river system within the South Atlantic DPS has been extirpated. The Altamaha River population of Atlantic sturgeon, with an estimated 343 adults spawning annually, is believed to be the largest population in the Southeast, yet is estimated to be only 6 percent of its historical population size. The ASSRT estimated the abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, to be less than 1 percent of what they were historically (ASSRT 2007).

The South Atlantic DPS was listed as endangered under the ESA as a result of a combination of habitat curtailment and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

The modification and curtailment of Atlantic sturgeon habitat resulting from dredging and degraded water quality is contributing to the status of the South Atlantic DPS. Maintenance dredging is currently modifying Atlantic sturgeon nursery habitat in the Savannah River and modeling indicates that the proposed deepening of the navigation channel will result in reduced DO and upriver movement of the salt wedge, curtailing spawning habitat. Dredging is also modifying nursery and foraging habitat in the St. Johns River. Reductions in water quality from terrestrial activities have modified habitat utilized by the South Atlantic DPS Non-point source inputs are causing low DO in the Ogeechee River and in the St. Marys River, which completely eliminates juvenile nursery habitat in summer. Low DO has also been observed in the St. Johns River in the summer. Sturgeon are more sensitive to low DO and the negative (metabolic, growth, and feeding) effects caused by low DO increase when water temperatures are concurrently high, as they are within the range of the South Atlantic DPS. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the South Atlantic DPS. Large withdrawals of over 240 million gallons per day (mgd) of water occur in the Savannah River for power generation and municipal uses. However, users withdrawing less than 100,000 gallons per day (gpd) are not required to get permits, so actual water withdrawals from the Savannah and other rivers within the range of the South Atlantic DPS are likely much higher. The removal of large amounts of water from the system will alter flows, temperature, and DO. Water shortages and "water wars" are already occurring in the rivers occupied by the South Atlantic DPS and will likely be compounded in the future by population growth and potentially by climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower DO, all of which are current stressors to the South Atlantic DPS.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the South Atlantic DPS. The loss of large subadults and adults as a result of bycatch impacts Atlantic sturgeon populations because they are a long-lived species, have an older age at maturity, have lower maximum fecundity values, and a large percentage of egg production occurs later in life. Little data exist on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Further, a total population abundance for the DPS is not available, and it is therefore not possible to calculate the percentage of the DPS subject to bycatch mortality based on the available bycatch mortality rates for individual fisheries. However, fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

As a wide-ranging anadromous species, Atlantic sturgeon are subject to numerous Federal (U.S. and Canadian), state and provincial, and inter-jurisdictional laws, regulations, and agency activities. While these mechanisms have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently no mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch. Though statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species, such as Atlantic sturgeon, and their habitat, these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Further, water quality continues to be a problem in the South Atlantic DPS, even with existing controls on some pollution sources. Current regulatory regimes are not necessarily effective in controlling water allocation issues (e.g., no permit requirements for water withdrawals under 100,000 gpd in Georgia, no restrictions on interbasin water transfers in South Carolina, the lack of ability to regulate non-point source pollution).

In the 2023 5-year review for the South Atlantic DPS, NMFS SERO reviewed and considered new information for the DPS that has become available since this DPS was listed as endangered in February 2012. In the review, NMFS concluded that the South Atlantic DPS' demographic risk is "High" because of its productivity (i.e., relatively few adults compared to historical levels and irregular spawning success), abundance (i.e., riverine populations vary significantly and abundance is generally low in the DPS, overall), and spatial distribution (i.e., riverine populations and connectivity vary, creating inconsistent population coverage across the DPS and potentially limited ability to repopulate extirpated river populations). However, NMFS also concluded that the South Atlantic DPS' potential to recover is 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, dams blocking access to spawning habitat, dredging, 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 even if they require further testing (e.g., gear modifications to minimize dredge or fishing gear interactions).The review includes a summary of additional information available since the listing determination, including information on life history and threats. Based on the best scientific and commercial data available at the time of the review, the review concluded that no change to the listing status is warranted. (NMFS 2023a).

Recovery Goals for All DPSs

A Recovery Plan has not been completed for any DPS of Atlantic sturgeon. In 2018, NMFS published a Recovery Outline[18] to serve as an initial recovery-planning document. In this, the recovery vision is stated, "Subpopulations of all five Atlantic sturgeon DPSs 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

[18] https://media.fisheries.noaa.gov/dam-migration/ats_recovery_outline.pdf; last accessed March 26, 2023.

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 Recovery Outline also includes steps that are expected to serve as an initial recovery action plan. These include protecting extant subpopulations and the species' habitat through reduction of threats; gathering information through research and monitoring on current distribution and abundance; and addressing vessel strikes in rivers, the effects of climate change and bycatch.

5.0 ENVIRONMENTAL BASELINE

The "environmental baseline" refers to the condition of the listed species or its 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 (50 C.F.R. §402.02).

There are a number of existing activities that regularly occur in various portions of the action area, including operation of vessels and federal and state authorized fisheries. Other activities that occur occasionally or intermittently include scientific research, military activities, and geophysical and geotechnical surveys. The action area includes the South Fork and Vineyard Wind 1 offshore energy projects which are undergoing construction. There are also environmental conditions caused or exacerbated by human activities (i.e., water quality and noise) that may affect listed species in the action area. Some of these stressors result in mortality or serious injury to individual animals (e.g., vessel strike, fisheries interactions), whereas others result in non-lethal impacts or impacts that are indirect. For all of the listed species considered here, given their extensive movements in and out of the action area and throughout their range as well as the similarities of stressors throughout the action area and other parts of their range the status of the species in the action area is the same as the range-wide status presented in Section 4.2 *Status of the Species* of this Opinion. Below, we describe the conditions of the action area, present a summary of the best available information on the use of the action area by listed species, and address the impacts to listed species of federal, state, and private activities in the action area that meet the definition of "environmental baseline."

As described above in Section 3.4, the action area includes the area from waters off New Jersey and western Long Island to the south and west, to eastern Georges Bank (where HabCam surveys will occur) to the east, and to Duxbury, Massachusetts and Cape Cod Bay (where ropeless camera testing will occur) to the north. The action area encompasses the RI/MA and MA WEAs which is where a majority of the activity for this project including ropeless camera surveys, video trawl testing and surveys, and portions of the HabCam testing and surveys will occur. The action area includes the project vessel transit routes between the areas where testing and surveys will occur and the Port of New Bedford, MA, where most fishing vessels being used for project research will originate, as well as Woods Hole, Fairhaven, Sandwich, and Duxbury, MA.

The action area is located within multiple defined marine areas. The broadest area, the U.S. Northeast Shelf Large Marine Ecosystem, extends from the Gulf of Maine to Cape Hatteras, North Carolina (Kaplan 2011). The action area is located within the Southern New England sub-region of the Northeast U.S. Shelf Ecosystem, which is distinct from other regions based on differences in productivity, species assemblages and structure, and habitat features (Cook and Auster 2007). The action area also overlaps with the Mid-Atlantic Bight, which is bounded by Cape Cod, MA to the north and Cape Hatteras, NC to the south. The physical oceanography of this region is influenced by the seafloor, freshwater input from multiple rivers and estuaries, large-scale weather patterns, and tropical or winter coastal storm events. Weather-driven surface currents, tidal mixing, and estuarine outflow all contribute to driving water movement through the area (Kaplan 2011).

At a broad scale over the entire action area, sediment is mainly mud and sand, with <5% boulder coverage in most of the area. Higher percentages of boulder coverage are found in the NW quadrant of the action area, overlapping the westernmost wind lease areas including South Fork and Revolution Wind, and in the transit area between Duxbury, MA and one of the possible ropeless camera testing sites in Cape Cod Bay. Sediment type and boulder coverage data sets are from the Northeast Ocean Data Portal (https://www.northeastoceandata.org/). Sediment type (grain size) is based on data from the United States Geological Survey that was compiled by the Nature Conservancy (Anderson et al. 2010). The percent boulder coverage data set was developed by the New England Fishery Management Council (NEFMC) as part of their Northeast Fishing Effects Model (https://www.nefmc.org/library/fishing-effects-model).

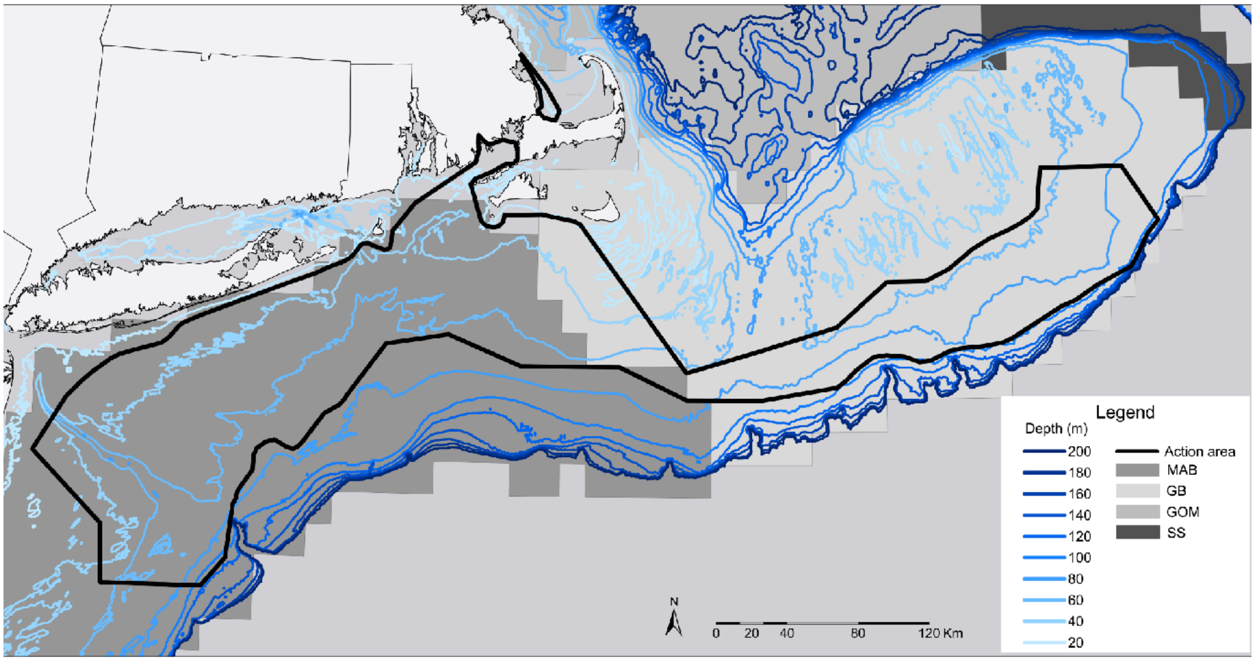
Benthic habitat mapping has been conducted by the wind developers with leases in the RI/MA and MA WEAs, and these surveys provide additional information about habitat types in the more complex region of the survey area that encompasses the RI/MA and MA WEAs. These surveys used the Coastal and Marine Ecological Classification Standard (CMECS), a standardized classification system based on geologic and biologic characteristics of habitats (FGDC 2012). CMECS geologic sediment categories include the sizes of the sediment grains and the percentages of larger grain sizes like gravel and cobble. In the NW corner of the action area where most surveys will take place (red highlight in Figure 3.4.1 in Section 3), complex habitat have been described and mapped (Inspire 2020, 2021). These lease areas include areas of glacial moraine, including Coxes Ledge, an important offshore fishing area and known habitat for fish aggregations and spawning. South Fork and Revolution Wind benthic habitat types range from areas with mud and sand to coarse mixed bottom with 30-80% gravel/cobble and glacial moraine. Transitions between sediment types occur over transects of less than 1,000 m, highlighting the complexity of these lease areas (Inspire 2020, 2021).

Water column characteristics vary widely over the action area, with several distinct zones, or Ecological Production Units (EPUs; NEFSC 2012), impacted by different combinations of interconnected oceanographic features. The eastward section of the action area covers the Georges Bank EPU, a submarine plateau, that ranges in depths from approximately 3 to 150 m with an average depth of 75 m (Figure 5.4.1) (Link et al. 2005, Kennedy et al. 2011). Georges Bank, which serves as a partial barrier between the Gulf of Maine and the Northwest Atlantic (Mavor & Bisagni 2001), is primarily impacted by strong tidal currents and an anticyclonic gyre generated by persistent gradients in temperature and salinity (Loder et al. 1992). Primary production on Georges Bank is among the highest of all shelf ecosystems, partially due to unique stratification during the summer (Franks & Chen 1996) and nutrient-rich waters (Steele et al. 2007).

The central portion of the action area, including the RI/MA and MA WEAs, covers the Nantucket Shoals region, which separates Georges Bank and Mid-Atlantic Bight EPUs (Saba et al. 2015). The southwestern portion of the Nantucket Shoals region is also referred to as the Eastern New England (ENE) subregion of the Mid-Atlantic Bight (Wallace et al. 2018, Roarty et al. 2020). Nantucket Shoals is very shallow (< 5m) in some areas, but the region covered by the action area ranges in depths from 20 to 80m (Figure 5.4.1). The oceanography of Nantucket Shoals is similar to Georges Bank, as the two areas are sister banks shaped by similar glacial processes (White & Veit 2020). Currents in the Nantucket Shoals region are driven by a surface flow originating in the GOM and traveling southwestward along the coast and through the Great South Channel, which is commonly used as the specific boundary between the Mid-Atlantic Bight and Georges Bank (NAS 2023). Warm core rings breaking off from the Gulf Stream also periodically deposit warmer, high-salinity water to the Nantucket Shoals. Since 2000, these intrusions have increased in frequency (NAS 2023). Phytoplankton biomass is high in the Nantucket Shoals region, primarily due to tidal pumping and salinity-driven stratification (Saba et al. 2015, Franks & Chen 1996). Secondary production is also high on Nantucket Shoals, with considerable export of zooplankton from Georges Bank traveling southwestward to Nantucket Shoals (Kennedy et al. 2011); however, the zooplankton community is not well characterized (NAS 2023).

The southwestern section of the action area covers the Mid-Atlantic Bight EPU (Figure 5.4.1). Within the Mid-Atlantic Bight, the action area covers three distinct subregions – the ENE, the Southern New England (SNE), and NYB1 (Wallace et al. 2018). Bottom depths in these subregions range from 5 to 80m, progressively deepening towards the continental shelf break (Figure 5.4.1). The southern portion of the action area, NYB1, includes the relatively shallow (20 – 30m bottom depth) Hudson Shelf Valley (HSV) that leads to the Hudson Canyon (Rona et al. 2015). The HSV is an important component of exchange across the shelf, although the direction of the along-valley current (i.e., onshore or offshore) reverses depending on wind stress (Lentz et al. 2014, Zhang & Lentz 2017). Overall, the oceanography of the Mid-Atlantic Bight is well documented (Roarty et al. 2020), partially due to the large-scale deployment and management of High Frequency Radar (HFR) surface current mapping technology by the Mid-Atlantic Regional Association Coastal Ocean Observing System. Current along the shelf flows in a southwest direction, driven primarily by winds and the deep western boundary current (Forsyth et al. 2015). However, alongshore currents are seasonally variable due to energetic wind events during the fall and winter (Roarty et al. 2020). The northern Mid-Atlantic Bight subregions are highly productive, with phytoplankton concentrations peaking in the winter-spring (O'Reilly & Zetlin 199, Xu et al. 2013). Zooplankton in the Mid-Atlantic Bight are relatively well described and long-term analyses indicate their populations are exceptionally healthy, with counts and biomass both trending upward since the 1990s (Kane 2011).

Figure 5.4.1. Bathymetry surrounding the action area (black line) which overlaps with two Ecological Production Units (EPUs) as defined by the NEFSC, the Mid-Atlantic Bight (MAB) and Georges Bank (GB). Two adjacent EPUs are also shown, the Gulf of Maine (GOM) and the Scotian Shelf (SS). Bathymetric data are sourced from ESRI and EPU data are from NEFSC.



5.1 Summary of Information on Listed Large Whale Presence in the Action Area

North Atlantic right whale (Eubalaena glacialis)

North Atlantic right whale presence and behavior in the action area is best understood in the context of their range. North Atlantic right whales occur in the Northwest Atlantic Ocean from calving grounds in coastal waters of the southeastern United States to feeding grounds in New England waters into Canadian waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence extending to the waters of Greenland and Iceland (Hayes et al. 2022; 81 FR 4837).

In the late fall, pregnant female right whales move south to their calving grounds off Georgia and Florida, while the majority of the population likely remains on the feeding grounds or disperses along the eastern seaboard. There is at least one case of a calf being born in the Gulf of Maine (Patrician et al. 2009), and another newborn was detected in Cape Cod Bay in 2013 (CCS, unpublished data, as cited in Hayes et al. 2022); however, calving outside of the southeastern U.S. is considered to be extremely rare. A review of visual and passive acoustic monitoring data in the western North Atlantic demonstrated nearly continuous year-round presence across their entire habitat range (for at least some individuals), including in locations previously thought to be used only seasonally by individuals migrating along the coast (e.g., waters off New Jersey and Virginia). This suggests that not all of the population undergoes a consistent annual migration (Bort et al. 2015, Cole et al. 2013, Davis et al. 2017, Hayes et al. 2022, Leiter et al. 2017, Morano et al. 2012, Whitt et al. 2013). Surveys have demonstrated several areas where North

Atlantic right whales congregate seasonally or have historically congregated, including the coastal waters of the southeastern U.S.; the Great South Channel; Jordan Basin; Georges Basin along the northeastern edge of Georges Bank; Cape Cod and Cape Cod Bay; Massachusetts Bay; and the continental shelf south of New England (Brown et al. 2002, Cole et al. 2013, Hayes et al. 2020, Leiter et al. 2017). Several recent studies (Meyer-Gutbrod et al. 2015, 2021, Davis et al. 2017, Davies et al. 2019, Gowan et al. 2019, Simard et al. 2019) suggest spatiotemporal habitat-use patterns are in flux both with regards to a shift northward (Meyer-Gutbrod et al. 2021), and changing migration patterns (Gowan et al. 2019), as well as changing numbers in existing known high-use areas (Davis et al. 2017, 2020, O'Brien 2022).

North Atlantic right whales feed on dense patches of certain copepod species, primarily the late juvenile developmental stage of *C. finmarchicus*. These dense patches can be found throughout the water column depending on time of day and season. Copepods are known to undergo daily vertical migration where they are found within the surface waters at night and at depth during daytime to avoid visual predators. North Atlantic right whales' diving behavior is strongly correlated to the vertical distribution of *C. finmarchicus*. Baumgartner et al. (2017) investigated North Atlantic right whale foraging ecology by tagging 55 whales in six regions of the Gulf of Maine and southwestern Scotian Shelf in late winter to late fall from 2000 to 2010. Results indicated that on average North Atlantic right whales spent 72 percent of their time in the upper 33 feet (10 meters) of water and 15 of 55 whales (27 percent) dove to within 16.5 feet (5 meters) of the seafloor, spending as much as 45 percent of the total tagged time at this depth.

The distribution of right whales is linked to the distribution of their principal zooplankton prey, calanoid copepods (Baumgartner and Mate 2005, NMFS 2005, Waring et al. 2012, Winn et al. 1986). New England waters are important feeding habitats for right whales (Hayes et al. 2020). Right whale calls have been detected by autonomous passive acoustic sensors deployed between 2005 and 2010 at three sites (Massachusetts Bay, Stellwagen Bank, and Jeffreys Ledge) in the southern Gulf of Maine (Morano et al. 2012, Mussoline et al. 2012). Comparisons between detections from passive acoustic recorders and observations from aerial surveys in Cape Cod Bay between 2001 and 2005 demonstrated that aerial surveys found whales on approximately two-thirds of the days during which acoustic monitoring detected whales (Clark et al. 2010).

Recent changes in right whale distribution (Kraus et al. 2016) are driven by warming of deep waters in the Gulf of Maine (Record et al. 2019). Prior to 2010, right whale movements followed the seasonal occurrence of the late stage, lipid-rich copepod *C. finmarchicus* from the western Gulf of Maine in winter and spring to the eastern Gulf of Maine and Scotian Shelf in the summer and autumn (Beardsley et al. 1996, Mayo and Marx 1990, Murison and Gaskin 1989, Pendleton et al. 2009, Pendleton et al. 2012). urveys (2012 to 2015) have detected fewer individuals in the Great South Channel and the Bay of Fundy, and additional sighting records indicate that at least some right whales are shifting to other habitats, suggesting that existing habitat use patterns may be changing (Weinrich et al. 2000; Cole et al. 2007, 2013; Whitt et al. 2013; Khan et al. 2014). Warming in the Gulf of Maine has resulted in changes in the seasonal abundance of late-stage *C. finmarchicus*, with record high abundances in the western Gulf of Maine in spring and significantly lower abundances in the eastern Gulf of Maine in late summer and fall (Record et al. 2019). Baumgartner et al. (2017) discuss that ongoing and future environmental and ecosystem changes may displace *C. finmarchicus* from the Gulf of Maine and Scotian Shelf. The authors also suggest that North Atlantic right whales are dependent on the high lipid content of calanoid copepods from the Calanidae family (i.e., *C. finmarchicus, C. glacialis, C. hyperboreus*), and would not likely survive year-round only on the ingestion of small, less nutritious copepods in the area (i.e., *Pseudocalanus* spp., *Centropages* spp., *Acartia* spp., *Metridia* spp.). It is also possible that even if *C. finmarchicus* remained in the Gulf of Maine, changes to the water column structure from climate change may disrupt the mechanism that causes the very dense vertically compressed patches that North Atlantic right whales depend on (Baumgartner et al. 2017). One of the consequences of these environmental changes has been a shift of right whales out of habitats such as the Great South Channel and the Bay of Fundy, and into areas such as the Gulf of St. Lawrence in the summer and waters of southern New England primarily in the winter and spring, however, right whales have been observed there in all seasons (NMFS NEFSC, unpublished data, Kraus et al. 2016b, Leiter et al. 2017, Stone et al. 2017, Quintana-Rizzo et al. 2021, Estabrook et al. 2022, O'Brien et al. 2022), with observations of foraging in both areas.

North Atlantic right whale Presence in the Action Area and Surrounding Waters

Right whale presence in the action area is predominately seasonal; however, year-round occurrence in southern New England waters is documented, most notably around Nantucket Shoals. Within the action area, right whales are seasonally present in Cape Cod Bay and have year round occurrence around Georges Bank and the Mid-Atlantic Bight that is highest in the winter months (Leiter et al., 2017; O'Brien et al., 2022, Stone et al., 2017; Oleson et al., 2020, Quintana-Rizzo et al., 2021). Based on detections from aerial surveys and PAM deployments within the RI/MA and MA WEAs within the action area, right whales are expected in the action area in higher numbers in winter and spring followed by decreasing abundance into summer and early fall. The action area both spatially and temporally overlaps a portion of the migratory Biologically Important Area (BIA), which describes the area within which right whales migrate south to calving grounds generally in November and December, followed by a northward migration into feeding areas east and north of the action area in March and April (LaBrecque et al., 2015; Van Parijs et al., 2015).

Since 2017, right whales have been sighted in the southern New England area nearly every month, with peak sighting rates between late winter and spring. Model outputs suggest that 23% of the right whale population is present from December through May, and the mean residence time has increased to an average of 13 days during these months (Quintana-Rizzo et al., 2021). A hotspot analysis analyzing sighting data in southern New England from 2011-2019 indicated that right whale occurrence in the MA and RI/MA WEAs was highest in the spring (March through May), and that few right whales were sighted in the area during that time frame in summer or winter (Quintana-Rizzo et al., 2021), a time when right whales distribution shifted to the east and south into other portions of the study area. In this analysis, "hotspots" were defined as season-period combinations with greater than 10 right whale sightings and clusters within a 90% confidence level. Density data from Roberts et al. (2022) confirm that the highest average density of right whales within the action area occurs from January to May, with the highest density in March, which aligns with available sighting and acoustic data.

Age and sex ratios of the individuals present in the area are similar to those of the species as a whole, with adult males the most common demographic group. Reported behaviors include animals feeding and socializing. Areas of higher use within the study area varied between years and seasons, likely due to variable distribution of prey. The authors conclude that the mixture of movement patterns within the population and the geographical location of the study area suggests that the area could be a feeding location for whales that stay in the mid-Atlantic and north Atlantic during the winter–spring months and a stopover site for whales migrating to and from the calving grounds. Estabrook et al. (2022) reviewed acoustic data from 2011-2015 focused on the RI/MA and MA WEAs, which are located within the action area; they found seasonal variations that were elevated from January to March and lowest during the summer months of July to September. Despite the seasonal variation in detections of right whale upcalls, detections occurred year-round.

The Right Whale Sighting Advisory System (RWSAS) alerts mariners to the presence of right whales, and collects sighting reports from a variety of sources including aerial surveys, shipboard surveys, whale watch vessels, and opportunistic sources (Coast Guard, commercial ships, fishing vessels, and the public). In 2016, North Atlantic right whales were observed in the shelf waters south of Martha's Vineyard and Nantucket during January, February, and May. In 2017, North Atlantic right whales were observed in the shelf waters south of Martha's Vineyard and Nantucket in every month except January, August, and December. In 2018 and 2019, North Atlantic right whales were observed in the shelf waters south of Martha's Vineyard and Nantucket (i.e., the area between the islands and the Nantucket to Ambrose traffic lane) in every month except October; in 2020, right whales were detected in this area from January to March and July to December. No right whales were detected during aerial surveys of this area in June 2020, but right whales were observed in July, August, September, October, November, and December. Sightings data is not available for April and May 2020 as aerial survey operations were affected by pandemic restrictions (see https://whalemap.org/). In 2021, North Atlantic right whales were observed in the shelf waters south of Martha's Vineyard and Nantucket in every month except for June. In 2022, North Atlantic right whales were detected (acoustic or visual) in the shelf waters south of Martha's Vineyard and Nantucket, inshore of the Nantucket to Ambrose traffic lanes, in every month except May and June; in 2023 there was at least one right whale detected in that area in every month except for July, September, October for the first half of 2023 (see https://whalemap.org/).

During aerial surveys conducted from 2011-2015 in the RI/MA and MA WEAs within the main part of the action area, the highest number of right whale sightings occurred in March (n=21), with sightings also occurring in December (n=4), January (n=7), February (n=14), and April (n=14), and no sightings in any other months (Kraus et al., 2016). There was not significant variability in sighting rate among years, indicating consistent annual seasonal use of the area by right whales. North Atlantic right whales were acoustically detected in 30 out of the 36 recorded months (Kraus et al., 2016). However, right whales exhibited strong seasonality in acoustic presence, with mean monthly acoustic presence highest in January (mean = 74%), February (mean = 86%), and March (mean = 97%), and the lowest in July (mean = 16%), August (mean = 2%), and September (mean = 12%). Aerial survey results indicate that North Atlantic right whales begin to arrive in the RI/MA and MA WEAs in December and remain in the area through April. However, acoustic detections occurred during all months, with peak number of detections between December and late May (Kraus et al. 2016b; Leiter et al. 2017).

Kraus et al. (2016) observed that North Atlantic right whales were most commonly present in and near the RI/MA and MA WEAs in the winter and spring and absent in the summer and fall. Quintana-Rizzo et al. (2018) observed similar occurrence patterns in the winter and spring but an increase in observations in the summer and fall. The change in seasonal occurrence between the 2011-2015 aerial surveys (Kraus et al. 2016) and the 2017 and 2018 (Quintana-Rizzo et al. 2018) aerial surveys is consistent with an increase trend in acoustic detections on the Mid-Atlantic Outer Continential Shelf (OCS) in the summer and autumn (Davis et al. 2017).[19] These data suggest an increasing likelihood of species presence from September through June.

In summary, we anticipate individual right whales to occur year round in the action area in both coastal, shallower waters as well as offshore, deeper waters. We expect these individuals to be moving throughout the action area, making seasonal migrations, foraging in northern parts of the action area when copepod patches of sufficient density are present. Calving is not anticipated to occur in the action area.

Nova Scotia Stock of Sei whale (Balaenoptera borealis)
Sei whales are expected to be present in the action area, most likely in the deeper areas furthest from the coast. The presence and behavior of sei whales in the action area is best understood in the context of their range in the Atlantic, which extends from southern Europe/northwestern Africa to Norway in the east, and from the southeastern United States (or occasionally the Gulf of Mexico and Caribbean Sea; Mead 1977) to West Greenland in the west (Gambell 1977; Gambell 1985b; Horwood 1987). The southern portion of the species' range during spring and summer includes the northern portions of the U.S. EEZ, the Gulf of Maine, Georges Bank, and south of New England (Halpin et al. 2009, Hayes et al. 2017, Hayes et al. 2020). The breeding and calving areas used by this species are unknown (Hayes et al. 2021).

Sei whales occurring in the North Atlantic belong to the Nova Scotia stock (Hayes et al. 2020). They can be found in deeper waters of the continental shelf edge waters of the northeastern United States and northeastward to south of Newfoundland (Hain et al. 1985, Prieto et al., 2014). Documented sei whale sightings along the U.S. Atlantic Coast south of Cape Cod are relatively uncommon compared to other baleen whales (CETAP 1982; Kagueux et al. 2010; Hayes et al. 2020). Sei whale sightings in U.S. Atlantic waters are typically centered on mid-shelf and the shelf edge and slope (Olsen et al. 2009). Spring is the period of greatest sei whale abundance in New England waters, with sightings concentrated along the eastern margin of Georges Bank, into the Northeast Channel area, south of Nantucket, and along the southwestern edge of Georges Bank in the area of Hydrographer Canyon (Hayes et al. 2022).

Sei whales often occur along the shelf edge to feed, but also use shallower shelf waters, particularly during certain years when oceanographic conditions force planktonic prey to shelf and inshore waters (Payne et al. 1990, Schilling et al. 1992, Waring et al. 2004). Although known to eat fish in other oceans, sei whales off the northeastern U.S. are largely planktivorous, feeding primarily on euphausiids and copepods (Flinn et al. 2002, Hayes et al. 2017). These aggregations of prey are largely influenced by the dynamic oceanographic processes in the

[19] Based on frequency of acoustic detections of North Atlantic right whale in Davis et al. (2017) designated monitoring region 7: Southern New England and New York Bight. This monitoring region is within the action area.

region. LaBrecque et al. (2015) defined a May to November feeding Biologically Important Area (BIA) for sei whales that extends from the 82-foot (25-m) contour off coastal Maine and Massachusetts east to the 656-foot (200-m) contour in the central Gulf of Maine, including the northern shelf break area of Georges Bank, the Great South Channel, and the southern shelf break area of Georges Bank from 328 to 6,562 feet (100–2,000 m). This feeding BIA overlaps with the CFF project action area.

Sei whales may be present in the action area year-round but are most commonly present in the spring and early summer (Davis et al. 2020). Sightings data from 1981 to 2018, indicate that sei whales may occur in the area in relatively moderate numbers during the spring and in low numbers in the summer (North Atlantic Right Whale Consortium 2018). Kraus et al. (2016) and Quintana-Rizzo et al. (2018) report observed sei whales in and near the RI/MA and MA WEAs from March through June from 2011 through 2015 and in 2017, respectively, with the timing of peak occurrence varying by year. Sei whales were absent from the area from August through February. In the RI/MA and MA WEAs in 2017, sightings were generally concentrated to the south and east of the action area. This distribution suggests that sei whales are likely to occur in and near the action area between March and June if recent patterns of habitat use continue. However, no sei whales were observed in the same study area in 2018 (Quintana-Rizzo et al. 2018). During 2020-2021 aerial surveys of the Massachusetts WEA, one sei whale was observed during the spring of 2021 in an area to the southeast of the RI/MA WEA area (O'Brien et al. 2021). Kraus et al. (2016) observed an unusually large number of sei whales during aerial and acoustic surveys of the RI/MA and MA WEAs and vicinity that were conducted from 2011 through 2015. Several individuals were observed in the study area from March through June, with peaks in May and June, at a mean abundance ranging from zero to 26 animals (Stone et al. 2017). Quintana-Rizzo et al. (2019) observed a large concentration of sei whales in the area in April, May, and July of 2017 peaking at 29 individuals in May, but none were observed in 2018. O'Brien et al. (2020, 2021a, 2021b) observed several sei whales 40 miles or more to the southeast of the RI/MA and MA WEAs in 2019 but none were observed in the study area in 2020.

In summary, we anticipate individual sei whales to occur in the action area year round, with presence in the on-shelf portions of the action area primarily in the spring and fall. We expect individuals in the action area to be making seasonal migrations, and to be foraging when krill are present. Foraging adult sei whales are most likely to occur in the action area but the observation of three adult sei whales with calves in the MA and RI/MA WEAs during spring and summer months (Kraus et al. 2016) indicates adult/calf pairs could occasionally be seasonally present in the action area.

Sperm whale (Physeter macrocephalus)
In the action area, sperm whales may be present along the deeper water portions of the action area. Sperm whales in the action area belong to the North Atlantic stock. Sperm whales are widely distributed throughout the deep waters of the North Atlantic, primarily along the continental shelf edge, over the continental slope, and into mid-ocean regions (Hayes et al., 2020). They are found at higher densities in areas such as the Bay of Biscay, to the west of Iceland, and towards northern Norway (Rogan et al. 2017) as well as around the Azores. This offshore distribution is more commonly associated with the Gulf Stream edge and other features

(Waring et al. 1993, Waring et al. 2001). Calving for the species occurs in low latitude waters outside of the action area. Most sperm whales that are seen at higher latitudes are solitary males, with females generally remaining further south.

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In the U.S. Atlantic EEZ waters, there appears to be a distinct seasonal distribution pattern (CETAP 1982, Scott and Sadove 1997). In spring, the center of distribution shifts northward to east of Delaware and Virginia and is widespread throughout the central portion of the Mid-Atlantic Bight and the southern portion of Georges Bank. In summer, the distribution of sperm whales includes the area east and north of Georges Bank and into the Northeast Channel region, as well as the continental shelf (inshore of the 100-m isobath) such as Nantucket Shoals and Cox's ledge in southern of New England (Westell et. al. 2024). In the fall, sperm whale occurrence south of New England on the continental shelf is at its highest level. In winter, sperm whales are concentrated east and northeast of Cape Hatteras.

The average depth of sperm whale sightings observed during the CeTAP surveys was 5,880 ft. (1,792 m) (CETAP 1982). Female sperm whales and young males usually inhabit waters deeper than 3,280 ft. (1,000 m) and at latitudes less than 40° N (Whitehead 2002). Sperm whales feed on larger organisms that inhabit the deeper ocean regions including large- and medium-sized squid, octopus, and medium-and large-sized demersal fish, such as rays, sharks, and many teleosts (NMFS 2015; Whitehead 2002). Although primarily a deep-water species, sperm whales are known to visit shallow coastal regions when there are sharp increases in bottom depth where upwelling occurs resulting in areas of high planktonic biomass (Clarke 1956, Best 1969, Clarke et al. 1978, Jaquet 1996).

Historical sightings data from 1979 to 2018 indicate that sperm whales may occur in and near the RI/MA and MA WEAs along with the rest of the action area including Georges Bank and the Mid-Atlantic Bight in the summer and autumn in relatively low to moderate numbers (North Atlantic Right Whale Consortium 2018). Kraus et al. (2016) recorded four sperm whale sightings in and near the RI/MA and MA WEAs between 2011 and 2015. Three of the four sightings occurred in August and September 2012, and one occurred in June 2015. Because of the limited sample size, Kraus et al. (2016) were not able to calculate Sightings per Unit Effort (SPUE) or estimate abundance in the action area, and specific sighting locations were not provided. No adults were observed foraging or with calves during the 2011-2015 aerial surveys (Kraus et al. 2016).

In summary, individual adult sperm whales are anticipated to occur infrequently in deeper, offshore waters of the North Atlantic portion of the action area primarily in summer and fall months, with a small number of individuals potentially present year round. These individuals are expected to be moving through the action area as they make seasonal migrations, and to be foraging along the shelf break. As sperm whales typically forage at deep depths (500-1,000 m) (NMFS 2015), foraging is not expected to occur in the action area. However, a study by Westell et al. (2024) indicated that sperm whales are at least occasionally present within the action area in the vicinity of Nantucket Shoals and Cox's Ledge for socializing and potential foraging.

Western North Atlantic stock of fin whales (Balaenoptera physalus)
Fin whales are present in the action area and their presence and behavior in the action area is best understood in the context of their range. Fin whale presence in the North Atlantic is limited to waters north of Cape Hatteras, NC. In general, fin whales in the central and eastern Atlantic tend to occur most abundantly over the continental slope and on the shelf seaward of the 200-m isobath (Rørvik et al. 1976 in NMFS 2010). In contrast, off the eastern United States they are centered along the 100-m isobath but with sightings well spread out over shallower and deeper water, including submarine canyons along the shelf break (Kenney and Winn 1987; Hain et al. 1992).

Fin whales occurring in the North Atlantic belong to the western North Atlantic stock (Hayes et al. 2019). Fin whales are migratory, moving seasonally into and out of feeding areas, but the overall migration pattern is complex and specific routes are unknown (NMFS 2018a). The species occur year-round in a wide range of latitudes and longitudes, but the density of individuals in any one area changes seasonally. Thus, their movements overall are patterned and consistent, but distribution of individuals in a given year may vary according to their energetic and reproductive condition, and climatic factors (NMFS 2010a). Fin whales are believed to use the North Atlantic water primarily for feeding and more southern waters for calving. Movement of fin whales from the Labrador/Newfoundland region south into the West Indies during the fall have been reported (Clark 1995). However, neonate strandings along the U.S. Mid-Atlantic coast from October through January indicate a possible offshore calving area (Hain et al. 1992). Thus, their movements overall are patterned and consistent, but distribution of individuals in a given year may vary according to their energetic and reproductive condition, and climatic factors (NMFS 2010).

The northern Mid-Atlantic Bight represents a major feeding ground for fin whales as the physical and biological oceanographic structure of the area aggregates prey. This feeding area extends in a zone east from Montauk, Long Island, New York, to south of Nantucket (LaBrecque et al. 2015, Kenney and Vigness-Raposa 2010; NMFS 2010a) and is a location where fin whales congregate in dense aggregations and sightings frequently occur (Kenney and Vigness-Raposa 2010). Fin whales in this area feed on krill (*Meganyctiphanes norvegica* and *Thysanoessa inermis*) and schooling fish such as capelin (*Mallotus villosus*), herring (*Clupea harengus*), and sand lance (*Ammodytes* spp.) (Borobia et al. 1995) by skimming the water or lunge feeding. This area is used extensively by feeding fin whales from March to October. Several studies suggest that distribution and movements of fin whales along the east coast of the United States is influenced by the availability of sand lance (Kenney and Winn 1986, Payne 1990).

Aerial survey observations collected by Kraus et al. (2016) from 2011 through 2015 and Quintana-Rizzo et al. (2018) in 2017 and 2018 indicate peak fin whale occurrence in the RI/MA and MA WEAs within the action area from May to August; however, the species may be present at varying densities during any month of the year. During seasonal aerial and acoustic surveys conducted from 2011-2015 in the RI/MA and MA WEAs, fin whales were observed every year, and sightings occurred in every season with the greatest numbers during the spring (n = 35) and summer (n = 49) months (Kraus et al., 2016). Observed behavior included feeding and migrating. Despite much lower sighting rates during the winter, a hydrophone array confirmed fin whales presence throughout the year (Kraus et al. 2016). LaBrecque et al. (2015) delineated a BIA for fin whale feeding in an area extending from Montauk Point, New York, to the open ocean south of Martha's Vineyard between the 49-foot (15-m) and 164-foot (50-m) depth contours. This BIA is within the action area, and is used extensively by feeding fin whales from March to October.

In summary, we anticipate individual fin whales to occur in the action area year-round, with the highest numbers in the spring through early fall. We expect these individuals to be making seasonal coastal migrations, and to be foraging during spring and summer months. Fin whales occur year- round in a wide range of latitudes and longitudes, thus they may be present in the oceanic portions of the action area year round.

5.2 Summary of Information on Listed Sea Turtles in the Action Area

Four ESA-listed species of sea turtles (Leatherback sea turtles, North Atlantic DPS of green sea turtles, Northwest Atlantic Ocean DPS of loggerhead sea turtles, Kemp's ridley sea turtles) make seasonal migrations along the U.S. Atlantic Coast, including into Cape Cod Bay, southern New England waters, and southwestern George's Bank. Sea turtles are primarily expected to occur in the action area between June-November.

The four species of sea turtles considered here are highly migratory. One of the main factors influencing sea turtle presence in Mid-Atlantic waters and waters farther north is seasonal temperature patterns (Ruben and Morreale 1999) as waters in these areas are not warm enough to support sea turtle presence year round. In general, sea turtles move up the U.S. Atlantic Coast from southern wintering areas to northern foraging grounds as water temperatures warm in the spring. The trend is reversed in the fall as water temperatures cool. By December, sea turtles have passed Cape Hatteras, returning to more southern waters for the winter (Braun-McNeill and Epperly 2002, Ceriani et al. 2012, Griffin et al. 2013, James et al. 2005b, Mansfield et al. 2009, Morreale and Standora 2005, Morreale and Standora 1998, NEFSC and SEFSC 2011, Shoop and Kenney 1992, TEWG 2009, Winton et al. 2018). Water temperatures too cold or too warm may affect feeding rates and physiological functioning (Milton and Lutz 2003); metabolic rates may be suppressed when a sea turtle is exposed for a prolonged period to temperatures below 8-10°C (George 1997, Milton and Lutz 2003, Morreale et al. 1992). That said, loggerhead sea turtles have been found in waters as low as 7.1-8°C (Braun-McNeill et al. 2008, Smolowitz et al. 2015, Weeks et al. 2010). However, in assessing critical habitat for loggerhead sea turtles, the review team considered the water-temperature habitat range for loggerheads to be above 10° C (NMFS 2013). Sea turtles are most likely to occur in the action area when water temperatures are above this temperature, although depending on seasonal weather patterns and prey availability, they could be also present in months when water temperatures are cooler (as evidenced by fall and winter cold stunning records as well as year round stranding records).

Regional historical sightings, strandings, and bycatch data indicate that loggerhead and leatherback turtles are relatively common in waters of southern New England, while Kemp's ridley turtles and green turtles are less common (Kenney and Vigness-Raposa 2010). Aerial surveys conducted seasonally, from 2011-2015, in the MA WEA recorded the highest abundance of endangered sea turtles during the summer and fall, with no significant inter-annual variability. For most species of sea turtles, relative density was even throughout the WEA. Sea turtles in the action area are adults or juveniles; due to the distance from any nesting beaches, no hatchlings occur in the action area. Similarly, no reproductive behavior is known or suspected to occur in the action area.

Sea turtles feed on a variety of both pelagic and benthic prey, and change diets through different life stages. Adult loggerhead and Kemp's ridley sea turtles are carnivores that feed on crustaceans, mollusks, and occasionally fish, green sea turtles are herbivores and feed primarily on algae, seagrass, and seaweed, and leatherback sea turtles are pelagic feeders that forage throughout the water column primarily on gelatinivores. As juveniles, loggerhead and green sea turtles are omnivores (Wallace et al. 2009, Dodge et al. 2011, BA - Eckert et al. 2012, https://www.seeturtles.org/sea-turtle-diet, Murray et al 2013, Patel et al. 2016). The distribution of pelagic and benthic prey resources is primarily associated with dynamic oceanographic processes, which ultimately affect where sea turtles forage (Polovina et al. 2006). During late-spring, summer, and early-fall months when water temperatures are suitable, the physical and biological structure of both the pelagic and benthic environment in the action area provide habitat for both the four species of sea turtles in the region as well as their prey.

Additional species-specific information is presented below. It is important to note that most of these data sources report sightings data that is not corrected for the percentage of sea turtles that were unobservable due to being under the surface. As such, many of these sources represent a minimum estimate of sea turtles in the area.

Leatherback sea turtles
Leatherbacks are a predominantly pelagic species that ranges into cooler waters at higher latitudes than other sea turtles, and their large body size makes the species easier to observe in aerial and shipboard surveys. The CETAP regularly documented leatherback sea turtles on the OCS between Cape Hatteras and Nova Scotia during summer months in aerial and shipboard surveys conducted from 1978 through 1988. The greatest concentrations were observed between Long Island and the Gulf of Maine (Shoop and Kenney 1992). AMAPPS surveys conducted from 2010 through 2021 routinely documented leatherbacks in the action area and surrounding waters during summer months (NEFSC and SEFSC 2018, 2022; Palka 2021).

Satellite tagging studies have been used to understand leatherback sea turtle behavior and movement in portions of the action area (Dodge et al. 2014, Dodge et al. 2015, Eckert et al. 2006, James et al. 2005a, James et al. 2005b, James et al. 2006a). These studies show that leatherback sea turtles move throughout most of the North Atlantic from the equator to high latitudes. Key foraging destinations include, among others, the eastern coast of the United States (Eckert et al. 2006). Satellite tagging studies provide information on leatherback sea turtle behavior and movement in the action area. These studies show that leatherback sea turtles move throughout most of the North Atlantic from the equator to high latitudes. Based on tracking data for leatherbacks tagged off North Carolina (n=21), many of the tagged leatherbacks spent time in shelf waters from North Carolina, up the Mid-Atlantic shelf and into southern New England and the Gulf of Maine. After coastal residency, some leatherbacks undertook long migrations while tagged. Some migrated far offshore of the Mid-Atlantic, past Bermuda, even as far as the Mid-Atlantic Trench region. Others went towards Florida, the Caribbean, or Central America (Palka et al. 2021). This data indicates that leatherbacks are present throughout the action area at all depths of the water column and may be present along the vessel transit routes to/from the South Atlantic.

Telemetry studies provide information on the use of the water column by leatherback sea turtles. Based on telemetry data for leatherbacks (n=15) off Cape Cod, Massachusetts, leatherback turtles spent over 60% of their time in the top 33 ft. (10 m) of the water column and over 70% in the top 49 ft. (15 m) (Dodge et al. 2014). Leatherbacks on the foraging grounds moved with slow, sinuous area-restricted search behaviors. Shorter, shallower dives were taken in productive, shallow waters with strong sea surface temperature gradients. They were highly aggregated in shelf and slope waters in the summer, early fall, and late spring. During the late fall, winter, and early spring, they were more widely dispersed in more southern waters and neritic habitats (Dodge et al. 2014). Leatherbacks (n=24) tagged in Canadian waters primarily used the upper 98 ft. (30 m) of the water column and had shallow dives (Wallace et al. 2015).

Leatherbacks tagged off Massachusetts showed a strong affinity to the northeast United States continental shelf before dispersing widely throughout the northwest Atlantic (Dodge et al. 2014). The tagged leatherbacks ranged widely between 39°W and 83°W, and between 9°N and 47°N, over six oceanographically distinct ecoregions defined by Longhurst: the Northwest Atlantic Shelves (n=20), the Gulf Stream (n=16), the North Atlantic Subtropical Gyral West (hereafter referred to as the Subtropical Atlantic, n=15), the North Atlantic Tropical Gyral (the Tropical Atlantic, n=15), the Caribbean (n=6) and the Guianas Coastal (n=7) (Dodge et al. 2014). This data indicates that leatherbacks are present throughout the action area considered here and may be present along the vessel transit routes from Canada and Europe. From the tagged turtles in the Dodge et al. 2014 study, there was a strong seasonal component to habitat selection, with most leatherbacks remaining in temperate latitudes in the summer and early autumn and moving into subtropical and tropical habitat in the late autumn, winter, and spring. Leatherback turtles might initiate migration when the abundance of their prey declines (Sherrill-Mix et al. 2008).

Dodge et al. (2018) used an autonomous underwater vehicle (AUV) to remotely monitor fine-scale movements and behaviors of nine leatherbacks off Cape Cod, Massachusetts. The "TurtleCam" collected video of tagged leatherback sea turtles and simultaneously sampled the habitat (e.g., chlorophyll, temperature, salinity). Representative data from one turtle was reported in Dodge et al. (2018). During the 5.5 hours of tracking, the turtle dove continuously from the surface to the seafloor (0-66 ft. (0-20 m)). Over a two-hour period, the turtle spent 68% of its time diving, 16% swimming just above the seafloor, 15% at the surface, and 17% just below the surface. The animal frequently surfaced (>100 times in ~2 hours). The turtle used the entire water column, feeding on jellyfish from the seafloor to the surface. The turtle silhouetted prey 36% of the time, diving to near/at bottom, and looking up to locate prey. The authors note that silhouetting prey may increase entanglement in fixed gear if a buoy or float is mistaken for jellyfish (Dodge et al. 2018).

Leatherbacks were the most frequently sighted sea turtle species in monthly aerial surveys of the RI/MA and MA WEAs (where the majority of the surveys in this project take place) from October 2011 through June 2015 (Kraus et al. 2016). However, leatherback sea turtles showed an apparent preference for the northeastern corner of the WEA, which is consistent with results from a tagging study on leatherbacks in the area (Kraus et al. 2016, Dodge et al., 2014). These results suggest an important seasonal habitat for leatherbacks in southern New England (Kraus et al. 2016, Dodge et al. 2014) that overlaps with a portion of the action area. Kraus et al. (2016) recorded 153 observations (161 animals) in monthly aerial surveys, all between May and November, with a strong peak in the fall. Data from Kraus et al. (2016) indicates that in some parts of the year, leatherbacks would be the most abundant sea turtle species in the area, which is consistent with the other information on sea turtle occurrence in the vicinity presented here. As shown, the majority of observations were clustered in the eastern portion of the action area south of Nantucket with highest numbers in the fall months of October-December and one observation in July. The Sea Turtle Stranding and Salvage Network (STSSN) reported 89 offshore and 142 inshore leatherback sea turtle strandings between 2017 and 2021 from New York to Massachusetts (NMFS STSSN 2022).

Based on the information presented here, we anticipate leatherback sea turtles to occur in the action area during the warmer months, typically between June and November. Leatherbacks are also expected along the vessel transit routes used by research vessels transiting to and from marinas in New Bedford, MA and in Cape Cod, MA.

Northwest Atlantic DPS of Loggerhead sea turtles
The loggerhead is commonly found throughout the North Atlantic including the Gulf of Mexico, the northern Caribbean, the Bahamas archipelago (Dow et al. 2007), and eastward to West Africa, the western Mediterranean, and the west coast of Europe (NMFS and USFWS 2008). The range of the Northwest Atlantic DPS is the Northwest Atlantic Ocean north of the equator, south of 60° N. Lat., and west of 40° W. Long. Northwest Atlantic DPS loggerheads occur in the oceanic portions of the action area west of 40°W.

Extensive tagging results suggest that tagged loggerheads occur on the continental shelf along the United States Atlantic from Florida to North Carolina year-round but also highlight the importance of summer foraging areas on the Mid-Atlantic shelf, which includes the action area (Winton et al. 2018). In southern New England, loggerhead sea turtles can be found seasonally, primarily in the summer and autumn months when surface temperatures range from 44.6ºF to 86ºF (7ºC to 30ºC) (Kenney and Vigness-Raposa 2010; Shoop and Kenney 1992). Loggerheads are absent from southern New England during winter months (Kenney and Vigness-Raposa 2010; Shoop and Kenney 1992). Aerial surveys conducted over the Massachusetts WEA in 2020-2021, observed loggerhead sea turtles in the eastern portions of the WEA and Nantucket Shoals concentrated in the fall (O'Brien 2021, 2022).

In the summer of 2010, as part of the AMAPPS project, the NEFSC and SEFSC estimated the abundance of juvenile and adult loggerhead sea turtles in the portion of the northwestern Atlantic continental shelf between Cape Canaveral, Florida and the mouth of the Gulf of St. Lawrence, Canada (NEFSC and SEFSC 2011a). The abundance estimates were based on data collected from an aerial line-transect sighting survey as well as satellite tagged loggerheads. The preliminary regional abundance estimate was about 588,000 individuals (approximate inter-quartile range of 382,000- 817,000) based on only the positively identified loggerhead sightings, and about 801,000 individuals (approximate inter-quartile range of 521,000-1,111,000) when based on the positively identified loggerheads and a portion of the unidentified sea turtle sightings (NMFS 2011b). The loggerhead was the most frequently observed sea turtle species in 2010 to 2013 AMAPPS aerial surveys of the Atlantic continental shelf. Large concentrations were regularly observed in proximity to the RI/MA and MA WEAs within the action area (NEFSC and SEFSC 2018). Kraus et al. (2016) observed loggerhead sea turtles within the RI/MA and MA WEAs in the spring, summer, and autumn, with the greatest density of observations in August and September.

Barco et al. (2018) estimated loggerhead sea turtle abundance and density in the southern portion of the Mid-Atlantic Bight and Chesapeake Bay using data from 2011-2012. During aerial surveys off Virginia and Maryland, loggerhead sea turtles were the most common turtle species detected, followed by greens and leatherbacks, with few Kemp's ridleys documented. Density varied both spatially and temporally. Loggerhead abundance and density estimates in the ocean were higher in the spring (May-June) than the summer (July-August) or fall (September-October). Ocean abundance estimates of loggerheads ranged from highs of 27,508-80,503 in the spring months of May-June to lows of 3,005-17,962 in the fall months of September-October (Barco et al. 2018).

AMAPPS data, along with other sources, have been used in recent modeling studies. Winton et al. (2018) modeled the spatial distribution of satellite-tagged loggerhead sea turtles in the Western North Atlantic. The Mid-Atlantic Bight was identified as an important summer foraging area and the results suggest that the area may support a larger proportion of the population, over 50% of the predicted relative density of loggerheads north of Cape Hatteras from June to October (NMFS 2019a, Winton et al. 2018). Using satellite telemetry observations from 271 large juvenile and adult sea turtles collected from 2004 to 2016, the models predicted that overall densities were greatest in the shelf waters of the U.S. Atlantic coast from Florida to North Carolina. Tagged loggerheads primarily occupied the continental shelf from Long Island, New York to Florida, with some moving offshore. Monthly variation in the Mid-Atlantic Bight indicated migration north to the foraging grounds from March to May and migration south from November to December. In late spring and summer, predicted densities were highest in the shelf waters from Maryland to New Jersey. In the cooler months, the predicted densities in the Mid-Atlantic Bight were higher offshore (Winton et al. 2018). South of Cape Hatteras, there was less seasonal variability and predicted densities were high in all months. Many of the individuals tagged in this area remained in the general vicinity of the tagging location. The authors did caution that the model was driven, at least in part, by the weighting scheme chosen, is reflective only of the tagged population, and has biases associated with the non-random tag deployment. Most loggerheads tagged in the Mid-Atlantic Bight were tagged in offshore shelf waters north of Chesapeake Bay in the spring. Thus, loggerheads in the nearshore areas of the Mid-Atlantic Bight may have been under-represented (Winton et al. 2018).

To better understand loggerhead behavior on the Mid-Atlantic foraging grounds, Patel et al. (2016) used a remotely operated vehicle (ROV) to document the feeding habitats (and prey availability), buoyancy control, and water column use of 73 loggerheads recorded from 2008-2014. When the mouth and face were in view, loggerheads spent 13% of the time feeding on non-gelatinous prey and 2% feeding on gelatinous prey. Feeding on gelatinous prey occurred near the surface to depths of 52.5 ft. (16 m). Non-gelatinous prey were consumed on the bottom. Turtles spent approximately 7% of their time on the surface (associated with breathing), 42% in the near surface region, 44% in the water column, 0.4% near bottom, and 6% on bottom. When diving to depth, turtles displayed negative buoyancy, making staying at the bottom easier (Patel et al. 2016).

Patel et al. (2018) evaluated temperature-depth data from 162 satellite tags deployed on loggerhead sea turtles from 2009 to 2017 when the water column is highly stratified (June 1 – October 4). Turtles arrived in the Mid-Atlantic Bight in late May as the Cold Pool formed and departed in early October when the Cold Pool started to dissipate. The Cold Pool is an oceanographic feature that forms annually in late May. During the highly stratified season, tagged turtles were documented throughout the water column from June through September. Fewer bottom dives occurred north of Hudson Canyon early (June) and late (September) in the foraging season (Patel et al. 2018).

Based on the information presented here, we anticipate loggerheads from the Northwest Atlantic DPS to occur in the action area during the warmer months, typically between June and November. Loggerheads are also expected along the vessel transit routes used by research vessels transiting to and from marinas in New Bedford, MA and in Cape Cod, MA.

Kemp's ridley sea turtles

Kemp's ridleys are distributed throughout the Gulf of Mexico and U.S. Atlantic coastal waters, from Florida to New England. Adult Kemp's ridleys primarily occupy nearshore coastal (neritic) habitats. Many adult Kemp's ridleys remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS, USFWS, and SEAMARNAT 2011). Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 feet (37 m) deep (Landry and Seney 2008; Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters.

During spring and summer, juvenile Kemp's ridleys generally occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida and along the United States Atlantic coast from southern Florida to the Mid-Atlantic and New England. In addition, the NEFSC caught a juvenile Kemp's ridley during a recent research project in deep water south of Georges Bank (NEFSC unpublished data, as cited in NMFS [2020a]). In the fall, most Kemp's ridleys migrate to deeper or more southern, warmer waters and remain there through the winter (Schmid 1998). Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 feet (37 m) deep (Seney and Landry 2008; Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters.

Juvenile and subadult Kemp's ridley sea turtles are known to travel as far north as Long Island Sound and Cape Cod Bay during summer and autumn foraging (NMFS, USFWS, and SEAMARNAT 2011). Visual sighting data are limited because this small species is difficult to observe using aerial survey methods (Kraus et al. 2016), and most surveys do not cover its preferred shallow bay and estuary habitats. However, Kraus et al. (2016) recorded six observations in the RI/MA and MA WEAs over 4 years, all in August and September 2012. The sighting data were insufficient for calculating SPUE for this species (Kraus et al. 2016). Other aerial surveys efforts conducted in the region between 1998 and 2017 have observational records of species occurrence in the waters surrounding the RI/ME WEA during the autumn (September to November) at densities ranging from 10 to 40 individuals per 1,000 km (North Atlantic Right Whale Consortium 2018; NEFSC and SEFSC 2018). Juvenile Kemp's ridley sea turtles represented 66% of 293 cold-stunned turtle stranding records collected in inshore waters of Long Island Sound from 1981 to 1997 (Gerle et al. 1998) and represent the greatest number of sea turtle strandings in most years.

Based on the information presented here, we anticipate Kemp's ridley sea turtles to occur in the action area during the warmer months, typically between June and November. Kemp's ridleys are also expected along the vessel transit routes used by research vessels transiting to and from marinas in New Bedford, MA and in Cape Cod, MA.

North Atlantic DPS of Green sea turtles
Most green turtles spend the majority of their lives in coastal foraging grounds. These areas include fairly shallow waters in both open coastline and protected bays and lagoons. In addition to coastal foraging areas, oceanic habitats are used by oceanic-stage juveniles, migrating adults, and, on some occasions, by green turtles that reside in the oceanic zone for foraging.

This species is typically observed in U.S. waters in the Gulf of Mexico or coastal waters south of Virginia (USFWS 2021). Juveniles and subadults are occasionally observed in Atlantic coastal waters as far north as Massachusetts (NMFS and USFWS 1991), including the waters of Long Island Sound and Cape Cod Bay (CETAP 1982). Kenney and Vigness-Raposa (2010) recorded one confirmed sighting within the RI/MA and MA WEAs in 2005. The Sea Turtle Stranding and Salvage Network (STSSN) reported one offshore and 20 inshore green sea turtle strandings between 2017 and 2019, and green sea turtles are found each year stranded on Cape Cod beaches (NMFS STSSN 2021; WBWS 2018). Five green turtle sightings were recorded off the Long Island shoreline 10 to 30 miles southwest of the RI/MA and MA WEAs in aerial surveys conducted from 2010-2013 (NEFSC and SEFSC 2018). However, given the relative abundance of observations farther to the south, adult green sea turtles are likely an infrequent visitor to the area. This conclusion is supported by the lack of green sea turtle observations recorded in an intensive aerial survey of the RI/MA and MA WEAs from October 2011 to June 2015 (Kraus et al. 2016). However, the aerial survey methods used in the region to date are unable to reliably detect juvenile turtles, sight several unidentified turtles, and do not cover the shallow nearshore habitats most commonly used by this species.

Juvenile green sea turtles represented 6% of 293 cold-stunned turtle stranding records collected in inshore waters of Long Island Sound from 1981 to 1997 (Gerle et al. 1998) and represent the lowest number of overall stranding between 1979 and 2016. These and other sources of information indicate that juvenile green turtles occur periodically in shallow nearshore waters of Long Island Sound and the coastal bays of New England (Morreale et al. 1992; Massachusetts Audubon 2012), but their presence offshore in the action area is also possible.

Based on the information presented here, we anticipate green sea turtles to occur in the action area during the warmer months, typically between June and November. Green sea turtles are also expected along the vessel transit routes used by research vessels transiting to and from marinas in New Bedford, MA and in Cape Cod, MA.

5.3 Summary of Information on Atlantic sturgeon in the Action Area

Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus)
Adult and subadult (less than 150cm in total length, not sexually mature, but have left their natal rivers) Atlantic sturgeon from all five DPSs undertake seasonal, nearshore (i.e., typically depths less than 50 meters), coastal marine migrations along the United States eastern coastline including in waters of southern New England (Dunton et al. 2010, Erickson et al. 2011). Given their anticipated distribution in depths primarily 50 m and less, Atlantic sturgeon are also expected along the vessel transit routes used by research vessels transiting to and from marinas in New Bedford, MA and in Cape Cod, MA.

Atlantic sturgeon demonstrate strong spawning habitat fidelity and extensive migratory behavior (Savoy et al. 2017). Adults and subadults migrate extensively along the Atlantic coastal shelf (Erickson et al. 2011; Savoy et al. 2017), and use the coastal nearshore zone to migrate between river systems (ASSRT 2007; Eyler et al. 2004). Erickson et al. (2011) found that adults remain in nearshore and shelf habitats ranging from 6 to 125 feet (2 to 38 m) in depth, preferring shallower waters in the summer and autumn and deeper waters in the winter and spring. Data from capture records, tagging studies, and other research efforts (Damon-Randall et al. 2013; Dunton et al. 2010; Stein et al. 2004a, 2004b; Zollett 2009) indicate the potential for occurrence in the action area during all months of the year. Individuals from every Atlantic sturgeon DPS have been captured in the Virginian marine ecoregion (Cook and Auster 2007; Wirgin et al. 2015a, 2015b), which extends from Cape Cod, Massachusetts, to Cape Lookout, North Carolina.

Based on tag data, sturgeon migrate to southern waters (e.g., off the coast of North Carolina and Virginia) during the fall, and migrate to more northern waters (e.g., off the coast of New York, southern New England, as far north as the Bay of Fundy) during the spring (Dunton et al. 2010, Erickson et al. 2011, Wippelhauser et al. 2017). In areas with gravel, sand and/or silt bottom habitats and relatively shallow depths (primarily <50 meters), sturgeon may also be foraging during these trips on prey including mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Stein et al. 2004b, Dadswell 2006, Dunton et al. 2010, Erickson et al. 2011).

Atlantic sturgeon aggregate in several distinct areas along the Mid-Atlantic coastline; Atlantic sturgeon are most likely to occur in areas adjacent to estuaries and/or coastal features formed by bay mouths and inlets (Stein et al. 2004a; Laney et. al 2007; Erickson et al. 2011; Dunton et al. 2010). These aggregation areas are located within the coastal waters off North Carolina; waters between the Chesapeake Bay and Delaware Bay; the southern New Jersey coast near the mouth of Delaware Bay; and the southwest shores of Long Island (Laney et. al 2007; Erickson et al. 2011; Dunton et al. 2010). These aggregation areas are believed to be where Atlantic sturgeon overwinter and/or forage (Laney et. al 2007; Erickson et al. 2011; Dunton et al. 2010). Based on five fishery-independent surveys, Dunton et al. (2010) identified several "hotspots" for Atlantic sturgeon captures, all located in depths of less than 20 m adjacent to estuaries including the

Hudson River/NY Bight, Delaware Bay, Chesapeake Bay, Cape Hatteras, and Kennebec River. These “hotspots” are aggregation areas that are most often used during the spring, summer, and fall months (Erickson et al. 2011; Dunton et al. 2010). Areas between these sites are used by sturgeon migrating to and from these areas, as well as to spawning grounds found within natal rivers. Adult sturgeon return to their natal river to spawn in the spring. The nearest river to the project area that is known to regularly support Atlantic sturgeon spawning is the Hudson River. Atlantic sturgeon may also at least occasionally spawn in the Connecticut River. The Delaware River also supports a population of spawning Atlantic sturgeon.

Ingram et al. (2019) studied Atlantic sturgeon distribution in the New York WEA by monitoring the movements of tagged Atlantic sturgeon from November 2016 through February 2018 on an array of 24 acoustic receivers (see Figure 1 in Ingram et al. 2019 for acoustic receiver locations). While this area overlaps with a small portion of the action area, it is reasonable to expect that distribution and use of the rest of the action area would be similar, given the similar geography and habitat conditions. Total confirmed detections for Atlantic Sturgeon ranged from 1 to 310 detections per individual, with a total of 5,490 valid detections of 181 unique individuals. Detections of 181 unique Atlantic sturgeon were documented with detections being highly seasonal peaking from November through January, with tagged individuals uncommon (less than 2 individuals detected) or absent in July, August, and September. As described in the paper, Atlantic Sturgeon were detected on all transceivers in the array including the most offshore receiver, located 44.3 km offshore (21 total detections of 5 unique fish). Total counts and detections of unique fish were highest at the receivers nearer to shore and appeared to decrease with distance from shore. Counts at each station ranged between 21–909 total detections and 4–59 unique detections of Atlantic sturgeon. Fifty-five individuals were documented in multiple years. The authors reported that the transition from coastal to offshore areas, predictably associated with photoperiod and river temperature, typically occurred in the autumn and winter months. During this time, individual Atlantic sturgeon were actively moving throughout the area. Residence events, defined in the paper as “a minimum of two successive detections of an individual at a single transceiver station over a minimum period of two hours. Residence events are completed by either a detection of the individual on another transceiver station or a period of 12 hours without detection.” Residence events were uncommon (only 22 events over the study period) and of short duration (mean of 10 hours) and were generally limited to receivers with depths of less than 30 m. The authors indicate that the movement patterns may be suggestive of foraging but could not draw any conclusions. By assuming the maximum observed rate of movement of 0.86 m/s and maximum straight-line distance of 40.6 km between stations from the transceiver-distance matrix, the minimum transit time for an Atlantic Sturgeon through the NY WEA at its longest point was estimated to be 13.1 hrs. As described by the authors, the absence of Atlantic Sturgeon in the NY WEA during the summer months, particularly from June through September, suggests a putative shift to nearshore habitat and corresponds with periods of known-residence in shallow, coastal waters that are associated with juvenile and sub-adult aggregations as well as adult spawning migrations.

A number of surveys occur regularly in the action area that are designed to characterize the fish community and use sampling gear that is expected to collect Atlantic sturgeon if they were present in the area. One such survey is the Northeast Area Monitoring and Assessment Program (NEAMAP), which samples from Cape Cod, MA south to Cape Hatteras, NC and targets both juvenile and adult fishes. The NEAMAP trawl survey samples near shore water to a depth of 60 feet and includes the sounds to 120 feet. Atlantic sturgeon are regularly captured in this survey; however, there are a few instances of collection in the action area. The area is also sampled in the NEFSC bottom trawl surveys, which surveys from Cape Hatteras to the Western Scotian Shelf. Presence has been confirmed by the collection of Atlantic sturgeon in several sampling programs off the New Jersey coast (Stein et al. 2004b; Eyler et al. 2009; Dunton et al. 2010; Erickson et al. 2011). Dunton et al. (2010) analyzed data from surveys covering the northwest Atlantic Ocean from Cape Hatteras to the Gulf of Maine conducted by five agencies. The catch per unit of effort for Atlantic sturgeon off New Jersey, from New York Harbor south to the entrance of Delaware Bay (Delaware), was second only to catch per unit of effort from the entrance of New York Harbor to Montauk Point, New York. About 95% of all Atlantic sturgeon captured in the sampling off New Jersey occurred in depths less than 66 feet (20 meters) with the highest catch per unit of effort at depths of 33 to 49 feet (10 to 15 meters) (Dunton et al. 2010).

Between March 2009 and February 2012, 173 Atlantic sturgeon were documented as bycatch in Federal fisheries by the Northeast Observer Program. Observers operated on fishing vessels from the Gulf of Maine to Cape Hatteras. Observer Program coverage across this entire area for this period was 8% of all trips with the exception that Observer coverage for the New England groundfish fisheries, extending from Maine to Rhode Island, was an additional 18% (26% coverage in total). Despite the highest observer coverage in the groundfish fisheries that overlap with the action area and the regular occurrence of commercial fishing activity in the area, only 2 of the 173 Atlantic sturgeon observed by the observer program in this period were collected in the RI/MA and MA WEAs portion of the action area.

Dunton et al. (2015) documented sturgeon bycatch in waters less than 50 feet deep during the New York summer flounder fishery; Atlantic sturgeon occurred along eastern Long Island in all seasons except for the winter, with the highest frequency in the spring and fall. The species migrates along coastal New York from April to June and from October to November (Dunton et al. 2015). Ingram et al. (2019) studied Atlantic sturgeon distribution using acoustic tags and determined peak seasonal occurrence in the offshore waters of the OCS off the coast of New York from November through January, whereas tagged individuals were uncommon or absent from July to September. The authors reported that the transition from coastal to offshore areas, predictably associated with photoperiod and river temperature, typically occurred in the autumn and winter months.

Migratory adults and sub-adults have been collected in shallow nearshore areas of the continental shelf (32.9–164 feet [10–50 m]) on any variety of bottom types (silt, sand, gravel, or clay). Evidence suggests that Atlantic sturgeon orient to specific coastal features that provide foraging opportunities linked to depth-specific concentrations of fauna. Concentration areas of Atlantic sturgeon near Chesapeake Bay and North Carolina were strongly correlated with the coastal features formed by the bay mouth, inlets, and the physical and biological features produced by outflow plumes (Kingsford and Suthers 1994, as cited in Stein et al. 2004a). They are also known to commonly aggregate in areas that presumably provide optimal foraging opportunities, such as the Bay of Fundy, Massachusetts Bay, Rhode Island, New Jersey, and Delaware Bay (Dovel and Berggren 1983; Johnson et al. 1997; Rochard et al. 1997; Kynard et al. 2000; Eyler et al. 2004; Stein et al. 2004a; Dadswell 2006, as cited in ASSRT 2007).

Stein et al. (2004a, 2004b) reviewed 21 years of sturgeon bycatch records in the Mid-Atlantic OCS to identify regional patterns of habitat use and association with specific habitat types. Atlantic sturgeon were routinely captured in waters within and in immediate proximity to the action area, most commonly in waters ranging from 33 to 164 feet (10–50 m) deep. Sturgeon in this area were most frequently associated with coarse gravel substrates within a narrow depth range, presumably associated with depth-specific concentrations of preferred prey fauna.

Spawning, juvenile growth and development, and overwintering are not known to occur in the project area. In the project area, the majority of individuals will be from the New York Bight DPSs (Kazyak et al. 2021). Considering the action area as whole, individuals from all five DPSs may be present.

In summary, we anticipate Atlantic sturgeon to occur in the action area primarily in waters less than 50 m depth during the spring, summer, and fall, including waters transited by project vessels moving to and from marinas in New Bedford, MA and ports in Cape Cod Bay.

5.4 Consideration of Federal, State, and Private Activities in the Action Area

In the nearshore portions of the action area including the marinas from which vessels will transit, dredging and in water construction regularly occur, including dock, pier, and wharf maintenance and construction. Dredging and in water construction is subject to a number of regulations. There are a number of ESA section 7 consultations that have been completed for such activities in the action area; no serious injury or mortality of any ESA listed whales, sea turtles, or sturgeon are anticipated to occur from dredging or dock, pier, and wharf maintenance or construction in the action area over the life of the proposed action.

Fishing Activity in the Action Area

Commercial and recreational fishing occurs throughout the action area. The project area and vessel transit routes occupy a portion of NMFS statistical areas 514, 526, 525, 534, 537, 541, 542 613, 615, and 616, (see, https://www.fisheries.noaa.gov/resource/map/greater-atlantic-region-statistical-areas). Commercial fishing in the U.S. EEZ portion of the action area is authorized by the individual states or by NMFS under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Fisheries that operate pursuant to the MSA have undergone consultation pursuant to section 7 of the ESA. These biological opinions are available online (available at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-biological-opinions-greater-atlantic-region).

Given that fisheries occurring in the action area are known to interact with large whales, the past and ongoing risk of entanglement in the action area is considered here. The degree of risk in the future may change in association with fishing practices and accompanying regulations.
It is important to note that in nearly all cases, the location where a whale first encountered entangling gear is unknown and the location reported is the location where the entangled whale was first sighted. The risk of entanglement in fishing gear to large whales in the action area appears to be low given the low interaction rates in the U.S. EEZ as a whole.

We have reviewed the most recent data available on reported entanglements for the ESA-listed whales that occur in the action area (Hayes et al. 2023, 2022, 2021, and 2020 and Henry et al.

2022). As reported in Hayes et al. (2022), for the most recent 5-year period of review (2015-2019) in the U.S. Atlantic, the minimum rate of serious injury or mortality resulting from fishery interactions was 1.45/year for fin whales, 0.4 for sei whales. For the period 2016-2020, the annual detected (observed) human-caused mortality and serious injury for right whales averaged 5.7 entanglements per year (Hayes et al. 2023). The minimum rate of serious injury or mortality resulting from fishery interaction is zero for sperm whales as reported in the most recent SAR for blue whales and sperm whales in the North Atlantic (Hayes et al. 2020). Hayes et al. (2020) notes that no confirmed fishery-related mortalities or serious injuries of sei whales have been reported in the NMFS Sea Sampling bycatch database and that a review of the records of stranded, floating, or injured sei whales for the period 2015 through 2019 on file at NMFS found 3 records with substantial evidence of fishery interaction causing serious injury or mortality. Hayes et al. (2020), reports that sperm whales have not been documented as bycatch in the observed U.S. Atlantic commercial fisheries. No confirmed fishery-related mortalities or serious injuries of fin whales have been reported in the NMFS Sea Sampling bycatch database and a review of the records of stranded, floating, or injured fin whales for the period 2015 through 2019 with substantial evidence of fishery interactions causing injury or mortality are captured in the total observed incidental fishery interaction rate reported above (Hayes et al. 2022).

We also reviewed available data that post-dates the information presented in the most recent stock assessment reports. As explained in the Section 4.2 *Status of the Species* of this Opinion, there is an active UME for North Atlantic right whales[20]. Of the 123 right whales in the UME, 9 mortalities are attributed to entanglement as well as 31 serious injuries and 39 sublethal injuries. Eight of the whales recorded as part of the UME were first documented in the action area[21]. Two of these were on Georges Bank, a female on 08/09/2017 and an unknown sex animal on 10/14/2018. One female was documented in Cape Cod Bay on 04/13/2017. Four whales were documented near Nantucket/Martha’s Vineyard; a male in advanced decay on 08/06/2017, an unknown sex animal in advanced decay on 11/26/2017, a male in moderate decay on 08/27/2018, and a female in moderate decay on 01/28/2024. A male was also found in advanced decay in Buzzards Bay on 10/23/2017. We reviewed information on serious injury and mortalities reported in Henry et al. (2022); ix live right whales were first documented as entangled in waters off the coast of southern Massachusetts; right whale 3139 was documented showing entanglement related injuries (without gear currently present) on July 4, 2017 approximately 1.5 nm south of Nantucket, MA, right whale 4091 was documented as free-swimming with a line trailing from it on May 12, 2018 approximately 53.7 nm east of Chatham, MA. North Atlantic right whale 3208 was observed injured without gear present on December 1, 2018, 30.8 nm south of Nantucket, MA. On December 20, 20218, right whale 2310 was observed swimming with gear through the mouth 238.5 nm southeast of Nantucket, MA, and on December 27, 2018, right whale 3950 was observed with new, healed injuries without gear present and was located 16.3 nm south of Nantucket, MA. North Atlantic right whale 3466 was seen swimming 20.03 nm south of Nantucket, MA on December 21, 2019. It was free-swimming, but multiple lines were seen around the mouth and trailed behind the whale for approximately 1 body length, and subsequent sightings indicated the gear was shed successfully with evidence of healing injuries.

[20] Information in this paragraph related to the UME is available at: *https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2021-north-atlantic-right-whale-unusual-mortality-event*; last accessed on February 26, 2024

[21] https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=e502f7daf4af43ffa9776c17c2aff3ea; last accessed February 26, 2024

It is unknown where these entanglements actually occurred. Henry et al. (2022) includes no records of entangled fin, sei, blue, or sperm whales first reported in waters between Long Island, NY to Nantucket Shoals. Henry et al. (2022) presented three documented human-caused mortality events for North Atlantic right whales in the coastal area between Long Island, NY and Martha's Vineyard, MA since 2016. The first was the right whale 4681 located near Morris Island, MA (southeast of Cape Cod) on May 3, 2016 due to sharp trauma. The following two were unknown whales on August 6, 2017 and August 25, 2018 and both were near Martha's Vineyard, MA. The whale found on August 6, 2017 had no gear present, but showed signs of constriction associated with gear and evidence of subsequent hemorrhaging, and similarly the whale found on August 25, 2018 had no gear present, but showed evidence of acute entanglement surrounding the pectoral area as well as hemorrhaging.

Given the co-occurrence of fisheries and large whales in the action area, it is assumed that there have been entanglements in the action area in the past and that this risk will persist at some level throughout the six field sampling seasons for the project. However, it is important to note a number of initiatives with the goal of reducing risk of fisheries operations on ESA-listed whales including ongoing implementation of the Atlantic Large Whale Take Reduction Plan (ALWTRP). The goal of the ALWTRP is to reduce injuries and deaths of large whales due to incidental entanglement in fishing gear. The ALWTRP is an evolving plan that changes as NMFS learns more about why whales become entangled and how fishing practices might be modified to reduce the risk of entanglement. It has several components including restrictions on where and how gear can be set; research into whale populations and whale behavior, as well as fishing gear interactions and modifications; outreach to inform and collaborate with fishermen and other stakeholders; and a large whale disentanglement program that seeks to safely remove entangling gear from large whales whenever possible. All states that regulate fisheries in the U.S. portion of the action area codify the ALWTRP measures into their state fishery regulations.

Atlantic sturgeon are captured as bycatch in trawl and gillnet fisheries. An analysis of the Northeast Fisheries Observer Program/at-sea monitoring (NEFOP/ASM) bycatch data from 2000-2015 (ASMFC 2017) found that most trips that encountered Atlantic sturgeon were in depths less than 20 meters and water temperatures between 45-60°F. Average mortality in bottom otter trawls was 4% and mortality averaged 30% in gillnets (ASMFC 2017). Incidental capture of Atlantic sturgeon in commercial fisheries is expected to continue in the action area throughout the six field sampling seasons for the project. While the rate of encounter is low and survival is relatively high (96% in otter trawls and 70% in gillnets), bycatch is expected to be the primary source of mortality of Atlantic sturgeon in the action area.

Sea turtles are vulnerable to capture in trawls as well as entanglement in gillnets and vertical lines. Leatherback sea turtles are particularly vulnerable to entanglement in vertical lines. Since 2005, 379 leatherbacks have been reported entangled in vertical lines in the Northeast Region. In response to high numbers of leatherback sea turtles found entangled in the vertical lines of fixed gear in the Northeast Region, NMFS established the Northeast Atlantic Coast Sea Turtle Disentanglement Network (STDN). Formally established in 2002, the STDN is an important component of the National Sea Turtle Stranding and Salvage Network. The STDN works to reduce serious injuries and mortalities caused by entanglements and is active throughout the action area responding to reports of entanglements. Where possible, turtles are disentangled and may be brought back to rehabilitation facilities for treatment and recovery. This helps to reduce the rate of death from entanglement. For all fisheries for which there is a fishery management plan (FMP) or for which any federal action is taken to manage that fishery, the impacts have been evaluated via an ESA section 7 consultation. Past consultations have addressed the effects of federally permitted fisheries on ESA-listed species, sought to minimize the adverse impacts of the action on ESA-listed species, and, when appropriate, have authorized the incidental taking of these species. Incidental capture and entanglement of sea turtles is expected to continue in the action area at a similar rate throughout the six field sampling seasons for the project. Safe release and disentanglement protocols help to reduce the severity of impacts of these interactions and these efforts are expected to continue over the life of the project.

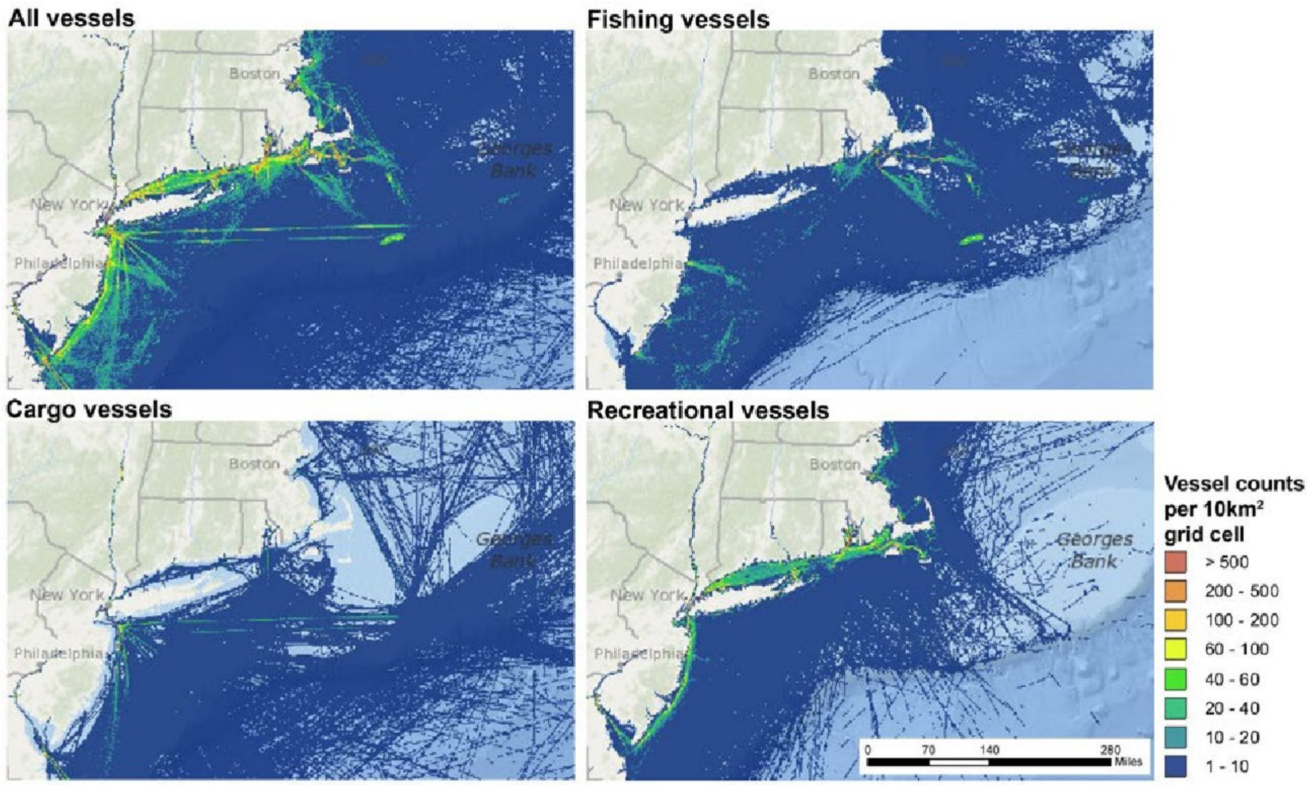
Vessel Operations

The action area is used by a variety of vessels ranging from small recreational fishing vessels to large commercial cargo vessels. Commercial vessel traffic in the action area includes research, tug/barge, and search-and-rescue vessels, and commercial fishing vessels.

In the BE, CFF reports on vessel traffic in the action area based on AIS data. Based on this data, the most common type of vessels transiting in the action area are commercial fishing, recreational, and cargo vessels (Figure 5.7.2). The action area includes New Bedford, one of the busiest commercial fishing ports in the United States (NMFS 2022), and the Nantucket to Ambrose Traffic Separation Scheme. The levels of all types of vessel traffic are also higher near the entrances to the Cape Cod Canal where project vessels will make trips to test ropeless camera systems in Cape Cod Bay. Vessel Monitoring System (VMS) data also shows that the action area has a high level of fishing effort (Figure 5.7.3).

To comply with the North Atlantic Right Whale Vessel Strike Reduction Rule (50 CFR 224.105), all vessels greater than or equal to 65 ft. (19.8 m) in overall length and subject to the jurisdiction of the United States and all vessels greater than or equal to 65 ft. in overall length entering or departing a port or place subject to the jurisdiction of the United States must slow to speeds of 10 knots or less in Seasonal Management Areas (SMA). The Block Island SMA overlaps with the portion of the action area where surveys will be conducted. The Mid-Atlantic SMAs are the southern vicinity of the action area but do not overlap with the action area. All vessels 65 feet or longer that transit through the SMAs from November 1 – April 30 each year (the period when SMAs are active) must operate at 10 knots or less. Mandatory speed restrictions of 10 knots or less are required in all of the SMAs along the U.S. East Coast during times when right whales are likely to be present; a number of these SMAs (Block Island SMA, Cape Cod Bay SMA, and New York SMA) overlap with the portion of the action area that may be used by project vessels. The purpose of this regulation is to reduce the likelihood of deaths and serious injuries to these endangered whales that result from collisions with ships. On August 1, 2022, NMFS published proposed amendments to the North Atlantic Right Whale Vessel Strike reduction Rule (87 FR 46921). The proposed rule would: (1) modify the spatial and temporal boundaries of current speed restriction areas referred to as SMAs, (2) include most vessels greater than or equal to 35 ft. (10.7 m) and less than 65 ft. (19.8 m) in length in the size class subject to speed restriction, (3) create a Dynamic Speed Zone framework to implement mandatory speed restrictions when whales are known to be present outside active SMAs, and (4)

Figure 5.7.2. 2021 vessel traffic based on AIS data. Vessel traffic data sets are from the Northeast Ocean Data Portal (https://www.northeastoceandata.org/). Vessel traffic data is based on Automatic Identification System (AIS) records from vessels required to use an AIS system, with data aggregated into 100m x 100m grid squares. Vessels in this data set include fishing vessels, tankers, other cargo vessels, recreational vessels, passenger transport vessels, and tug boats.



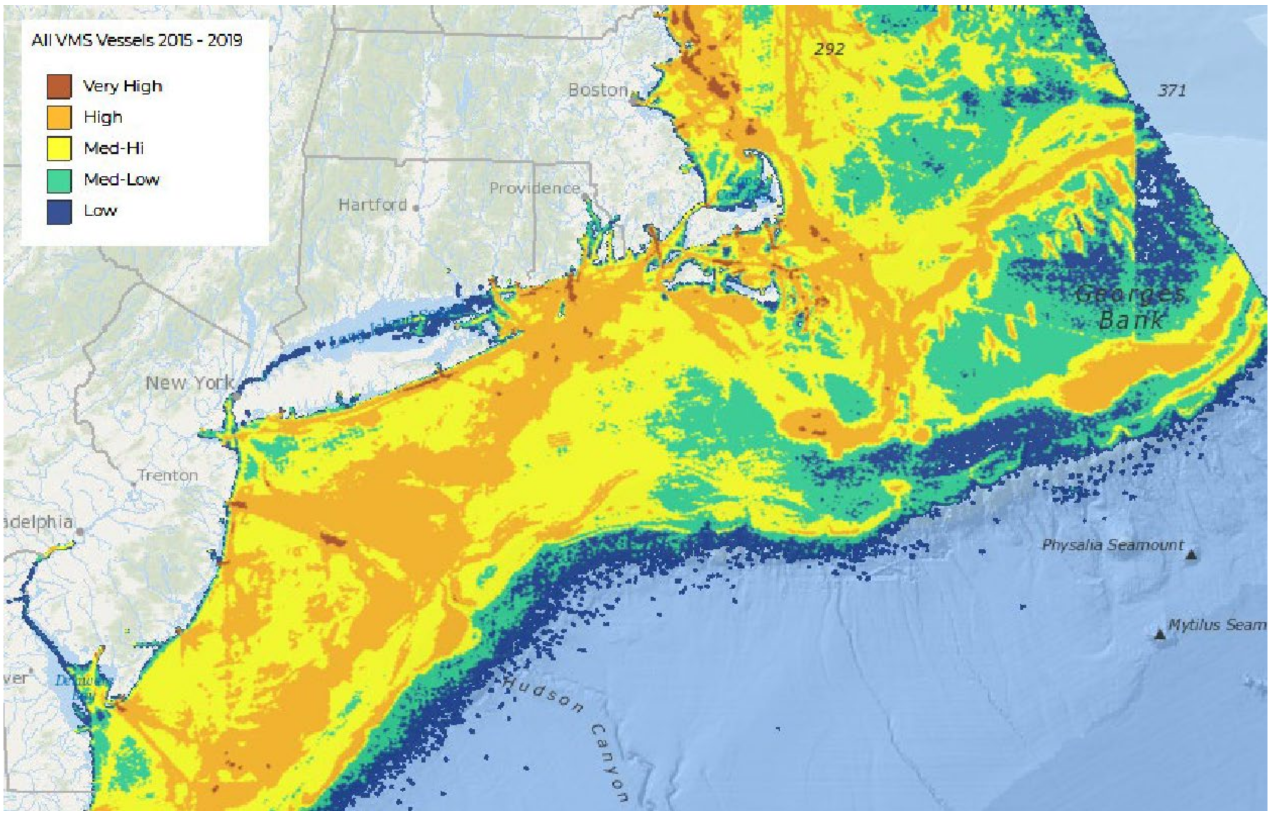
update the speed rule's safety deviation provision. Changes to the speed regulations are proposed to reduce vessel strike risk based on a coast-wide collision mortality risk assessment and updated information on right whale distribution, vessel traffic patterns, and vessel strike mortality and serious injury events. To date, the rule has not been finalized.

Restrictions are in place on how close vessels can approach right whales to reduce vessel-related impacts, including disturbance. NMFS rulemaking (62 FR 6729, February 13, 1997) restricts vessel approach to right whales to a distance of 500 yards. This rule is expected to reduce the potential for vessel collisions and other adverse vessel-related effects in the environmental baseline. The Mandatory Ship Reporting System (MSR) requires ships entering the northeast and southeast MSR boundaries to report the vessel identity, date, time, course, speed, destination, and other relevant information. In return, the vessel receives an automated reply with the most recent right whale sightings or management areas and information on precautionary measures to take while in the vicinity of right whales.

SMAs are supplemented by Dynamic Management Areas (DMAs) that are implemented for 15-

day periods in areas in which right whales are sighted outside of SMA boundaries (73 FR 60173; October 10, 2008). DMAs can be designated anywhere along the U.S. eastern seaboard, including the action area, when NOAA aerial surveys or other reliable sources report aggregations of three or more right whales in a density that indicates the whales are likely to persist in the area.

Figure 5.7.3. 2015-2019 VMS data summarizing commercial fishing activity across the action area. Commercial fishing vessels over 20 m in length must comply with VMS regulations. VMS data set is from the Northeast Ocean Data Portal (https://www.northeastoceandata.org/).



DMAs are put in place for two weeks in an area that encompass an area commensurate to the number of whales present. Mariners are notified of DMAs via email, the internet, Broadcast Notice to Mariners (BNM), NOAA Weather Radio, and the Mandatory Ship Reporting system (MSR). NOAA requests that mariners navigate around these zones or transit through them at 10 knots or less. In 2021, NMFS supplemented the DMA program with a new Slow Zone program, which identifies areas for recommended 10-knot speed reductions based on acoustic detection of right whales. Together, these zones are established around areas where right whales have been recently seen or heard, and the program provides maps and coordinates to vessel operators indicating areas where they have been detected. Compliance with these zones is voluntary.

Atlantic sturgeon, sea turtles, and ESA-listed whales are all vulnerable to vessel strike, although the risk factors and areas of concern are different. Vessels have the potential to affect animals through strikes, sound, and disturbance by their physical presence.

As reported in Hayes et al. 2022, for the most recent 5-year period of review (2015-2019) in the North Atlantic, the minimum rate of serious injury or mortality resulting from vessel interactions is 0.40/year for fin whales, and 0.2 for sei whales. As reported in Hayes et al. (2023), for the most recent 5-year period of review (2016-2020) in the North Atlantic, the minimum rate of serious injury or mortality resulting from vessel interactions is 2.4/year for right whales. No vessel strikes for blue or sperm whales have been documented (Hayes et al. 2020). A review of available data on serious injury and mortality determinations for blue, sei, fin, and sperm whales for 2000-2020 and right whales for 2000-2023 (Henry et al. 2022, UME website as cited above), includes no records of whales that were first detected in the action area. The nearest records identified in the UME are four right whales documented in 2017, 2018, and 2024 in moderate to advanced decomposition off the southern coast of Martha's Vineyard[22]. Hayes et al. (2021) reports three vessel struck sei whales first documented in the U.S. Northeast – all three were discovered on the bow of vessels entering port (two in the Hudson River and one in the Delaware River); no information on where the whales were hit is available. Hayes et al. (2020) reports only four recorded ship strikes of sperm whales. In May 1994, a ship-struck sperm whale was observed south of Nova Scotia (Reeves and Whitehead 1997), in May 2000, a merchant ship reported a strike in Block Canyon and in 2001, and the U.S. Navy reported a ship strike within the EEZ (NMFS, unpublished data). In 2006, a sperm whale was found dead from ship-strike wounds off Portland, Maine. A similar rate of strike is expected to continue in the action area over the life of the project and we expect vessel strike will continue to be a source of mortality for right, sei, fin, and sperm whales in the action area. As outlined above, there are a number of measures that are in place to reduce the risk of vessel strikes to large whales that apply to vessels that operate in the action area.

NMFS' Sea Turtle Stranding and Salvage Network (STSSN) database provides information on records of stranded sea turtles in the region. The STSSN database was queried for records of stranded sea turtles with evidence of vessel strike throughout the waters of Atlantic New Jersey (NJ coast not including Delaware Bay) north through Cape Cod, MA to overlap with the area where all of the project vessel traffic will occur. Out of the 513 recovered stranded sea turtles in the region surrounding the action area during the most recent 10 year period (2013-2022) for which data was available, there were 405 recorded sea turtle vessel strikes, primarily between the months of August and November.

Atlantic sturgeon are struck and killed by vessels in at least some portions of their range. There are no records of vessel strike in the action area. Risk is thought to be highest in areas with reduced opportunity for escape and from vessels operating at a high rate of speed or with propellers large enough to entrain sturgeon. A summary of information on vessel strikes of Atlantic sturgeon in the region around the action area is provided in the Section 4.2 *Status of the Species* of this Opinion.

Underwater Noise

The ESA-listed species that occur in the action area are regularly exposed to several sources of sounds in the action area. Ambient noise includes the combination of biological, environmental, and anthropogenic sounds occurring within a particular region. In temperate marine

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[22] https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=e502f7daf4af43ffa9776c17c2aff3ea; last accessed 3/11/24

environments including the action area, major contributors to the overall acoustic ambient noise environment include the combination of surface wave action (generated by wind), weather events such as rain, lightning, marine organisms, and anthropogenic sound sources. Anthropogenic sources include, but are not limited to maritime activities, vessel sounds, seismic surveys (exploration and research), and marine construction (dredging and pile-driving as well as the construction, operation, and decommissioning of offshore structures). These activities occur to varying degrees throughout the year. Many researchers have described behavioral responses of marine mammals to sounds produced by boats and vessels, as well as other sound sources such as dredging and construction (reviewed in Gomez et al. 2016; Nowacek et al. 2007). Most observations have been limited to short-term behavioral responses, which included avoidance behavior and temporary cessation of feeding, resting, or social interactions; however, in terrestrial species habitat abandonment can lead to more long-term effects, which may have implications at the population level (Barber et al. 2010). Cetaceans generate and rely on sound to navigate, hunt, and communicate with other individuals and anthropogenic sound can interfere with these important activities (Nowacek et al. 2007). Noise generated by human activity has the potential to affect sea turtles as well, although effects to sea turtles are not well understood. ESA-listed species may be impacted by either increased levels of anthropogenic-induced background sound or high intensity, short- term anthropogenic sounds.

Despite the potential for these impacts to affect individual ESA-listed marine mammals and sea turtles, information is not currently available to determine the potential population level effects of anthropogenic sound levels in the marine environment (MMC 2007). For example, we currently lack empirical data on how sound impacts growth, survival, reproduction, and vital rates, nor do we understand the relative influence of such effects on the population being considered. As a result, the consequences of anthropogenic sound on ESA-listed marine mammals and sea turtles at the population or species scale remain uncertain, although recent efforts have made progress establishing frameworks to consider such effects (NAS 2017).

The project area lies within a dynamic ambient noise environment, with natural background noise contributed by natural wind and wave action, a diverse community of vocalizing cetaceans, and other organisms. Anthropogenic noise sources, including commercial shipping traffic in high-use shipping lanes in proximity to the action area, also contribute ambient sound.

Studies provide additional ambient underwater noise measurements within the action area. Kraus et al. (2016) surveyed the ambient underwater noise environment in the RI/MA and MA WEAs, within the action area, as part of a broader study of large whale and sea turtle use of marine habitats in the WEAs. Acoustic monitoring sensor locations in and around the RI/MA and MA WEAs had water depths ranging from approximately 98 to 197 ft (30 to 60 m), similar to the Project area, where water depths vary from 43 to 112 ft (13 to 34 m). Depending on location, ambient underwater sound levels within the RI/MA and MA WEAs varied from 96 to 103 dB in the 70.8- to 224-Hertz frequency band at least 50% of the recording time, with peak ambient noise levels reaching as high as 125 dB in proximity to the Narraganset Bay and Buzzards Bay shipping lanes (Kraus et al. 2016). Similar to the conclusions of Rice et al. (2014) for New Jersey, low-frequency sound from large marine vessel traffic in these and other major shipping lanes to the east (Boston Harbor) and south (New York) were the dominant sources of underwater noise in the RI/MA and MA WEAs.

Short-term increases in noise in the action area associated with vessel traffic and other activities, including geotechnical and geophysical surveys that have taken place in the past and will continue in the future in the portions of the action area that overlap with other offshore wind lease areas and/or potential cable routes. Exposure to these noise sources can result in temporary masking or temporary behavioral disturbance; however, in all cases, these effects are expected to be temporary and short-term (e.g., the seconds to minutes it takes for a vessel to pass by) and not result in any injury or mortality in the action area.

Military Operations
Military operations in the action area are expected to be restricted to vessel transits, the effects of which are subsumed in the discussion of vessel strikes above.

Scientific Surveys
Numerous scientific surveys, including fisheries and ecosystem surveys carried out by NMFS operate in the action area. Regulations issued to implement Section 10(a)(1)(A) of the ESA allow issuance of permits authorizing take of ESA-listed species for the purposes of scientific research (50 CFR 17.22; 50 CFR 17.32). Prior to the issuance of such a permit, an ESA section 7 consultation must take place. No permit can be issued unless the proposed research is determined to be not likely to jeopardize the continued existence of any listed species. Scientific research permits are issued by NMFS for ESA-listed whales and Atlantic sturgeon; the U.S. Fish and Wildlife Service is the permitting authority for ESA-listed sea turtles.

Marine mammals, sea turtles, and Atlantic sturgeon have been the subject of field studies for decades. The primary objective of most of these field studies has generally been monitoring populations or gathering data for behavioral and ecological studies. Research on ESA-listed whales, sea turtles, and Atlantic sturgeon has occurred in the action area in the past and is expected to continue over the life of the proposed action. Authorized research on ESA-listed whales includes close vessel and aerial approaches, photographic identification, photogrammetry, biopsy sampling, tagging, ultrasound, exposure to acoustic activities, breath sampling, behavioral observations, passive acoustic recording, and underwater observation. No lethal interactions are anticipated in association with any of the permitted research. ESA-listed sea turtle research includes approach, capture, handling, restraint, tagging, biopsy, blood or tissue sampling, lavage, ultrasound, imaging, antibiotic (tetracycline) injections, laparoscopy, and captive experiments. Most authorized take is sub-lethal with limited amounts of incidental mortality authorized in some permits (i.e., no more than one or two incidents per permit and only a few individuals overall). Authorized research for Atlantic sturgeon includes capture, collection, handling, restraint, internal and external tagging, blood or tissue sampling, gastric lavage, and collection of morphometric information. Most authorized take of Atlantic sturgeon for research activities is sub-lethal with small amounts of incidental mortality authorized; a programmatic ESA section 7 consultation was issued in 2017 that identifies a limit on lethal take for each river population (NMFS OPR 2017); depending on the identified health of the river population, the allowable mortality limit, across all issued permits, ranges from 0.4 to 0.8%. In that 2017 biological opinion, NMFS determined this was not likely to jeopardize the continued existence of any DPS.

Marine Debris and Pollution

Whales, sea turtles, and Atlantic sturgeon are exposed to a number of other stressors in the action area that are widespread and not unique to the action area which makes it difficult to determine to what extent these species may be affected by past, present, and future exposure within the action area. These stressors include water quality and marine debris. Marine debris in some form is present in nearly all parts of the world's oceans, including the action area. While the action area is not known to aggregate marine debris as occurs in some parts of the world (e.g., The Great Pacific garbage patch, also described as the Pacific trash vortex, a gyre of marine debris particles in the north central Pacific Ocean), marine debris, including plastics that can be ingested and cause health problems in whales and sea turtles is expected to occur in the action area.

The project area is located in offshore marine waters where available water quality data are limited. Broadly speaking, ambient water quality in these areas is expected to be generally representative of the regional ocean environment and subject to constant oceanic circulation that disperses, dilutes, and biodegrades anthropogenic pollutants from upland and shoreline sources (BOEM 2013).

Ocean waters beyond 3 miles (4.8 km) offshore typically have low concentrations of suspended particles and low turbidity. Waters along the Northeast U.S. coast average 5.6 milligrams per liter (mg/L) of total suspended solids (TSS), which is considered low. While most ocean waters had TSS concentrations under 10 mg/L, which is the 90th percentile of all measured values, most estuarine waters (65.7% of the Northeast Coast area) had TSS concentrations above this level. Near-bottom TSS concentrations were similar to those near the water surface, averaging 6.9 mg/L. All coastal ocean stations had near-bottom levels of TSS less than or equal to 16.3 mg/L (EPA 2012).

A study conducted by the EPA evaluated over 1,100 coastal locations in 2010, as reported in their National Coastal Condition Assessment (EPA 2015). The EPA used a Water Quality Index (WQI) to determine the quality of various coastal areas including the northeast coast from Virginia to Maine and assigned three condition levels for a number of constituents: good, fair, and poor. A number of the sample locations overlap with the action area. Chlorophyll concentrations, an indicator of primary productivity, levels in northeastern coastal waters were generally rated as fair (45%) to good (51%) condition, and stations in the action area were all also fair to good (EPA 2015). Nitrogen and phosphorous levels in northeastern coastal waters generally rated as fair to good (13% fair and 82% good for nitrogen and 62% fair and 26% good for phosphorous); stations in the action area were all also fair to good (EPA 2015). Dissolved oxygen levels in northeastern coastal waters are generally rated as fair (14%) to good (80%) condition, with consistent results for the sampling locations in the action area. Based on the available information, water quality in the action area appears to be consistent with surrounding areas. We are not aware of any discharges to the action area that would be expected to result in adverse effects to listed species or their prey. Outside of conditions related to climate change, discussed in Section 6.7, water quality is not anticipated to negatively affect listed species that may occur in the action area.

Consideration of Construction, Operation, and Decommissioning of Offshore Wind Projects

We have completed ESA consultation for 11 offshore wind projects to date. Complete information on the assessment of effects of these 11 projects is found in their respective Biological Opinions (South Fork Wind - NMFS 2021a, Vineyard Wind 1 - NMFS 2021b, CVOW - NMFS 2016, and Block Island - NMFS 2014, Ocean Wind – NMFS 2023a, CVOW – NMFS 2023b, Empire Wind – NMFS 2023c, Revolution Wind – NMFS 2023d, Sunrise Wind – 2023e, Atlantic Shores South – 2023f, New England Wind – NMFS 2024). The Block Island and CVOW-Research projects have been constructed and turbines are operational. Construction of the Vineyard Wind 1 is ongoing and expected to be completed during the CFF project. The South Fork, Vineyard Wind 1, Revolution Wind, Sunrise Wind, and New England Wind lease areas are in the MA or RI/MA WEAs and are within the action area, along with the Empire Wind lease area in the action area. We provide more information below on the projects in the action area.

In the Opinions prepared for these projects, we anticipated temporary loss of hearing sensitivity (Temporary Threshold Shift - TTS) and/or short term behavioral disturbance of ESA-listed sea turtles and whales exposed to pile driving noise or UXO detonations resulting in take that meets the ESA definition of harassment and, in a few cases, anticipated permanent loss of hearing sensitivity (Permanent Threshold Shift - PTS) resulting in take that meets the definition of harm. The amount of incidental take exempted through project Opinions is included below for the projects that occur in the action area (Tables 5.7.1 and 5.7.2). In the Biological Opinions prepared for the offshore wind projects considered to date, we anticipated short term behavioral disturbance of ESA listed sea turtles and whales exposed to pile driving noise. In these Opinions, we concluded that effects of operational noise would be insignificant. With the exception of the gillnet interactions noted above, the only mortality anticipated is a small number of sea turtles and Atlantic sturgeon expected to be struck and injured or killed by vessels associated with the South Fork, Vineyard Wind 1, Empire Wind, Revolution Wind, Sunrise Wind, and New England Wind projects.

Table 5.7.1. Summary of available Incidental Take Statements (ITS) regarding project noise (pile driving and/or UXO detonations) for the following completed offshore wind consultations. Note that not all construction periods overlap.

South Fork Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Impact and Vibratory Pile Driving)		
Species	Harm (Auditory Injury - PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	10
Fin Whale	1	15
Sei Whale	1	2
Sperm whale	None	3
NA DPS green sea turtle	None	6
Kemp’s ridley sea turtle	None	6

Leatherback sea turtle	None	8
NWA DPS Loggerhead sea turtle	None	6
Vineyard Wind 1 - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Maximum Impact Scenario; Impact Pile Driving Only)		
Species	Harm (Auditory Injury - PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	20
Fin whale	5	5
Sei Whale	2	2
Sperm whale	None	None
NWA DPS Loggerhead sea turtle	None	3
NA DPS green sea turtle	None	1
Kemp's ridley sea turtle	None	1
Leatherback sea turtle	None	7
Revolution Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Exposure to Noise (UXO Detonation and Impact Pile Driving)		
Species	Harm (Auditory Injury - PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	34
Fin whale	None	33
Sei Whale	None	16
Sperm whale	None	5
Blue whale	None	2
NA DPS green sea turtle	None	8
Kemp's ridley sea turtle	None	7
Leatherback sea turtle	None	7
NWA DPS Loggerhead sea turtle	None	15
Empire Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Impact Pile Driving Only)		
Species	Harm (Auditory Injury - PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	22
Fin whale	6	190

Sei Whale	None	5
Sperm whale	None	6
NA DPS green sea turtle	None	1
Kemp’s ridley sea turtle	None	9
Leatherback sea turtle	None	2
NWA DPS Loggerhead sea turtle	None	96
Sunrise Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Impact Pile Driving Only)		
Species	Harm (Auditory Injury - PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	23
Fin whale	4	55
Sei Whale	2	22
Sperm whale	None	10
Blue whale	None	2
NA DPS green sea turtle	None	1
Kemp’s ridley sea turtle	None	1
Leatherback sea turtle	4	9
NWA DPS Loggerhead sea turtle	None	7
New England Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Impact Pile Driving Only)		
Species	Harm (Auditory Injury - PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	74
Blue Whale	2	4
Fin whale	33	352
Sei Whale	6	49
Sperm whale	None	96
NA DPS green sea turtle	1	2
Kemp’s ridley sea turtle	None	2
Leatherback sea turtle	7	12
NWA DPS Loggerhead sea turtle	3	17

Source: New England Wind – NMFS 2024, Empire Wind – NMFS 2023c, Revolution Wind –

NMFS 2023d, Sunrise Wind – 2023e, South Fork Wind - NMFS 2021a, and Vineyard Wind 1 - NMFS 2021b.

Table 5.7.2. Summary of available Incidental Take Statements (ITS) regarding vessel strikes for the following completed offshore wind consultations. The amount of take identified is over the life of the project (construction, operations, and decommissioning).

South Fork Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
NA DPS green sea turtle	1
Kemp's ridley sea turtle	1
Leatherback sea turtle	7
NWA DPS Loggerhead sea turtle	3
Vineyard Wind 1 - Amount and Extent of Take Identified in the BiOp's ITS Due to Vessel Strike	
Species	Serious Injury or Mortality
NWA DPS Loggerhead sea turtle	17
NA DPS green sea turtle	2
Kemp's ridley sea turtle	2
Leatherback sea turtle	20
Revolution Wind -Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
North Atlantic DPS green sea turtle	1
Kemp's ridley sea turtle	1
Leatherback sea turtle	5
Northwest Act DPS Loggerhead sea turtle	6
Empire Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
North Atlantic DPS green sea turtle	1
Kemp's ridley sea turtle	3
Leatherback sea turtle	4
Northwest Atlantic DPS Loggerhead sea turtle	22
Sunrise Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	

Species	Serious Injury or Mortality
North Atlantic DPS green sea turtle	1
Kemp's ridley sea turtle	1
Leatherback sea turtle	5
Northwest Atlantic DPS Loggerhead sea turtle	6
New England Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
North Atlantic DPS green sea turtle	2
Kemp's ridley sea turtle	2
Leatherback sea turtle	22
Northwest Atlantic DPS Loggerhead sea turtle	28
NYB DPS Atlantic Sturgeon	1

Source: New England Wind – NMFS 2024, Empire Wind – NMFS 2023c, Revolution Wind – NMFS 2023d, Sunrise Wind – 2023e, South Fork Wind - NMFS 2021a, and Vineyard Wind 1 - NMFS 2021b.

6.0 EFFECTS OF THE ACTION

This section of the biological opinion assesses the effects of the proposed action on threatened or endangered species and designated critical habitat. Effects of the action are all consequences to 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. 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 and § 402.17).

The activities associated with the proposed action include the survey activities and the use of project vessels to carry out those surveys. Here, we examine the activities associated with the proposed action and determine what the consequences of the proposed action are to listed species and critical habitat in the action area. 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. In analyzing effects, we evaluate whether a source of impacts is "likely to adversely affect" listed species/critical habitat or "not likely to adversely affect" listed species/critical habitat. A "not likely to adversely affect" determination is appropriate when an effect is expected to be discountable, insignificant, or completely beneficial. As discussed in the FWS-NMFS Joint Section 7 Consultation Handbook (1998), "[b]eneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. If an effect is beneficial, discountable, or insignificant it is not considered adverse and thus cannot cause "take" of any listed species. “Take” means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct” (ESA §3(19)).

6.1 Effects of Project Vessels

In this section we consider the effects of the operation of project vessels on listed species in the action area by describing the existing vessel traffic in the action area (i.e., as previously summarized in the *Environmental Baseline,* Section 5.0 of this Opinion), estimating the anticipated increase in vessel traffic associated with the project, and then analyzing risk and determining likely effects to listed whales, sea turtles, and Atlantic sturgeon. In Section 3.0 *Description of the Proposed Action* of this Opinion we described proposed vessel use over the duration of the proposed action; that information is summarized here.

There will be limited vessel traffic associated with the proposed action. A total of 20 port-to-port vessel trips (each individual vessel will leave from and return to the same port, staying at sea for the length of the trip) will occur over the four-year project period. As explained in Section 3.0, 18 vessel trips would originate primarily from New Bedford, MA, with an additional two total trips from either Woods Hole, Fairhaven, Sandwich, or Duxbury (all located in MA); all vessels will travel directly to the survey site. The associated vessel trips to conduct testing and surveying activities over the four year project period are summarized in Table 6.1.1.

6.1.1 Project Vessel Description and Increase in Vessel Traffic from the Proposed Action

Descriptions of project vessel use and traffic are described in Section 3.0 of this Opinion and summarized here for reference. Between 8 and 13 different vessels in three classes will be used during the project. Each vessel will be on the water for a maximum of 16 days-at-sea (DAS) per testing or survey period across all activities (103-107 total DAS during the 20 overall trips over the four years of the project).

Table 6.1.1. Potential Ports and Estimated Total Number of Vessels and Trips to Conduct Project Activities. Trips are all Port-to-port.

Activity	Vessels	Port	Vessel Survey Speed	Vessel Transit Speed	Length of Trip	Number of Trips	Coverage/ Deployments
HabCam Sonar Testing	80-110 ft. commercial scallop vessel (1 vessel)	New Bedford, MA	4.5-5.0 knots	<10 knots	8-10 days	2	1200 nm combined
HabCam Surveys (with Sonar)	80-110 ft. commercial scallop vessel (1-2 vessels)	New Bedford, MA	4.5-5.0 knots	<10 knots	4 days	5	220 nm
Ropeless Camera Testing	25-40 ft commercial lobster	Fairhaven, Woods Hole,	N/A	<10 knots	<1 day	2	5 deployments per trip, <2.5 hrs per day in

	vessels (1-2 vessels)	Sandwich, or Duxbury, MA					water
Stationary Camera Surveys	65-110 commercial scallop vessels (3-5 vessels)	New Bedford, MA	2.5-5.5 knots	<10 knots	7 days	5	45-50 deployments per trip (1 camera per 40 km^2)
Video Trawl Testing	80-110 ft commercial scallop vessel (1 vessel)	New Bedford, MA	2.8-3.0 knots	<10 knots	5 days	1	40 hours, 120 nm
Video Trawl Surveys	80-110 ft commercial scallop vessel (1-2 vessels)	New Bedford, MA	2.8-3.0 knots	<10 knots	5 days	5	40 hours, 120 nm

Of the 20 trips, 18 will occur between the Port of New Bedford and the Mid-Atlantic Bight offshore New Jersey and New York, south of Long Island, southern New England, eastern Georges Bank, and north through Buzzards Bay (Figure 3.4.1). The remaining two trips will occur between harbors in Fairhaven, Woods Hole, or Duxbury and Western Cape Cod Bay. Five of these trips (HabCam Surveys with sonar) would occur regardless of the proposed action (the vessels would be undertaking the HabCam surveys, absent the sonar, as addressed in the 2023 NEFSC Opinion). As explained in Section 5.0 *Environmental Baseline*, the best available information indicates there are approximately 172,267 vessel tracks (individual paths by boats with tracking systems) annually in the area including Georges Bank and the Mid-Atlantic Bight regions and the wind lease areas where the majority of the project's vessel transits will overlap and, based on the USCG MA RI Port Access Route Study, approximately 46,900 unique vessel transits through the action area in an average year (USCG MARI PARS 2020). Given the small number of vessel trips attributable to the proposed action, this vessel traffic represents an extremely small, near zero, increase over baseline vessel traffic.

Mitigation and Monitoring Measures for Vessels Included in the Proposed Action
There are a number of measures that DOE and CFF are proposing to take that are designed to avoid, minimize, or monitor effects of the action on ESA-listed species throughout the four year duration of the project. These measures are fully described in Section 3.3 and can be grouped into two main categories: vessel speed reductions and increased vigilance/animal avoidance. Specific measures related to vessel speed reduction include that all vessels regardless of size will travel at 10 knots at all times, including transit to and from port. Additionally, at all times of the year regardless of vessel size, visual observers will monitor a vessel strike avoidance zone and if an animal is spotted, the vessel must slow down and take action to transit safely away from or around the animal. During surveys, vessels will be traveling at speeds under 5.5 knots (see Table 6.1.1). Monitoring measures will also include the integration of sighting communication tools, such as Whale Alert, to establish a situational awareness network for marine mammal and sea turtle detections. To minimize risk to whales, vessel operators will maintain a distance of 100-m from all whales, and 500-m from North Atlantic right whales. Vessels will also comply with all

North Atlantic right whale related vessel speed regulations and separation distances. These measures are all considered part of the proposed action and can be found in Section 3.0 *Description of the Proposed Action*.

6.1.2 Vessel Noise

ESA Listed Whales

The frequency range for vessel noise (10 to 1000 Hz; MMS 2007) overlaps with the generalized hearing range for sei, fin, and right whales (7 Hz to 35 kHz) and sperm whales (150 Hz to 160 kHz) and would therefore be detectable by these species. Marine mammals may experience masking due to vessel noises. For example, right whales were observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks et al. 2007a) as well as increasing the amplitude (intensity) of their calls (Parks et al. 2011a; Parks et al. 2009). Right whales also had their communication space reduced by up to 84 percent in the presence of vessels (Clark et al. 2009a). Although humpback whales did not change the frequency or duration of their vocalizations in the presence of ship noise, their source levels were lower than expected, potentially indicating some signal masking (Dunlop 2016).

Vessel noise can potentially mask vocalizations and other biologically important sounds (e.g., sounds of prey or predators) that marine mammals may rely on. Potential masking can vary depending on the ambient noise level within the environment, the received level and frequency of the vessel noise, and the received level and frequency of the sound of biological interest. In the open ocean, ambient noise levels are between about 60 and 80 dB re 1 μPa in the band between 10 Hz and 10 kHz due to a combination of natural (e.g., wind) and anthropogenic sources (Urick 1983a), while inshore noise levels, especially around busy ports, can exceed 120 dB re 1 μPa. Areas with increased levels of ambient noise from anthropogenic noise sources such as shipping lanes and near harbors and ports may cause sustained levels of masking for marine mammals, which could reduce an animal's ability to find prey, find mates, socialize, avoid predators, or navigate. When the noise level is above the sound of interest, and in a similar frequency band, masking could occur. This analysis reasonably assumes that any sound that is above ambient noise levels and within an animal's hearing range may potentially cause masking. However, the degree of masking increases with increasing noise levels; a noise that is just detectable over ambient levels is unlikely to cause any substantial masking.

Vessel noise has the potential to disturb marine mammals and elicit an alerting, avoidance, or other behavioral reaction. These reactions are anticipated to be short-term, likely lasting the amount of time the vessel and the whale are in close proximity (Magalhaes et al. 2002; Richardson et al. 1995d; Watkins 1981a), and not consequential to the animals. We also note that we do not anticipate any project vessels to occur within close proximity of any sighted ESA-listed whales; regulations prohibit vessels from approaching right whales closer than 500 meters and the vessel strike avoidance measures identified in Section 3.0 *Description of the Proposed Action* are expected to ensure no project vessels operate in close proximity to any whales in the action area. However, short-term masking could occur. Masking by project vessels operating in the action area would be short term and intermittent, and limited to the few seconds that it takes a whale and vessel to pass each other; therefore, effects of masking on the ability of a whale to detect environmental cues or communicate are extremely unlikely to occur.

Based on the best available information, ESA-listed whales in the action area are either not likely to respond to project vessel noise or, in the case of masking, effects are extremely unlikely to occur. Therefore, the effects of vessel noise on ESA-listed whales if they occur are likely to be so small that they cannot be meaningfully measured, detected or evaluated and therefore insignificant.

Sea Turtles
ESA-listed sea turtles could be exposed to a range of vessel noises within their hearing range (30 Hz to 2 kHz). Depending on the context of exposure, potential responses of green, Kemp's ridley, leatherback, and loggerhead sea turtles to vessel noise disturbance, would include startle responses, avoidance, or other behavioral reactions, and physiological stress responses. Very little research exists on sea turtle responses to vessel noise disturbance. Currently, there is nothing in the available literature specifically aimed at studying and quantifying sea turtle response to vessel noise. However, a study examining vessel strike risk to green sea turtles suggested that sea turtles may habituate to vessel sound and may be more likely to respond to the sight of a vessel rather than the sound of a vessel, although both may play a role in prompting reactions (Hazel et al. 2007). Regardless of the specific stressor associated with vessels to which turtles are responding, they only appear to show responses (avoidance behavior) at approximately 10 m or closer (Hazel et al. 2007).

Therefore, the noise from vessels is not likely to affect sea turtles from further distances, and disturbance may only occur if a sea turtle hears a vessel nearby or sees it as it approaches. These responses appear limited to non-injurious, minor changes in behavior based on the limited information available on sea turtle response to vessel noise.

For these reasons, vessel noise is expected to cause minimal disturbance to sea turtles in the action area. If a sea turtle detects a vessel and avoids it or has a stress response from the noise disturbance, these responses are expected to be temporary and only occur while the vessel operates in the area where the sea turtle encountered it. Therefore, sea turtle responses to vessel noise disturbance are considered insignificant (i.e., so minor that the effect cannot be meaningfully evaluated), and a sea turtle would be expected to return to normal behaviors and stress levels shortly after the vessel passes by.

Atlantic Sturgeon
In general, information regarding the effects of vessel noise on fish hearing and behaviors is limited. Some TTS has been observed in fishes exposed to elevated background noise and other white noise, a continuous sound source similar to noise produced from vessels. Caged studies on sound pressure sensitive fishes show some TTS after several days or weeks of exposure to increased background sounds, although the hearing loss appeared to recover (e.g., Scholik and Yan 2002; Smith et al. 2006; Smith et al. 2004b). Smith et al. (2004b) and Smith et al. (2006) exposed goldfish (a fish with hearing specializations, unlike any of the ESA-listed species considered in this opinion) to noise with a sound pressure level of 170 dB re 1 μPa and found a clear relationship between the amount of TTS and duration of exposure, until maximum hearing loss occurred at about 24 hours of exposure. A short duration (e.g., 10-minute) exposure resulted

in 5 dB of TTS, whereas a three-week exposure resulted in a 28 dB TTS that took over two weeks to return to pre-exposure baseline levels (Smith et al. 2004b). Recovery times were not measured by researchers for shorter exposure durations, so recovery time for lower levels of TTS was not documented.

Vessel noise may also affect fish behavior by causing them to startle, swim away from an occupied area, change swimming direction and speed, or alter schooling behavior (Engas et al. 1998; Engas et al. 1995; Mitson and Knudsen 2003). Physiological responses have also been documented for fish exposed to increased boat noise. Nichols et al. (2015b) demonstrated physiological effects of increased noise (playback of boat noise) on coastal giant kelpfish. The fish exhibited acute stress responses when exposed to intermittent noise, but not to continuous noise. These results indicate variability in the acoustic environment may be more important than the period of noise exposure for inducing stress in fishes. However, other studies have also shown exposure to continuous or chronic vessel noise may elicit stress responses indicated by increased cortisol levels (Scholik and Yan 2001; Wysocki et al. 2006). These experiments demonstrate physiological and behavioral responses to various boat noises that have the potential to affect species' fitness and survival, but may also be influenced by the context and duration of exposure. It is important to note that most of these exposures were continuous, not intermittent, and the fish were unable to avoid the sound source for the duration of the experiment because this was a controlled study. In contrast, wild fish are not hindered from movement away from an irritating sound source, if detected, so are less likely to be subjected to accumulation periods that lead to the onset of hearing damage as indicated in these studies. In other cases, fish may eventually become habituated to the changes in their soundscape and adjust to the ambient and background noises.

All fish species can detect vessel noise due to its low-frequency content and their hearing capabilities. Because of the characteristics of vessel noise, sound produced from vessels is extremely unlikely to result in direct injury, hearing impairment, or other physiological impacts to Atlantic sturgeon. Thus, fish are expected to react to vessel noise through avoidance behaviors. Depending on frequency, auditory masking due to vessel noise could mask biologically important sounds that fish may rely on (to the extent that any particular fish species rely on auditory cues). However, impacts from vessel noise would be intermittent, temporary, and localized, and given that Atlantic sturgeon are not known to rely on auditory cues to avoid threats or to communicate, it is extremely unlikely that masking would have any biologically meaningful effects on any individual.

Therefore, if any Atlantic sturgeon are exposed to vessel noise the anticipated effects are limited to minor and temporary behavioral responses such as a startle or brief movements away from the noise source. Vessel noise would only result in brief periods of exposure for fishes and would not be expected to accumulate to the levels that would lead to any injury or hearing impairment. We also do not anticipate any effects of masking of biologically relevant auditory cues. The effects of exposure to vessel noise will be so minor that they cannot be meaningfully measured, detected, or evaluated. Therefore, the effects of vessel noise on Atlantic sturgeon are insignificant.

6.1.3 Assessment of Risk of Vessel Strike

Here, we consider the risk of vessel strike to ESA-listed species from the vessel transits that are part of the proposed action. This assessment incorporates the strike avoidance measures identified in Section 3.0 and summarized above, because they are considered part of the proposed action or are otherwise required by regulation. This analysis is organized by species group (i.e., whales, sea turtles, and Atlantic sturgeon) because the risk factors and effectiveness of strike avoidance measures are different for the different species groups.

6.1.3.1 ESA-Listed Whales

Project vessels will represent an extremely small portion of the vessel traffic traveling in waters off the coast of Massachusetts, New York, and New Jersey (less than 0.01% annually). As described in more detail in Section 5.4 *Environmental Baseline*, the vessel traffic in the action area is predominantly pleasure and fishing vessels, which are similar ships in size and speed to the ones that will be used during the proposed project.

We have determined that it is extremely unlikely that a whale would be struck by any of the survey vessels. This is due to the small number of vessel transits (20 over a 4-year period) and the operational characteristics of the survey vessels. The small number of trips and small number of days that the vessels will be operating, makes the potential for co-occurrence with a whale extremely small. No project vessels are expected to operate at speeds over 10 knots, including during transits, and will be operating at much slower speeds during survey and testing activities (5.5 knots or less depending on survey type). As such, at all times, the project vessels will be in compliance with measures that NMFS has determined minimize the potential for ship strike (i.e., operating at 10 knots or less). Additionally, a number of measures designed to reduce the likelihood of striking marine mammals including ESA-listed large whales, particularly North Atlantic right whales, are included as part of the proposed action. These measures include vessel operators and crews receiving protected species identification and avoidance training, as well as all vessel operators and crews maintaining a vigilant watch for all marine mammals and executing additional slow down and avoidance procedures when sightings occur. These measures, combined with the slow operating speeds, are expected to enable the detection of any ESA-listed whale that may be in the path of a project vessel with enough time to allow for vessel operators to avoid any such whales.

In summary, we expect that the extremely small and intermittent increase in vessel traffic that will result from the proposed action, the slow transit speeds (not exceeding 10 knots), and additional measures to detect and avoid whales, will make it extremely unlikely that a project vessel will strike a whale. Therefore, effects are discountable.

6.1.3.2 Sea Turtles

Background Information on the Risk of Vessel Strike to Sea Turtles

While research is limited on the relationship between sea turtles, ship collisions, and ship speeds, sea turtles are at risk of vessel strike where they co-occur with vessels. Sea turtles are vulnerable to vessel collisions because they regularly surface to breathe, and often rest at or near the surface. Sea turtles, with the exception of hatchlings and pre-recruitment juveniles, spend a majority of their time submerged (Renaud and Carpenter 1994; Sasso and Witzell 2006). Although, Hazel et al. (2007) demonstrated sea turtles preferred to stay within the three meters of the water's surface, despite deeper water being available. Any of the sea turtle species found in the action area can occur at or near the surface in open-ocean and coastal areas, whether resting, feeding or periodically surfacing to breathe. Therefore, all ESA-listed sea turtles considered in the biological opinion are at risk of vessel strikes.

A sea turtle's detection of a vessel is likely based primarily on the animal's ability to see the oncoming vessel, which would provide less time to react to as vessel speed increases (Hazel et al. 2007), however, given the low vantage point of a sea turtle at the surface it is unlikely they are readily able to visually detect vessels at a distance. Hazel et al. (2007) examined vessel strike risk to green sea turtles and suggested that sea turtles may habituate to vessel sound and are more likely to respond to the sight of a vessel rather than the sound of a vessel, although both may play a role in eliciting responses (Hazel et al. 2007). Regardless of what specific stressor associated with vessels turtles are responding to, they only appear to show responses (avoidance behavior) at approximately 10 m or closer (Hazel et al. 2007). This is a concern because faster vessel speeds also have the potential to result in more serious injuries (Work et al. 2010). Although sea turtles can move quickly, Hazel et al. (2007) concluded that at vessel speeds above 4 km/hour (2.1 knots) vessel operators cannot rely on turtles to actively avoid being struck. Thus, sea turtles are not considered reliably capable of moving out of the way of vessels moving at speeds greater than 2.1 knots.

Stranding networks that keep track of sea turtles that wash up dead or injured have consistently recorded vessel propeller strikes, skeg strikes, and blunt force trauma as a cause or possible cause of death (Chaloupka et al. 2008). Vessel strikes can cause permanent injury or death from bleeding or other trauma, paralysis and subsequent drowning, infection, or inability to feed. Apart from the severity of the physical strike, the likelihood and rate of a turtle's recovery from a strike may be influenced by its age, reproductive state, and general condition at the time of injury. Much of what has been documented about recovery from vessel strikes on sea turtles has been inferred from observation of individual animals for some duration of time after a strike occurs (Hazel et al. 2007; Lutcavage et al. 1997). In the U.S., the percentage of strandings that were attributed to vessel strikes increased from approximately 10 percent in the 1980s to a record high of 20.5 percent in 2004 (USFWS 2007). In 1990, the National Research Council estimated that 50-500 loggerhead and 5-50 Kemp's ridley sea turtles were struck and killed by boats annually in waters of the U.S. (NRC 1990). The report indicates that this estimate is highly uncertain and could be a large overestimate or underestimate.

Vessel strike has been identified as a threat in recovery plans prepared for all sea turtle species in the action area. As described in the Recovery Plan for loggerhead sea turtles (NMFS and USFWS 2008), propeller and collision injuries from boats and ships are common in sea turtles. From 1997 to 2005, 14.9% of all stranded loggerheads in the U.S. Atlantic and Gulf of Mexico were documented as having sustained some type of propeller or collision injuries although it is not known what proportion of these injuries were post or ante-mortem. The proportion of vessel-struck sea turtles that survive is unknown. In some cases, it is not possible to determine whether documented injuries on stranded animals resulted in death or were post-mortem injuries. However, the available data indicate that post-mortem vessel strike injuries are uncommon in stranded sea turtles. Based on data from off the coast of Florida, there is good evidence that when vessel strike injuries are observed as the principle finding for a stranded turtle, the injuries were both ante-mortem and the cause of death (Foley et al 2019). Foley et al. (2019) found that the cause of death was vessel strike or probable vessel strike in approximately 93% of stranded turtles with vessel strike injuries. Sea turtles found alive with concussive or propeller injuries are frequently brought to rehabilitation facilities; some are later released and others are deemed unfit to return to the wild and remain in captivity. Sea turtles in the wild have been documented with healed injuries so at least some sea turtles survive without human intervention. As noted in NRC (1990), the regions of greatest concern for vessel strike are outside the action area and include areas with high concentrations of recreational-boat traffic such as the eastern Florida coast, the Florida Keys, and the shallow coastal bays in the Gulf of Mexico. In general, the overall risk of strike for sea turtles in the Northwest Atlantic is considered greatest in areas with high densities of sea turtles and small, fast moving vessels such as recreational vessels (NRC 1990). This combination of factors in the action area is limited to nearshore areas in the southern extent of the action area, well outside the lease area and the transit routes to New Bedford, MA where the vast majority of vessel traffic will occur.

Exposure Analysis – Sea Turtles
We queried the NMFS' Sea Turtle Stranding and Salvage Network (STSSN) database for records of sea turtles with injuries consistent with vessel strike (recorded as definitive vessel and blunt force trauma in the database) from just north of Delaware Bay in New Jersey covering the Atlantic coast of the state (labeled as Atlantic NJ) through Duxbury, MA from 2013 to 2022. The results from this query are presented in Table 6.1.2.1.

While we recognize that some vessel strikes may be post-mortem, the available data indicate that post-mortem vessel strike injuries are uncommon in stranded sea turtles (Foley et al. 2019). Based on the findings of Foley et al. (2019) that found vessel strike was the cause of death in 93% of strandings with indications of vessel strike, to estimate the number of interactions where vessel strike was the cause of death we first added the number of "definitive vessel" and "blunt force trauma" cases and then calculated 93% of the total.

Table 6.1.2.1. Preliminary STSSN cases from 2013 to 2022 with evidence of propeller strike or probable vessel collision in New Jersey and estimated presumed vessel mortalities.

Sea Turtles	Total Records	Definitive Vessel	Blunt Force Trauma	Total Presumed Vessel Mortalities *
Loggerhead	784	245	69	293
Green	56	18	3	20
Leatherback	367	118	25	133
Kemp's	35	23	10	31

*93% of the total vessel plus blunt force trauma
Source: STSSN (February 2024) (Atlantic NJ through Duxbury, MA)

The data in Table 6.1.2.1 are only based on observed stranding records, which represent only a portion of the total at-sea mortalities of sea turtles. Sea turtle carcasses typically sink upon death, and float to the surface only when enough accumulation of decomposition gasses cause the body to bloat (Epperly et al., 1996). Though floating, the body is still partially submerged and acts as a drifting object. The drift of a sea turtle carcass depends on the direction and intensity of local currents and winds. As sea turtles are vulnerable to human interactions such as fisheries bycatch and vessel strike, a number of studies have estimated at-sea mortality of marine turtles and the influence of nearshore physical oceanographic and wind regimes on sea turtle strandings. Although sea turtle stranding rates are variable, they may represent as low as five percent of total mortalities in some areas but usually do not exceed 20 percent of total mortality, as predators, scavengers, wind, and currents prevent carcasses from reaching the shore (Koch et al. 2013). Strandings of dead sea turtles from fishery interaction have been reported to represent as low as seven percent of total mortalities caused at sea (Epperly et al. 1996). Remote or difficult to access areas may further limit the amount of strandings that are observed. Because of the low probability of stranding under different conditions, determining total vessel strikes directly from raw numbers of stranded sea turtle data would vary between regions, seasons, and other factors such as currents.

To estimate unobserved vessel strike mortalities within the action area, we relied on available estimates from the literature. Based on data reviewed in Murphy and Hopkins-Murphy (1989), only six of 22 loggerhead sea turtle carcasses tagged within the South Atlantic and Gulf of Mexico region were reported in stranding records, indicating that stranding data represent approximately 27 percent of at-sea mortalities. In comparing estimates of at-sea fisheries induced mortalities to estimates of stranded sea turtle mortalities due to fisheries, Epperly et al. (1996) estimated that strandings represented 7 to13 percent of all at-sea mortalities.

Based on these two studies, both of which include waters of the U.S. East Coast, stranding data likely represent 7 to 27 percent of all at-sea mortalities. While there are additional estimates of the percent of at-sea mortalities likely to be observed in stranding data for locations outside the action area (e.g., Peckham et al. 2008, Koch et al. 2013), we did not rely on these since stranding rates depend heavily on beach survey effort, current patterns, weather, and seasonal factors among others, and these factors vary greatly with geographic location (Hart et al. 2006). Thus, based on the mid-point between the lower estimate provided by Epperly et al. (1996) of seven percent, and the upper estimate provided by Murphy and Hopkins-Murphy (1989) of 27 percent, we assume that the STSSN stranding data represent approximately 17 percent of all at sea mortalities. This estimate closely aligns with an analysis of drift bottle data from the Atlantic Ocean by Hart et al. (2006), which estimated that the upper limit of the proportion of sea turtle carcasses that strand is approximately 20 percent.

To estimate the annual average vessel strike mortalities corrected for unobserved vessel strike mortalities, we adjusted our calculated total presumed vessel mortality with the detection value of 17%. The resulting, adjusted number of vessel strike mortalities over the 10 years of data of each species for the action area are below. In using the 17 percent correction factor, we assume that all sea turtle species and at-sea mortalities are equally likely to be represented in the STSSN dataset. That is, sea turtles killed by vessel strikes are just as likely to strand or be observed at sea and be recorded in the STSSN database (i.e., 17 percent) as those killed by other activities, such as interactions with fisheries, and the likelihood of stranding once injured or killed does not vary by species.

Table 6.1.2.2. Estimated Annual Vessel Strike Mortalities Corrected for Unobserved Vessel

Strike Mortalities in the Action Area (Atlantic NJ through Duxbury, MA).

Sea Turtles	Presumed Vessel Mortalities Over 10 years	Total Over 10 Years (17% detection rate)	Annual Total presumed vessel mortalities*
Loggerhead	293	1,724	173
Green	20	118	12
Leatherback	133	783	79
Kemp's ridley	31	183	19

*93% of the total vessel plus blunt force trauma, calculated in Table 6.1.2.2

In the BE, DOE indicates that there will be up to 18 trips total to and from the Port of New Bedford, MA and 2 trips total from Fairhaven, Woods Hole, Sandwich, or Duxbury, MA. These trips will occur over a 4-year period. Project vessels have the greatest chance to co-occur with sea turtles during the summer months in the nearshore waters and in inlets with ocean access. As explained above in Section 5.0 *Environmental Baseline*, over 46,900 vessel transits a year occur in the action area. Considering the potential trips in the action area, project vessels will represent an extremely small increase above the baseline vessel traffic (i.e., less than 0.01%). If we assume a proportional increase in vessel strikes for sea turtles with an increase in vessel traffic, we would predict a near zero, 0.01%, increase in vessel strikes as a result of the survey vessel traffic. Using the annual total presumed vessel mortalities in the table above and increasing those by 0.01% results in tiny, near zero fractions of sea turtles (e.g., for loggerheads the number of mortalities annually would increase from 173 to 173.017). Given this extremely small and close to zero increase, we consider any increased risk of vessel strike to be extremely small.

Based on this analysis, given the extremely small, near zero, increase in vessel traffic and associated extremely small increase in subsequent risk, effects of this increase in traffic resulting in vessel strikes of any sea turtles is extremely unlikely; therefore, effects are discountable.

6.1.3.3 Atlantic Sturgeon

The distribution of Atlantic sturgeon overlaps with the entirety of the action area. The marine range of Atlantic sturgeon extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida with distribution largely from shore to the 50m depth contour (ASMFC 2006; Stein et al. 2004). Atlantic sturgeon may occur in nearshore waters (depths less than 50 m) and some inlets that may be transited by project vessels. While Atlantic sturgeon are known to be struck and killed by vessels in rivers and in estuaries adjacent to spawning rivers (i.e., Delaware Bay), we have no reports of vessel strikes in the marine environment generally or the action area specifically. We have considered whether Atlantic sturgeon are likely to be struck by project vessels. As established elsewhere in this Opinion, Atlantic sturgeon use of the action area is intermittent and disperse. The dispersed nature of Atlantic sturgeon in this area means that the potential for co-occurrence between a project vessel and an Atlantic sturgeon in time and space is extremely low.

In order to be struck by a vessel, an Atlantic sturgeon needs to co-occur with the vessel hull or propeller in the water column. Given the depths in the vast majority of the marine waters that will be transited by project vessels (with the exception of near shore areas where vessels will dock at ports along the coast of MA) and that sturgeon typically occur at or near the bottom while in the marine environment, the potential for co-occurrence of a vessel and a sturgeon in the water column is extremely low even if a sturgeon and vessel co-occurred generally. The areas identified in this section to be transited by the project vessels are free flowing with no obstructions; this further reduces the potential for co-occurrence which further reduces the potential for strike. The nearshore areas at the ports along the coast of MA where vessels will enter shallower water and dock are not known to be used by Atlantic sturgeon or Atlantic sturgeon use is expected to be rare; as such, co-occurrence between any Atlantic sturgeon and any project vessels in areas near these landfall sites with shallow water or constricted waterways where the risk of vessel strike is theoretically higher, is extremely unlikely to occur. Considering this analysis, it is extremely unlikely that any project vessels operating in the action area or transiting in marine waters will strike an Atlantic sturgeon during any phase of the proposed project. Therefore, effects to Atlantic sturgeon of project vessels operating in this portion of the action area are discountable.

6.2 Artificial Light

All of the optical survey gear being used for the project includes artificial lights. All lights are white lights with contributions across the color spectrum. The HabCam v3 has four strobe lights that fire 5-7 times per second as the vehicle travels at 4.5-5 knots. The video trawl uses 2-4 dive lights that are on continuously as the trawl is towed at 2.8-3 knots. The stationary anchored camera units include two LED lights. These lights may be turned on for the 60-90 minute deployments at each survey station. To conserve battery power over long deployments, the lights will not be used on the ropeless systems that are deployed for 5-6 days. The first two survey trips with the stationary cameras will test the impacts of lights on the resulting relative abundance estimates of the project target fish species. While unexpected, any changes in detection rates of protected species will also be noted and reported.

The impacts of artificial underwater lights on most marine species are poorly studied and poorly understood. Most of the existing research studies have been conducted to limit mortalities from anthropogenic causes like river dams and commercial fishing (Wang et al. 2007, Gless et al. 2008, Poletto et al. 2014, Ford et al. 2018, Warraich et al. 2020). Research investigating the use of lights to deter sturgeon from interacting with manmade structures in rivers have presented conflicting evidence that white sturgeon and green sturgeon (Acipenser medirostris) are attracted to underwater lights (Poletto et al. 2014, Ford et al. 2018). Research on the impacts of the lightsticks used on longlines and their relationship to sea turtle bycatch have also led to conflicting results that may be species dependent (Warraich et al. 2020). Loggerhead sea turtles may be attracted to the lightsticks used on pelagic longlines (Wang et al. 2007), but lightsticks do not impact leatherback bycatch rates (Gless et al. 2008). Shore-based lights in areas with sea turtle nesting beaches are known to disrupt sea turtle hatchling orientation toward the water, providing evidence that sea turtles can be attracted to artificial light sources when their behaviors depend on natural light fields that have been altered by anthropogenic light pollution (Salmon 2003).

Light exposures will be short and/or mobile, and while research suggests that sturgeon and sea turtles may be attracted to artificial light in some situations, there is both a low likelihood of exposure of individual sea turtles or sturgeon to project lighting because the species would have to co-occur in the areas with the mobile lighting sources and remain in the area of the lighting sources to be exposed and no evidence that brief exposures would have any consequences. There is also no information to suggest that there would be any consequences to any ESA listed whales exposed to survey lighting. As such, effects to individual listed whales, sturgeon, or sea turtles from exposure to the lights on the survey equipment are extremely unlikely to occur, and therefore, discountable.

6.3 Effects of HabCam Surveys

CFF will deploy the front facing Teledyne Blueview M459 sonar system on seven RSA scallop surveys that would otherwise occur with the HabCam v3 system. As explained above, these surveys (minus the sonar) have been evaluated in the 2023 NEFSC Opinion where NMFS concluded that the HabCam surveys were not likely to adversely affect any ESA listed species. Here, we consider the effects of the 7 survey trips where the sonar will be deployed.

During survey operations, the HabCam is towed off a commercial scallop vessel via a tether at target speeds of 4.5-5.0 knots while "flown" at altitudes of 1.5 to 2.5 meters off the bottom. Two trips to test the sonar and five trips to conduct surveys using the sonar will occur between Atlantic sea scallop grounds in the Mid-Atlantic Bight and on Georges Bank (green shading in Figure 3.4.1). Each of the two sonar testing trips will be 8-10 days and cover approximately 1,200 nm between the two trips. Each of the five HabCam survey trips will be four days long, covering roughly 220 nautical miles of track line per trip in the southern New England portion of the action area (red shading in Figure 3.4.1). Surveys will occur at night and during the day.

The tether connecting the HabCam v3 vehicle to the survey vessel will be present in the entire depth of the water column during these surveys but entanglement risk will be minimized because the tether from the vessel to the HabCam v3 vehicle is stiff and under tension during tows. No risk of entanglement was determined in the 2023 NEFSC Opinion and there are no changes to the equipment that would change that determination for the seven survey events considered here.

Noise from Sonar Testing

Sounds from front-facing sonar systems are categorized as non-impulsive directional sounds (Ruppel et al. 2022). The sonar system operates at a frequency of 450 kHz at roughly 180 dB re 1 μPa at 1 m (Martin et al. 2021, Ruppel et al. 2022). The sonar being added to the HabCam v3 operates within the range of many fish finders and other sonar systems used on commercial and recreational fishing vessels (Martin et al. 2021). The frequency of the sonar (450 kHz) is well above the hearing threshold of any ESA listed whales, sea turtles, or fish. As such, even if an individual was exposed to the sonar there would be no effect as the noise could not be perceived.

Based on the information presented in DOE's BE and summarized here, there will be no effects to any ESA listed species resulting from deployment and operation of the sonar on the HabCam surveys. Therefore, there will be no effects beyond those considered in the 2023 NEFSC Opinion.

6.4 Effects of Stationary Camera Surveys

CFF plans to conduct camera surveys in the action area during the testing season and each of the five field survey seasons. Planned equipment includes an anchored stationary camera and six on-demand (ropeless) cameras. Up to six on-demand (ropeless) cameras will be deployed within a 1,800 km^2 area and set to record for the duration of the survey (5 days). While the ropeless cameras are deployed, the anchored camera system will be deployed for short-periods of time at selected locations in the same general area.

As described in Section 3.1.2, the cameras will have a frame, a small (15 lb) mushroom anchor, and trawl ball floats to suspend the camera frame. Both camera system frames will have boxes with bait (squid and/or mackerel) one meter from the cameras. All camera surveys will be conducted during daylight hours only. Effects to benthic disturbance from the mushroom anchor are discussed in Section 6.5. The ropeless cameras will use modified on-demand lobster traps for retrieval, eliminating the need for a persistent vertical line connecting the trap to the surface. Since there will be no lines in the water except for the brief period during retrieval, which will be monitored, there is not considered to be any entanglement risk for any ESA-listed species.

The anchored camera system will have a vertical line that is attached to a buoy and high flyer at the surface. The vertical line will be 3/8" sinking line and scopes will range from 1.5:1 to 2:1. The vertical line will incorporate the use of weak links and weak rope (engineered to break at 1,700 pounds [771 kg] or less). The anchored stationary camera will be deployed for 60-90 minutes at a time and will be continuously monitored by the deployment vessel then retrieved and deployed at another location. The deployment of the anchored stationary camera will be repeated 45-50 times over the 7 days at sea per survey period within a discrete portion of the action area (red shading in Figure 3.4.1).

Despite the general concerns about the risk of entanglement for ESA-listed species due to buoy and anchor lines, we have determined that entanglement of ESA-listed species in the vertical lines associated with the stationary anchored camera surveys is extremely unlikely to occur. This is because the limited number of vertical lines (1 total), the short soak times (60 to 90 minutes), and pre-deployment and continued observation for ESA-listed species makes it extremely unlikely that any ESA-listed species will encounter the vertical line at any point during the survey period. Additionally, if an ESA listed species is detected near the survey station, the camera would either not be deployed or it would be immediately retrieved. Together, these measures make it extremely unlikely that any ESA listed species would encounter the line. Additionally, the spring stationary camera surveys will be conducted in May which is outside the time of year when right whale presence is greatest in the area and outside the time when the area is closed to fishing gear with vertical lines and surface buoys (February 1 – April 30).

Based on the analysis presented here, entanglement of any species during any of the camera surveys is extremely unlikely to occur, therefore the effects are discountable.

6.5 Effects of Bottom Trawl Surveys

CFF will conduct trawl surveys over six field testing and surveying seasons (April/May 2024, Spring and Fall 2025, Spring 2026, Spring and Fall 2027) over the four-year project duration to test video imagery that can be used to assess groundfish stocks over large distances. The majority of these surveys will be open-codend surveys where the trawl net will be continuously towed for up to 9 hours at a time (for a total of 40 hours per survey) and monitored via video feed. At towing speed (2.8-3.0 knots), the mean door spread of the net is 61 m and the mean wing spread is 15 m. Up to 30% of these surveys will be closed codend tows to calibrate the video system. All closed codend surveys will be less than 20 minutes in duration. All surveys will occur in daylight hours only and operate at 2.8-3.0 knots.

6.5.1 ESA-Listed Whales

Factors Affecting Interactions and Existing Information on Interactions
Entanglement or capture of ESA-listed North Atlantic right, sei, sperm, and fin whales in bottom otter trawl gear is extremely unlikely to occur. While these species may occur in the action area where survey activities will take place, bottom otter trawl gear is not expected to directly affect right and fin whales given that these large cetaceans have the speed and maneuverability to get out of the way of oncoming gear which is towed behind a slow moving vessel (less than 3 knots). There have been no observed or reported interactions of right, sei, sperm, or fin whales with bottom otter trawl gear (NEFSC observer/sea sampling database, unpublished data; GAR Marine Animal Incident database, unpublished data). The slow speed of the trawl gear being towed and the short tow times to be implemented further reduce the potential for entanglement or any other interaction. As a result, we have determined that it is extremely unlikely that any large whale would interact with the trawl survey gear; therefore, effects are discountable.

Effects to Prey
The proposed bottom trawl survey activities will not have any effects on the availability of prey for right and sei whales. Right whales and sei whales feed on copepods (Perry et al. 1999). Copepods are very small organisms that will pass through trawl gear rather than being captured in it. In addition, copepods will not be affected by turbidity created by the gear moving through the water. Fin whales feed on krill and small schooling fish (e.g., sand lance, herring, mackerel) (Aguilar 2002). The trawl gear used in the survey activities operates on or very near the bottom, while schooling fish such as herring and mackerel occur higher in the water column. Sand lance inhabit both benthic and pelagic habitats, however, they typically bury into the benthos and would not be caught in the trawl. Sperm whales feed on deep water species that do not occur in the area to be surveyed. Based on this analysis, effects to right, sei, sperm, and fin whale prey are extremely unlikely to occur.

6.5.3 Sea Turtles

Factors Affecting Interactions and Existing Information on Interactions
Sea turtles forcibly submerged in any type of restrictive gear can eventually suffer fatal consequences from prolonged anoxia and/or seawater infiltration of the lung (Lutcavage and Lutz 1997; Lutcavage et al. 1997). A study examining the relationship between tow time and sea turtle mortality in the shrimp trawl fishery showed that mortality was strongly dependent on trawling duration, with the proportion of dead or comatose sea turtles rising from 0% for the first 50 minutes of capture to 70% after 90 minutes of capture (Henwood and Stuntz 1987). Following the recommendations of the National Resource Council (NRC) to reexamine the association between tow times and sea turtle deaths, the data set used by Henwood and Stuntz (1987) was updated and re-analyzed (Epperly et al. 2002; Sasso and Epperly 2006). Seasonal differences in the likelihood of mortality for sea turtles caught in trawl gear were apparent. For example, the observed mortality exceeded 1% after 10 minutes of towing in the winter (defined in Sasso and Epperly (2006) as the months of December-February), while the observed mortality did not

exceed 1% until after 50 minutes in the summer (defined as March-November; Sasso and Epperly 2006). In general, tows of short duration (<10 minutes) in either season have little effect on the likelihood of mortality for sea turtles caught in the trawl gear and would likely achieve a negligible mortality rate (defined by the NRC as <1%). Longer tow times (up to 200 minutes in summer and up to 150 minutes in winter) result in a rapid escalation of mortality, and eventually reach a plateau of high mortality, but will not equal 100%, as a sea turtle caught within the last hour of a long tow will likely survive (Epperly et al. 2002; Sasso and Epperly 2006). However, in both seasons, a rapid escalation in the mortality rate did not occur until after 50 minutes (Sasso and Epperly 2006) as had been found by Henwood and Stuntz (1987). Although the data used in the NRC reanalysis were specific to bottom otter trawl gear in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries, the authors considered the findings to be applicable to the impacts of forced submergence in general (Sasso and Epperly 2006).

Sea turtle behaviors may influence the likelihood of them being captured in bottom trawl gear. Video footage recorded by the NMFS, Southeast Fisheries Science Center (SEFSC), Pascagoula Laboratory indicated that sea turtles will keep swimming in front of an advancing shrimp trawl, rather than deviating to the side, until they become fatigued and are caught by the trawl or the trawl is hauled up (NMFS 2002). Sea turtles have also been observed to dive to the bottom and hunker down when alarmed by loud noise or gear (Memo to the File, L. Lankshear, December 4, 2007), which could place them in the path of bottom gear such as a bottom otter trawl. There are very few reports of sea turtles dying during research trawls. Based on the analysis by Sasso and Epperly (2006) and Epperly et al. (2002) as well as information on captured sea turtles from past state trawl surveys and the NEAMAP and NEFSC bottom trawl surveys, tow times less than 30 minutes are expected to eliminate the risk of death from forced submergence for sea turtles caught in beam and bottom otter trawl survey gear.

During the spring and fall bottom trawl surveys conducted by the NEFSC from 1963-2017, a total of 85 loggerhead sea turtles were captured. Only one of the 85 loggerheads suffered injuries (cracks to the carapace) causing death. All others were alive and returned to the water unharmed. One leatherback and one Kemp's ridley sea turtle have also been captured in the NEFSC bottom trawl surveys and both were released alive and uninjured. NEFSC bottom trawl survey tows are approximately 30 minutes in duration. All 20 loggerhead, 28 Kemp's ridley, and one green sea turtles captured in the NEAMAP surveys since 2007 have also been released alive and uninjured. NEAMAP surveys operate with a 20-minute tow time. Swimmer et al. (2014) indicates that there are few reliable estimates of post-release mortality for sea turtles because of the many challenges and costs associated with tracking animals released at sea. We assume that post-release mortality for sea turtles in bottom otter trawl gear where tow times are short (less than 30 minutes) is minimal to non-existent unless the turtle is already compromised to begin with. In that case, however, the animal would likely be retained onboard the vessel and transported to a rehabilitation center rather than released back into the water.

Estimating Interactions with and Mortality of Sea Turtles during Closed Codend Tows
As explained above, up to 30% of the total tows will have a closed codend. Considering the approximately 2,400 minutes of total trawl survey tow time described in the BE, and that the closed codend tows would not exceed 20 minutes, we expect 36 20-minute closed codend tows per testing or sampling period for a total of 216 closed codend tows over the 4-year project

duration. We have considered the available data sets to best predict the number of sea turtles that may be incidentally captured in the proposed trawl surveys. The largest and longest duration data sets for surveys in the general area where the CFF trawl surveys will occur are the NEAMAP and NEFSC bottom trawl surveys. Both surveys occur in the spring and fall using trawl gear. The NEAMAP survey area is farther inshore but overlaps with a portion of the CFF surveys while the NEFSC survey area occurs farther offshore but also overlaps with the portions of the CFF surveys. We have also considered information on interactions with sea turtles and commercial trawl fisheries available from fisheries observer data (Murray 2020).

Murray (2020) estimated the interaction rates of sea turtles in the US commercial bottom trawl fisheries along the Atlantic coast between 2014-2018 using fisheries observer data. In this analysis, a total of 5,227 days fished were observed from 2014-2018 in bottom trawl fisheries in the Georges Bank and Mid-Atlantic, which represented 13% of commercial trawl fishing effort across both regions. During this period, NEFOP observers documented 50 loggerhead turtle interactions in bottom trawl gear, 48 of which occurred in the Mid-Atlantic; observers also recorded 5 Kemp's ridley turtles, 3 leatherback turtles, and 2 green turtles. These data overlap temporally and spatially with the survey area and the seasons that surveys will occur; however, there are differences in the trawl gear used in commercial fisheries compared to the gear that will be used in the proposed survey. Therefore, because other data sources are available that better align with the proposed surveys, we are not using the interaction rate for commercial trawl fisheries to predict the number of sea turtles likely to be captured in the CFF video trawl surveys. However, we note that the Murray (2020) dataset demonstrates that all the sea turtle species that occur in the survey area are vulnerable to capture in commercial trawl gear.

We reviewed records for sea turtles captured in the NEFSC spring (March-May) and fall (September-October) trawl surveys from 2012-2022 for trawls above 39° N (excluding the Gulf of Maine). This is the geographic area determined to best predict capture rates in a trawl survey carried out in or around the portion of the action area where the trawl surveys will take place. For the 2012-2022 fall surveys, three loggerhead sea turtle captures were documented over 1,716 tows; this is a capture rate of 0.00175 loggerhead sea turtles per tow. The NEFSC surveys did not capture any sea turtles during spring surveys in this geographic area; however, the surveys are conducted in early spring, likely before sea turtles arrive in the area.

Applying the NEFSC trawl survey capture rate of 0.00175 loggerhead sea turtles per tow to the 216 CFF tows resulted in an estimated 0.377 loggerheads captured over the four year period the trawl survey will be conducted. No other sea turtle species have been collected in the NEFSC fall trawl survey.

The CFF video trawl survey will use the same trawl design as the NEAMAP survey carried out by the Virginia Institute of Marine Science (VIMS); the NEAMAP survey area overlaps with a portion of the action area where trawl surveys are proposed. The NEAMAP nearshore trawl survey began in 2007. The majority of captures of sea turtles in the NEAMAP survey (2008-2023) have been loggerheads (56), followed by Kemp's ridley (35). Only one green sea turtle has been captured and there have been no captures of leatherback sea turtles. Using the data from the

NEAMAP surveys (2008-2023) to calculate a rate of sea turtle captures per tow[23] and applying that to the number of closed codend tows estimated for CFF trawl surveys, we estimated the capture of 2.69 loggerheads, 1.68 Kemp's ridley, zero leatherbacks, and 0.048 green sea turtles captured over the four years of trawl surveys.

Given the geographic distribution of the proposed CFF surveys, it is likely that the number of sea turtles captured would fall between the number predicted using the NEFSC dataset and the NEAMAP dataset. However, the generally shallow depths of the area where the CFF surveys will occur suggests that the NEAMAP survey data would be a better predictor of sea turtle interactions than the NEFSC survey which occurs in deeper, more offshore waters. We note that neither survey has ever captured a leatherback sea turtle; therefore, despite Murray (2020) documenting past captures of leatherback sea turtles in commercial trawl gear and predicting future interaction rates, we do not expect the CFF survey to result in the capture of a leatherback sea turtle.

Based on the analysis by Sasso and Epperly (2006) and Epperly et al. (2002) discussed previously, as well as information on captured sea turtles from past state trawl surveys and the NEAMAP and NEFSC trawl surveys (no mortalities or serious injuries reported in either survey), and a 20-minute tow time for the bottom trawl gear when the codend is closed is expected to eliminate the risk of serious injury and mortality from forced submergence for captured sea turtles. The video feed will be monitored continuously while the codend is closed and a designated scientist will be able to document all sea turtles that enter the trawl net. Tows will be stopped immediately and the net will be hauled in to allow for rapid release if any sea turtle is captured in the closed codend.

Using the above estimates and the four year duration of the closed codend portion of the trawl surveys, and rounding up any fractions of sea turtles to whole animals, we estimate up to 3 loggerheads, 2 Kemp's ridley, and 1 green sea turtle will be captured over the entirety of the closed codend trawl survey period (Table 6.5.3.1). We anticipate that all sea turtles will be returned to the water alive and with only minor injury (i.e., potential bruising or scratches/scrapes) and that all injuries will be fully recoverable.

Table 6.5.3.1. Estimated captures of sea turtles by species from the proposed trawl surveys over the four-year duration for closed codend tows.

Species	**Total estimated captures over the 4-year survey period**
Loggerhead	3
Kemp's ridley	2
Green	1
Leatherback	0

[23] Using capture rates of 0.0111 loggerhead per tow, 0.0076 for Kemp's ridley, 0.000 for leatherback, and 0.0002 for green.

Effects of Open Codend Tows

Unlike the closed codend tows, during the open codend tows, any animals that enter the trawl net should pass through the open net. This allows for monitoring of the "catch" by video without needing to haul the net back or handle any animals. The net will otherwise operate the same way as described above, except that the trawl will be of greater duration. During the tows with an open codend, any turtle that does not avoid the net will be overtaken by the net but would be expected to pass through the open codend uninjured. However, during the time in the net sea turtles may try to swim out, interact with the net, or get tired trying to leave the net resulting in temporary capture of the animal for the time it is in the net. The net will be monitored continuously with a live feed and if there is any indication that a sea turtle is entangled in the net or does not escape, the net will be hauled back so that the animal can be safely released.

As with the closed codend tows, data from 2008-2023 from the NEAMAP Near Shore Trawl Program – Southern Segment was used to estimate a rate of sea turtles per tow expected to result in temporary capture before passing through the net that was then applied to the operations of the CFF trawl survey to generate an estimate of the total number of sea turtles expected to temporarily "captured" over the four year survey period. Open codend tows will occur for approximately 1,680 minutes, equivalent to 84 20-minute tows. Applying the interaction rate derived from the NEAMAP survey described above, we calculate 5.88 loggerhead sea turtles, 3.68 Kemp's ridley sea turtles, 0.11 green sea turtles, and 0 leatherback sea turtles will be temporarily captured and eventually pass through the open codend trawl survey.

During the open codend trawls, sea turtles are expected to be able to pass safely and completely through the trawl net. Sea turtles may interact with the net as they pass through or change their swimming behavior in response to the presence of the net, however, we expect the risk of entanglement in the net to be low. The video feed will be designed to document all sea turtles that pass through the trawl net and if a sea turtle is not seen passing safely and completely through the codend, the open codend tow will be immediately terminated and the net will be hauled back in to allow for rapid release of any sea turtle caught in the net. Because this is a novel survey methodology, there is no information from similar surveys for us to use to determine the percentage of sea turtles that enter the net that may end up not passing through the codend when it is open; however, given that sea turtles are known to escape through Turtle Escape Devices (TEDs) in a number of commercial trawl fisheries, it is reasonable to expect that most, if not all, sea turtles that are overcome by the trawl net will be able to pass through the open codend without experiencing any injury or entanglement. However, it is possible that some number of the turtles temporarily captured in the trawl will not escape immediately and that the survey operators will call for the net to be hauled back to the vessel so that the turtle can be released. We expect this may be more likely to occur at the beginning of the survey period when there is more uncertainty about how long it should take a turtle to pass through. However, in any case, serious injury or mortality is not expected to occur because the net will be hauled back and the turtle released if any turtle is observed not escaping from the net.

Using the above estimates, and rounding up any fractions of sea turtles to whole animals, we estimate that up to 6 loggerheads, 4 Kemp's ridleys, and 1 green sea turtle would be temporarily captured in the open codend trawl net (Table 6.5.3.2) and that, dependent on the speed at which they pass through the net, may be subject to handling if the net is hauled back for the turtle to be released. We anticipate that these sea turtles will pass through the net opening, net, camera ring, and open codend without injury; however, we expect that the speed at which some turtles pass through the net may result in the operators hauling the net back to ensure that the turtle is released safely. These turtles may experience minor, recoverable injuries, consisting of minor bruising and scrapes as a result of the net being hauled in and being handled.

Table 6.5.3.2. Estimated temporary captures of sea turtles by species from the proposed trawl surveys expected to pass through the net over the four-year duration for open codend tows.

Species	**Total estimated temporary captures over the 4-year survey period**
Loggerhead	6
Kemp's ridley	4
Green	1
Leatherback	0

Considering all tows with both open and closed codends, we expect up to 9 loggerheads, 6 Kemp's ridley, and 2 green sea turtles will be captured in the net (Table 6.5.3.3). Turtles captured in the closed codend net will be brought onto the deck of the survey vessel, handled, and released. Turtles captured in the open codend net may either pass through the net or will be brought onto the deck of the survey vessel, handled, and released. Effects to all turtles are limited to capture, minor and recoverable injury due to interactions with the net or as a result of handling, temporary stress and fatigue, and temporary interruption to behaviors such as resting, migration, or foraging. No serious injury or mortality is anticipated. Capture of leatherback sea turtles is extremely unlikely to occur and effects are discountable.

Table 6.5.3.3. Estimated total number of captures of sea turtles by species from the proposed trawl surveys expected to be captured over the four-year duration for both open and closed codend tows.

Species	**Total estimated captures over the 4-year survey period**
Loggerhead	9
Kemp's ridley	6
Green	2
Leatherback	0

Effects to Prey

Sea turtle prey items such as horseshoe crabs, other crabs, whelks, and fish may be caught in bottom trawls; however, all captured animals will be returned to the water, either through the open codend, or as the net fished with a closed codend is emptied. Neritic juveniles and adults of both loggerhead and Kemp's ridley sea turtles are known to feed on these species that may be caught as bycatch in the bottom trawls. Injured or deceased bycatch would still be available as prey for sea turtles, particularly loggerheads, which are known to eat a variety of live prey as well as scavenge dead organisms. Leatherback sea turtles prey on jellyfish, which are not vulnerable to capture in the bottom trawl. Similarly, neritic juvenile and adult green sea turtles prey on seagrasses and sponges which are not captured in trawls. Therefore, the proposed trawl surveys will not affect the availability of prey for leatherback and green sea turtles in the action area. As there will be no permanent loss of any sea turtle prey, any effects on loggerhead and Kemp's ridley sea turtles from collection or disruption of potential sea turtle prey in the bottom trawl gear will be so small that they cannot be meaningfully measured, detected, or evaluated and, therefore, effects are insignificant.

6.5.4 Atlantic Sturgeon

Factors Affecting Interactions and Existing Information on Interactions
While migrating, Atlantic sturgeon may be present throughout the water column and could interact with trawl gear while it is moving through the water column. Atlantic sturgeon interactions with bottom trawl gear are likely at times when and in areas where their distribution overlaps with the operation of the gear. Adult and subadult Atlantic sturgeon may be present in the action area year-round. In the marine environment, Atlantic sturgeon are most often captured in depths less than 50 meters. Some information suggests that captures in otter trawl gear are most likely to occur in waters with depths less than 30 meters (ASMFC TC 2007). The capture of Atlantic sturgeon in otter trawls used for commercial fisheries is well documented (see for example, Stein et al. 2004b and ASMFC TC 2007).

NEFOP data from Miller and Shepherd (2011) indicates that mortality rates of Atlantic sturgeon caught in otter trawl gear used in commercial fisheries is approximately 5 percent. Atlantic sturgeon are also captured incidentally in trawls used for scientific studies, including the standard NEFSC bottom trawl surveys and both the spring and fall NEAMAP bottom trawl surveys; no mortalities of Atlantic sturgeon have been recorded in these surveys. None of the hundreds of Atlantic and shortnose sturgeon captured in past state ocean, estuary, and inshore trawl surveys have had any evidence of serious injury and there have been no recorded mortalities. Both the NEFSC and NEAMAP surveys have recorded the capture of hundreds of Atlantic sturgeon since the inception of each. To date, there have been no recorded serious injuries or mortalities. In the Hudson River, a trawl survey that incidentally captures shortnose and Atlantic sturgeon has been ongoing since the late 1970s. To date, no serious injuries or mortalities of any sturgeon have been recorded in those surveys.

Effects to Atlantic Sturgeon during Closed Codend Tows
We have considered the available data sets to best predict the number of Atlantic sturgeon that may be incidentally captured in the proposed trawl surveys. The largest and longest duration data sets for surveys in the general area where the CFF trawl surveys will occur are the NEAMAP and NEFSC bottom trawl surveys. As explained above, the NEAMAP survey area is farther inshore and does not overlap completely with the CFF survey area while the NEFSC survey area occurs farther offshore and overlaps with the area within portions of the area where the CFF trawl survey is proposed.

We reviewed records for Atlantic sturgeon captured in the NEFSC spring (March-May) and fall (September-October) trawl surveys from 2012-2022 for trawls above 39° N (excluding the Gulf of Maine); this geographic area was considered the best predictor for interaction rates in the

RI/MA and MA WEAs where the trawl surveys will take place. Three Atlantic sturgeon were captured in the spring surveys from 2012-2022; considering the total of over 1,796 tows, this results in an interaction rate of 0.00167 sturgeon per tow. During these same years, 1 Atlantic sturgeon was captured in the fall surveys; considering the total of over 1,716 tows, this results in an interaction rate of 0.00058 sturgeon per tow. Averaging the two interaction rates for a yearly rate, results in an interaction rate of 0.00113 sturgeon per tow. Applying the NEFSC annual interaction rate (0.00113 sturgeon/tow) to the estimated 216 closed codend tows planned for the CFF surveys, results in a total estimate of 0.24 Atlantic sturgeon.

The NEAMAP survey has captured 546 sturgeon from 2008-2023 and averages 300 tows per year, this equates to a capture rate of 0.114 sturgeon per tow. Using this interaction rate and the 216 closed codend tows, we estimate the capture of 24.6 Atlantic sturgeon over the four year CFF trawl survey period.

As noted above, trawl surveys are underway in the South Fork, Vineyard Wind 1, Revolution Wind, and Sunrise Wind lease areas, with the Revolution Wind and Sunrise Wind surveys having completed only one season to date (fall 2023). To date, five Atlantic sturgeon have been captured in the South Fork trawl surveys (2 in May 2022, 1 in July 2022, and 2 in May 2023). Given that these lease areas all fall within the CFF project action area, these captures indicate that using the NEFSC survey data (which predicts less than 1 Atlantic sturgeon capture over the 4 year survey period) to predict future interactions with Atlantic sturgeon in the proposed trawl surveys would result in an underestimate.

As noted above, we are not aware of any other survey data that could be used to predict interaction rates for Atlantic sturgeon in the CFF action area. The Massachusetts nearshore trawl survey occurs in waters inshore of the CFF project survey area (see map of 2023 sample locations at https://www.mass.gov/files/documents/2023/07/11/MLA_Letter_fall_2023.pdf) and therefore would not be a reasonable predictor of capture rates as the areas sampled are not comparable. Dunton et al. (2015) calculated catch per unit effort (CPUE; fish per minute towed) for Atlantic sturgeon captured in trawls off the south coast of Long Island; CPUE is reported for both trawls carried out in a stratified random sampling design and trawls targeting Atlantic sturgeon. The study reports catch of 149 Atlantic sturgeon for 10,380 minutes of trawling in the stratified random sampling design; this translates to 0.0144 Atlantic sturgeon/minute. CPUE from targeted trawling was 0.226 sturgeon/minute. The area surveyed by Dunton et al. (2015) is a high use area for Atlantic sturgeon and thus is not expected to be representative of catch rates in the CFF project survey area where Atlantic sturgeon are expected to be transient and be less common given the deeper, more offshore location.

Given the geographic distribution of the proposed CFF surveys, it is likely that the number of Atlantic sturgeon captured would fall between the number predicted using the NEFSC dataset and the NEAMAP dataset. However, as noted above, the capture rate of ongoing surveys in the area suggest that the NEAMAP survey data would be a better predictor of sturgeon interactions than the NEFSC survey which appears likely to undercount the number of interactions for this area. Therefore, absent any other data source, we have determined that using the NEAMAP data provides the best predictor of the number of Atlantic sturgeon likely to be captured in the CFF trawl surveys. As such, we expect up to 25 Atlantic sturgeon (24.6 rounded up to a whole number) will be captured over the four year survey period.

As explained in Section 4.2 *Status of Species*, the range of all five DPSs overlaps and extends from Canada through Cape Canaveral, Florida. Atlantic sturgeon originating from all five DPSs use the area where trawl gear will be set. The best available information on the composition of the mixed stock of Atlantic sturgeon in Atlantic coastal waters is the mixed stock analysis carried out by Kazyak et al. (2021). The authors used 12 microsatellite markers to characterize the stock composition of 1,704 Atlantic sturgeon encountered across the U.S. Atlantic Coast and provide estimates of the percent of Atlantic sturgeon that belong to each DPS in a number of geographic areas. This study confirmed significant movement of sturgeon between regions irrespective of their river of origin. The CFF survey area falls within the "MID Offshore" area described in that paper. Using that data, we expect that Atlantic sturgeon in the area where trawl surveys will occur originate from the five DPSs at the following frequencies: New York Bight (55.3%), Chesapeake (22.9%), South Atlantic (13.6%), Carolina (5.8%), and Gulf of Maine (1.6%) DPSs (Table 6.5.4.1). It is possible that a small fraction (0.7%) of Atlantic sturgeon in the action area may be Canadian origin (Kazyak et al. 2021); Canadian-origin Atlantic sturgeon are not listed under the ESA. This represents the best available information on the likely genetic makeup of individuals occurring in this area. Using this data, we predict that up to 25 Atlantic sturgeon are expected to be captured over the four year period for the CFF project trawl surveys during the closed codend portions and will consist of individuals from the 5 DPSs as described in Table 6.5.4.1 below. Based on the information presented above and in consideration of the short tow times and priority handling of any sturgeon that are captured in the trawl net, we do not anticipate the serious injury or mortality of any Atlantic sturgeon captured in the trawl gear. Individuals may experience minor abrasions or scrapes but these minor injuries are expected to be fully recoverable in a short period of time with no effects on individual health or fitness. The video feed will be monitored continuously while the codend is closed and a designated scientist will be able to document all sturgeon that enter the codend. Tows will be stopped immediately and the net will be hauled in to allow for rapid release of any sturgeon that become captured in the closed codend.

Table 6.5.4.1. Estimated capture of Atlantic sturgeon by DPS in the CFF project trawl survey over the four year survey period for closed codend tows. DPS percentages listed are the percentage values representing the genetics mixed stock analysis results (Kazyak et al. 2021). Fractions of animals are rounded up to whole animals to generate the total estimate.

Bottom Trawl (Closed Codend)	**Total Estimated Captures Over Four Years**
Total	25
New York Bight (55.3%)	14
Chesapeake (22.9%)	6
South Atlantic (13.6%)	3
Carolina (5.8%)	1
Gulf of Maine (1.6%)	1

Estimates derived from NEAMAP Near Shore Trawl Program – Southern Segment data

Estimating of Open Codend Tows

Unlike the closed codend tows, during the open codend tows, any animals that enter the trawl net are expected to pass through the open net. This allows for monitoring of "temporary catch" by video without needing to haul the net back or handle any animals. The net will otherwise operate the same way as described above, except that the trawl will be of greater duration. During the tows, any sturgeon that does not avoid the net will be overtaken by the net but are expected to pass through the open codend uninjured. However, during the time in the net sturgeon may try to swim out, interact with the net, or get tired trying to leave the net resulting in temporary capture of the animal for the time it is in the net. The net will be monitored continuously with a live feed and if there is any indication that a sturgeon is entangled in the net or does not escape, the net will be hauled back so that the animal can be safely released.

As with the closed codend surveys, data from 2008-2023 from the NEAMAP Near Shore Trawl Program – Southern Segment was used to estimate a rate of sturgeon per tow expected result in a temporary capture before passing through the net that was then applied to the operations of the CFF trawl survey to create an estimate of the number of Atlantic sturgeon expected to be temporarily captured over the four years of the survey. Each survey season, open codend tows will occur for approximately 1,680 minutes, applying the 20 minute tow time from the closed codend tows, open codend tows will be conducted for an equivalent 84 20-minute tows. Applying the interaction rate derived from the NEAMAP survey described above (0.114 sturgeon/tow), we calculate 57.5 Atlantic sturgeon will be temporarily captured in open codend trawl surveys over the 4 years that the survey will take place. Using the same data from Kayzak et al. (2021) addressed above, we predict that the up to 58 Atlantic sturgeon (57.5 rounded up to 58) expected to be captured will consist of individuals from the 5 DPSs as described in Table 6.5.4.2 below.

Based on the information presented above and in consideration that the sturgeon are expected to pass through the net safely and completely, we do not anticipate the serious injury or mortality of any Atlantic sturgeon with the trawl gear. However, it is possible that some number of the sturgeon temporarily captured in the trawl will not escape immediately and that the survey operators will call for the net to be hauled back to the vessel so that the sturgeon can be released. We expect this may be more likely to occur at the beginning of the survey period when there is more uncertainty about how long it should take a sturgeon to pass through. However, in any case, serious injury or mortality is not expected to occur because the net will be hauled back and the sturgeon released if any sturgeon is observed not escaping from the net. If an Atlantic sturgeon passes through the open codend, the sturgeon may interact with the net or change their swimming behavior in response to the presence of the net, however, we do not anticipate any serious injuries or mortalities of sturgeon passing through the trawl net. The video feed will be able to document all sturgeon that pass through the trawl net and if a sturgeon is not seen passing safely and completely through the open codend tows will be immediately terminated and the net will be hauled back in to allow for rapid release of any sturgeon that does not safely and completely pass through the codend. These sturgeon may experience minor, recoverable injuries, consisting of minor bruising and scrapes as a result of the net being hauled in and being handled.

Table 6.5.4.2. Estimated number of Atlantic sturgeon by DPS in the CFF project trawl survey expected to be temporarily captured in the open codend tows over the four year survey period. DPS percentages listed are the percentage values representing the genetics mixed stock analysis

results (Kazyak et al. 2021). Fractions of animals are rounded up to whole animals to generate the total estimate.

Bottom Trawl (Open Codend)	Total Estimated Temporary Capture Over Four Years
Total	58
New York Bight (55.3%)	32
Chesapeake (22.9%)	13
South Atlantic (13.6%)	8
Carolina (5.8%)	4
Gulf of Maine (1.6%)	1

Estimates derived from NEAMAP Near Shore Trawl Program – Southern Segment data

Considering all tows with both open and closed codends, we expect up to 46 New York Bight DPS Atlantic sturgeon, 19 Chesapeake Bay DPS Atlantic sturgeon, 11 South Atlantic DPS Atlantic sturgeon, 5 Carolina DPS Atlantic sturgeon, and 2 Gulf of Maine DPS Atlantic sturgeon will be captured in the net (Table 6.5.4.3). Sturgeon captured in the closed codend net will be brought onto the deck of the survey vessel, handled, and released. Sturgeon captured in the open codend net may either pass through the net or will be brought onto the deck of the survey vessel, handled, and released. Effects to all sturgeon are limited to capture, minor and recoverable injury due to interactions with the net or as a result of handling, temporary stress and fatigue, and temporary interruption to behaviors such as resting, migration, or foraging. No serious injury or mortality is anticipated.

Table 6.5.4.3. Estimated number of Atlantic sturgeon by DPS in the CFF project trawl survey expected to be captured in total in both the open and closed codend tows over the four year survey period. DPS percentages listed are the percentage values representing the genetics mixed stock analysis results (Kazyak et al. 2021). Fractions of animals are rounded up to whole animals to generate the total estimate.

Bottom Trawl (Total for Both Open and Closed)	Total Estimated Temporary Capture Over Four Years
Total	83
New York Bight (55.3%)	46
Chesapeake (22.9%)	19
South Atlantic (13.6%)	11
Carolina (5.8%)	5
Gulf of Maine (1.6%)	2

Estimates derived from NEAMAP Near Shore Trawl Program – Southern Segment data

Effects to Prey

The effects of bottom trawls on benthic community structure have been the subject of a number of studies. In general, the severity of the impacts to bottom communities is a function of three variables: (1) energy of the environment, (2) type of gear used, and (3) intensity of trawling. High-energy and frequently disturbed environments are inhabited by organisms that are adapted to this stress and/or are short-lived and are unlikely to be severely affected, while stable environments with long-lived species are more likely to experience long-term and significant changes to the benthic community (Johnson 2002, Kathleen A. Mirarchi Inc. and CR Environmental Inc. 2005, Stevenson et al. 2004). For these surveys up to 30% of the tows will be closed codend and capable of collecting prey, while the other 70% of the time the open codend tows may just disturb prey. While there may be some changes to the benthic communities on which Atlantic sturgeon feed as a result of bottom trawling, there is no evidence the bottom trawl activities will have a negative impact on availability of Atlantic sturgeon prey; therefore, effects to Atlantic sturgeon are extremely unlikely to occur.

6.6 Effects to Habitat

Here we consider any effects of the proposed field testing and surveying methods on habitat in the action area and any consequences to listed species. Stationary camera systems will include a mushroom anchor that would rest on the seafloor. At any given time during these surveys up to seven 15 lb mushroom anchors will be resting on the seafloor, with the anchored camera system retrieved and deployed at 45-50 locations over the 7 day survey period. The cameras will be spaced so that there is only one system every 40 km^2 throughout the action area. The size of the area that would be disturbed by setting this gear is extremely small (less than 1 m^2 per camera) and dispersed, and any effects would be limited to temporary disturbance of the bottom in the immediate area where the 15 lb mushroom anchor is set. Ropeless camera systems will have a lobster trap resting on the seafloor, for a total of 6 traps. Although traps will rest on the seafloor, Carmichael et al. (2015) found that traps have little or low impact on bottom habitat. No effects to any ESA-listed species are anticipated to result from this small, temporary, intermittent, disturbance of the bottom sediments.

An assessment of fishing gear impacts found that mud, sand, and cobble features are more susceptible to disturbance by trawl gear, while granule-pebble and scattered boulder features are less susceptible (see Appendix D in NEFMC 2016, NEFMC 2020). Geological structures generally recovered more quickly from trawling on mud and sand substrates than on cobble and boulder substrates; while biological structures (i.e. sponges, corals, hydroids) recovered at similar rates across substrates. Susceptibility was defined as the percentage of habitat features encountered by the gear during a hypothetical single pass event that had their functional value reduced, and recovery was defined as the time required for the functional value to be restored (see Appendix D in NEFMC 2016, NEFMC 2020). The bottom trawl gear will also interact with the ocean floor and may affect bottom habitat in the areas surveyed. The video trawl surveys will cover an area of roughly 1,800 km^2 during all project activities based on maximum tow coverage of 120 nautical miles and the mean wing spread of the trawl of 15 m. This total trawl swept area is less than 0.01% of the action area. Given the infrequent survey effort (six times over four years), the limited duration of the surveys (40 hours per survey total, 240 total hours), and the small footprint (120 nm per trip), any effects to ESA-listed species resulting from these minor effects to benthic habitat will be so small that they cannot be meaningfully measured, evaluated, or detected; therefore, effects are insignificant.

6.7 Consideration of the Effects of the Action in the Context of Predicted Climate Change due to Past, Present, and Future Activities

Climate change is relevant to the Status of the Species, Environmental Baseline, Effects of the Action, and Cumulative Effects sections of this Opinion. In the Status of the Species section, climate change as it relates to the status of particular species is addressed. Rather than include partial discussion in several sections of this Opinion, we are synthesizing our consideration of the effects of the proposed action in the context of anticipated climate change here.

In general, waters in the action area are warming and are expected to continue to warm over throughout the four years of the project. However, waters in the North Atlantic Ocean have warmed more slowly than the global average or slightly cooled. This is because of the Gulf Stream's role in the Atlantic Meridional Overturning Circulation (AMOC). Warm water in the Gulf Stream cools, becomes dense, and sinks, eventually becoming cold, deep waters that travel back equatorward, spilling over features on the ocean floor and mixing with other deep Atlantic waters to form a southward current approximately 1500 m beneath the Gulf Stream (IPCC 2021). Globally averaged surface ocean temperatures are projected to increase by approximately 0.7 °C by 2030 and 1.4 °C by 2060 compared to the 1986-2005 average (IPCC 2014), with increases of closer to 2°C predicted for the geographic area that includes the action area. Data from the NOAA weather buoy closest to the action area (44009) collected from 1984-2008 indicate a mean temperature range from a low of 5°C in the winter to a high of 24°C in the summer, and boat based surveys in the vicinity of the action area had a minimum temperature of 2°C in the winter and a maximum of 26°C in the summer (NMFS 2023). Based on current predictions (IPCC 2014[24]), this could shift to a range of 7.9°C in the winter to 23.8°C in the summer. This shift in water temperature could impact seasonal availability and overall biomass of prey for ESA-listed whales (Ganley et al. 2022, Friedland et al. 2023). Ocean acidification is also expected to increase over the life of the project (Hare et al. 2016) which may affect the prey of a number of ESA-listed species. Ocean acidification is contributing to reduced growth or the decline of zooplankton and other invertebrates that have calcareous shells (Pacific Marine Environmental Laboratory [PMEL] 2020).

We have considered whether it is reasonable to expect ESA-listed species whose northern distribution does not currently overlap with the action area to occur in the action area over the project life due to a northward shift in distribution. We have determined that it is not reasonable to expect this to occur. This is largely because water temperature is only one factor that influences species distribution and given that the life of the proposed action is only four years, we expect little to no shifts in distribution to occur over this period. Even with warming waters we do not expect species that we determined were not present in the action area to shift distribution over the 4 year life of the project in a way that would result in these species being present in the action area. We do not expect hawksbill sea turtles to occur in the action area because there will still not be any sponge beds or coral reefs that hawksbills depend on and are key to their distribution (NMFS and USFWS 2013). We also do not expect oceanic whitetip shark to occur in the action area. Oceanic whitetip shark are a deep-water species (typically greater than 184 m) that occurs beyond the shelf edge on the high seas (Young et al. 2018). Smalltooth sawfish do not occur north of Florida. Their life history depends on shallow estuarine habitats fringed with vegetation, usually red mangroves (Norton et al. 2012); such habitat does not occur in the action area and would not occur even with ocean warming over the course of the proposed action. As such, regardless of the extent of ocean warming that may be reasonably expected in the action area throughout four years of the project, the habitat will remain

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[24] Available at: https://www.fisheries.noaa.gov/national/endangered-species-conservation/endangered-species-act-guidance-policies-and-regulations, last accessed March 2, 2024.

inconsistent with habitats used by ESA-listed species that currently occur south of the action area. Therefore, we do not anticipate that any of these species will occur in the action area over the course of the proposed action.

We have also considered whether climate change will result in changes in the use of the action area by Atlantic sturgeon or the ESA-listed turtles and whales considered in this consultation. In a climate vulnerability analysis, Hare et al. (2016) concluded that Atlantic sturgeon are relatively invulnerable to distribution shifts. Given the extensive range of the species along nearly the entire U.S. Atlantic Coast and into Canada, it is unlikely that Atlantic sturgeon would shift out of the action area over the course of the project. If there were shifts in the abundance or distribution of sturgeon prey, it is possible that use of the action area by foraging sturgeon could become more or less common. However, even if the frequency and abundance of use of the action area by Atlantic sturgeon increased over time, we would not expect any different effects to Atlantic sturgeon than those considered based on the current distribution and abundance of Atlantic sturgeon in the action area.

Use of the action area by sea turtles is driven at least in part by sea surface temperature, with sea turtles absent from the action area from the late fall through mid-spring due to colder water temperatures. An increase in water temperature could result in an expansion of the time of year that sea turtles are present in the action area and could increase the frequency and abundance of sea turtles in the action area. However, due to the short time frame of this project (4 years), any increase in water temperature would be minor and not expected to result in a shift in distribution of sea turtles in a way that would change our assessment of effects of the action. Any changes in distribution of prey, if any, would also be expected to be minor and not affect distribution and abundance of sea turtles. It has been speculated that the nesting range of some sea turtle species may shift northward as water temperatures warm. Currently, nesting in the mid-Atlantic is extremely rare. In order for nesting to be successful, fall and winter temperatures need to be warm enough to support the successful rearing of eggs and sea temperatures must be warm enough for hatchlings to survive when they enter the water. Predicted increases in water temperatures over the life of the project are not great enough to allow successful rearing of sea turtle hatchlings in the action area. Therefore, we do not expect that over the time-period considered here, that there would be any nesting activity or hatchlings in the action area. Based on the available information, we expect that any increase in the frequency and abundance of use of the action area by sea turtles due to increases in mean sea surface temperature would be small. Regardless of this, we would not expect any different effects to sea turtles than those considered based on the current distribution and abundance of sea turtles in the action area. Further, given that any increase in frequency or abundance of sea turtles in the action area is expected to be small we do not expect there to be an increase in risk of vessel strike above what has been considered based on current known distribution and abundance.

The distribution, abundance and migration of baleen whales reflects the distribution, abundance and movements of dense prey patches (e.g., copepods, euphausiids or krill, amphipods, shrimp), which have in turn been linked to oceanographic features affected by climate change (Learmonth et al. 2006). Changes in plankton distribution, abundance, and composition are closely related to ocean climate, including temperature. Changes in conditions may directly alter where foraging occurs by disrupting conditions in areas typically used by species and can result in shifts to areas not traditionally used that have lower quality or lower abundance of prey.

Two of the significant potential prey species for fin whales in the action area are sand lance and Atlantic herring. Hare et al. (2016) concluded that climate change is likely to negatively impact sand lance and Atlantic herring but noted that there was a high degree of uncertainty in this conclusion. The authors noted that higher temperatures may decrease productivity and limit habitat availability. A reduction in small schooling fish such as sand lance and Atlantic herring in the lease area could result in a decrease in the use of the area by foraging fin whales. The distribution of copepods in the North Atlantic, including in the lease area, is driven by a number of factors that may be impacted by climate change. Record et al. (2019) suggests that recent changes in the distribution of North Atlantic right whales are related to recent rapid changes in climate and prey and notes that while right whales may be able to shift their distribution in response to changing oceanic conditions, the ability to forage successfully in those new habitats is also critically important. Warming in the deep waters of the Gulf of Maine is negatively impacting the abundance of *Calanus finmarchicus*, a primary prey for right whales. *C. finmarchicus* is vulnerable to the effects of global warming, particularly on the Northeast U.S. Shelf, which is in the southern portion of its range (Grieve et al. 2017). Grieve et al. (2017) used models to project *C. finmarchicus* densities into the future under different climate scenarios considering predicted changes in water temperature and salinity. Based on their results, by the 2041–2060 period, 22 – 25% decreases in *C. finmarchicus* density are predicted across all regions of the Northeast U.S. shelf. A decrease in abundance of right whale prey in the action area could be expected to result in a similar decrease in abundance of right whales in the project area over the same time scale; however, whether the predicted decline in *C. finmarchicus* density is great enough to result in a decrease in right whale presence in the action area over the course of the project is unknown.

Right whale calving occurs off the coast of the Southeastern U.S. In the final rule designating critical habitat, the following features were identified as essential to successful calving: (1) calm sea surface conditions associated with Force 4 or less on the Beaufort Scale, (2) sea surface temperatures from 7 °C through 17 °C; and, (3) water depths of 6 to 28 meters where these features simultaneously co-occur over contiguous areas of at least 231 km^2 during the months of November through April. Even with a 2°C shift in mean sea surface temperature, waters off New England in the November to April period will not be warm enough to support calving. While there could be a northward shift in calving over this period, it is not reasonable to expect that over the life of the project that calving would occur in the action area. Further, given the thermal tolerances of young calves (Garrison 2007) we do not expect that the distribution of young calves would shift northward into the action area such that there would be more or younger calves in the action area.

Based on the available information, it is difficult to predict how the use of the action area by large whales may change over the course of the project; however, any changes are expected to be limited by the short duration of the project. Changes in habitat used by fin and right whales may be related to a northward shift in distribution due to warming waters and a decreased abundance of prey. However, it is also possible that reductions in prey in other areas, including the Gulf of Maine, result in persistence of foraging in the action area over time. Based on the information available at this time, it seems most likely that the use of the action area by large whales will remain stable over the four year period. As such, we do not expect any changes in abundance or distribution that would result in different effects of the action than those considered in the Section 6.0 *Effects of the Action* of this Opinion. To the extent new information on climate change, listed species, and their prey becomes available in the future, reinitiation of this consultation may be necessary.

7.0 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 C.F.R. §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. While the effects of past and ongoing Federal projects for which consultation has been completed are evaluated in both the NEPA and ESA processes (Section 5.0 *Environmental Baseline*), reasonably foreseeable future actions by Federal agencies must be considered (see 40 CFR 1508.7) in the NEPA process but not the ESA section 7 process.

This section attempts to identify the likely future environmental changes and their impact on ESA-listed species in the action area. This section is not meant to be a comprehensive socio-economic evaluation, but a brief outlook on future changes in the environment. Projections are based upon recognized organizations producing best-available information and reasonable rough-trend estimates of change stemming from these data. However, all changes are based upon projections that are subject to error and alteration by complex economic and social interactions. We expect that those aspects described in the *Environmental Baseline* will continue to impact ESA-listed resources into the foreseeable future. We expect anthropogenic effects that include climate change, oceanic temperature regimes, vessel interactions, fisheries interactions, pollution, and scientific research and enhancement activities, to continue into the future for ESA-listed resources. 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 on ESA-listed species. Therefore, NMFS expects that the levels of interactions between human activities and ESA-listed species described in the *Environmental Baseline* will continue at similar levels into the foreseeable future. Movements towards the reduction of vessel strikes and fisheries interactions or greater protections of ESA-listed species from these anthropogenic effects may aid in abating the downward trajectory of some populations and lead to recovery of other populations.

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 or have effects 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*. The primary non-Federal activities that will continue to have effects in the action area are: recreational fisheries, fisheries authorized by states, use of the action area by private vessels, discharge of wastewater and associated pollutants, and coastal development authorized by state and local governments. Any coastal and marine development that requires a Federal authorization, would require future section 7 consultation and would not be considered a cumulative effect. We do not have any information to indicate that effects of these activities over the four years/six field sampling seasons for the proposed project will have different effects than those considered in Section 4.2 *Status of the Species* and Section 5.0 *Environmental Baseline* of this Opinion, inclusive of how those activities may contribute to climate change.

8.0 INTEGRATION AND SYNTHESIS OF EFFECTS

The *Integration and Synthesis* section is the final step in our assessment of the effects and corresponding risk posed to ESA-listed species and designated critical habitat affected as a result of implementing the proposed action. In Section 4.1, we determined that the project will have no effect on blue whales, giant manta rays, oceanic white tip sharks, shortnose sturgeon, hawksbill sea turtles, Atlantic salmon or any designated critical habitat. As described in Section 6.0 *Effects of the Action*, we concluded that the proposed action is not likely to adversely affect leatherback sea turtles or fin, sei, sperm, and North Atlantic right whales. Those species and critical habitat for which we reached a "not likely to adversely affect" conclusion in Section 4.2 of this Opinion are not addressed further here.

In this section, for the species we did not reach a conclusion in Section 4.0, we add Section 6.0 *Effects of the Action* to Section 5.0 *Environmental Baseline* and Section 7.0 *Cumulative Effects*, while also considering effects in the context of climate change (Section 6.7) and Section 4.2 *Status of the Species*, to formulate the agency's biological opinion as to whether the proposed action "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 its numbers, reproduction, or distribution" (50 CFR §402.02; the definition of "jeopardize the continued existence of" an ESA-listed species). The purpose of this analysis in this Opinion is to determine whether the proposed action is likely to jeopardize the continued existence of North Atlantic right, fin, sei, or sperm whales, five DPSs of Atlantic sturgeon, the Northwest Atlantic DPS of loggerhead sea turtles, North Atlantic DPS of green sea turtles, or leatherback or Kemp's ridley sea turtles. Below, we summarize the status of the species and consider whether the action will result in reductions in reproduction, numbers, or distribution of any of these species. We then consider whether any reductions in reproduction, numbers, or distribution resulting from the action would reduce appreciably the likelihood of both the survival and recovery of the species, consistent with the definition of "jeopardize the existence of" (50 C.F.R. §402.02) for purposes of sections 7(a)(2) and 7(b) of the federal Endangered Species Act and its implementing regulations.

In addition, we use the following guidance and regulatory definitions related to survival and recovery to guide our jeopardy analysis. In the NMFS/USFWS section 7 Consultation Handbook (1998), for the purposes of determining whether jeopardy is likely, survival is defined as, "the species' persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said in another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter." Recovery is defined in regulation as, "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 C.F.R. §402.02

8.1 Marine Mammals

Our effects analysis determined that all effects of the proposed action to right, fin, sperm, and sei whales are insignificant or extremely unlikely to occur. We concluded that, with the incorporation of vessel strike risk avoidance measures that are part of the proposed action, strike of an ESA-listed whale by a project vessel is extremely unlikely. No entanglement or other effects are expected to result from the deployment of any of the survey equipment, including the sonar on the e HabCam, the other camera systems, or the trawl surveys carried out with open or closed codends. We also determined that effects to habitat and prey are insignificant or discountable. Because all effects to right, fin, sperm, and sei whales are insignificant or discountable, the proposed action is not likely to adversely affect right, fin, sperm, or sei whales. By definition, an action that is not likely to adversely affect a species is also not likely to jeopardize the continued existence of the species. Therefore, because there are no adverse effects of the action to these species, no further consideration in this section of the Opinion is necessary.

8.2 Sea Turtles

Our effects analysis determined that interactions with bottom trawl gear is likely to result in the temporary capture of a number of individual ESA-listed sea turtles in the action area, but no serious injury or mortality is anticipated and we expect all captured individuals to be released alive with only minor, recoverable injury (i.e., scrapes, minor bruises). We expect that closed codend portion of the bottom trawl survey will result in the capture of up to 3 loggerhead, 1 green, and 2 Kemp's ridley sea turtles (Table 6.5.3.1) and the open codend portion will result in the temporary capture of up to 6 loggerhead, 1 green, and 4 Kemp's ridley sea turtles over the 4-year survey period (Table 6.5.3.2). We do not expect the capture of any leatherback sea turtles. We do not expect the entanglement or capture of any sea turtles in vertical lines associated with stationary camera systems or any effects of deployment of the sonar on the HabCam surveys. We concluded that vessel strike of a sea turtle by a project vessel is extremely unlikely to occur and effects are thus discountable. We also determined that effects to habitat and prey from the proposed action are insignificant or discountable for all sea turtle species in the action area.

In this section we assess the likely consequences of these effects to the sea turtles that have been exposed, the populations those individuals represent, and the species those populations comprise. Section 4.2.2 described current sea turtle population statuses and the threats to their survival and recovery. Most sea turtle populations have undergone significant to severe reduction by human harvesting of both eggs and sea turtles, loss of beach nesting habitats, as well as severe bycatch pressure in worldwide fishing industries. Section 5 *Environmental Baseline* identified actions expected to generally continue for the foreseeable future for each of these species of sea turtle that may affect sea turtles in the action area. As described in Section 6.7, climate change may result in a northward shift in distribution of sea turtles over time; however, given the short duration of the proposed action (4 years), we do not expect any change in the abundance or seasonal distribution of sea turtles in the action area over the life of the proposed project. As noted in Section 7 *Cumulative Effects* of this Opinion, we have not identified any cumulative effects different from those considered in Section 4.2 *Status of the Species* and Section 5.0 *Environmental Baseline* of this Opinion, inclusive of how those activities may contribute to climate change.

8.2.1 Northwest Atlantic DPS of Loggerhead Sea Turtles

The Northwest Atlantic DPS of loggerhead sea turtles is listed as threatened. Based on nesting data and population abundance and trends at the time, NMFS and USFWS determined in 2011 that the Northwest Atlantic DPS should be listed as threatened and not endangered based on: (1) the large size of the nesting population, (2) the overall nesting population remains widespread, (3) the trend for the nesting population appears to be stabilizing, and (4) substantial conservation efforts are underway to address threats (76 FR 58868, September 22, 2011).

It takes decades for loggerhead sea turtles to reach maturity. Once they have reached maturity, females typically lay multiple clutches of eggs within a season, but do not typically lay eggs every season (NMFS and USFWS 2008). There are many natural and anthropogenic factors affecting the survival of loggerheads prior to their reaching maturity as well as for those adults who have reached maturity. As described in Section 4.2 *Status of the Species*, Section 5.0 *Environmental Baseline*, and Section 7.0 *Cumulative Effects* above, loggerhead sea turtles in the action area continue to be affected by multiple anthropogenic impacts including bycatch in commercial and recreational fisheries, habitat alteration, vessel interactions, and other factors that result in mortality of individuals at all life stages. Negative impacts causing death of various age classes occur both on land and in the water. Many actions have been taken to address known negative impacts to loggerhead sea turtles. However, others remain unaddressed, have not been sufficiently addressed, or have been addressed in some manner but whose success cannot be quantified.

There are five subpopulations of loggerhead sea turtles in the western North Atlantic (recognized as recovery units in the 2008 Recovery Plan for the species). These subpopulations show limited evidence of interbreeding. As described in Section 4.2 *Status of the Species*, recent assessments have evaluated the nesting trends for each recovery unit. Nesting trends are based on nest counts or nesting females; they do not include non-nesting adult females, adult males, or juvenile males or females in the population. Nesting trends for each of the loggerhead sea turtle recovery units in the Northwest Atlantic Ocean DPS are variable. Overall, short-term trends have shown increases, however, over the long-term the DPS is considered stable.

Estimates of the total loggerhead population in the Atlantic are not currently available. However, there is some information available for portions of the population. From 2004-2008, the loggerhead adult female population for the Northwest Atlantic ranged from 20,000 to 40,000 or more individuals (median 30,050), with a large range of uncertainty in total population size (NMFS SEFSC 2009). The estimate of Northwest Atlantic adult loggerhead females was considered conservative for several reasons. The number of nests used for the Northwest Atlantic was based primarily on U.S. nesting beaches. Thus, the results are a slight underestimate of total nests because of the inability to collect complete nest counts for many non-U.S. nesting beaches within the DPS. In estimating the current population size for adult nesting female loggerhead sea turtles, the report simplified the number of assumptions and reduced uncertainty by using the minimum total annual nest count (i.e., 48,252 nests) over the five years. This was a particularly conservative assumption considering how the number of nests and nesting females can vary widely from year to year (e.g., the 2008 nest count was 69,668 nests, which would have increased the adult female estimate proportionately to between 30,000 and 60,000). In addition, minimal assumptions were made about the distribution of remigration intervals and nests per female parameters, which are fairly robust and well known. A loggerhead population estimate using data from 2001-2010 estimated the loggerhead adult female population in the Northwest Atlantic at 38,334 individuals (SD =2,287) (Richards et al. 2011). These population studies are consistent with the definition of the Northwest Atlantic DPS.

The AMAPPS surveys and sea turtle telemetry studies conducted along the U.S. Atlantic coast in the summer of 2010 provided a preliminary regional abundance estimate of about 588,000 loggerheads along the U.S. Atlantic coast, with an inter-quartile range of 382,000-817,000 (NMFS 2011c). The estimate increases to approximately 801,000 (inter-quartile range of 521,000-1,111,000) when based on known loggerheads and a portion of unidentified sea turtle sightings (NMFS 2011c). Although there is much uncertainty in these population estimates, they provide some context for evaluating the size of the likely population of loggerheads in the Atlantic which is an indication of the size of the Northwest Atlantic DPS.

In Section 6.0 *Effects of the Action* above, we determined that no more than 3 Northwest Atlantic DPS of loggerheads are likely to be captured during the closed codend portion of the bottom trawl surveys and no more than 6 Northwest Atlantic DPS of loggerheads are likely to be temporarily captured during the open codend portion. We anticipate that all of the loggerheads captured during the closed codend portion will be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We anticipate that the loggerheads temporarily captured during the open codend portion will pass through the net, change swimming behavior due to the presence of the net, glance off the net, or if the net needs to be hauled back to release the turtle, a subset of these may be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We determined that all other effects of the action would be insignificant or extremely unlikely. No serious injury or mortality of any loggerhead sea turtle is anticipated to result from the proposed action.

Capture will temporarily disrupt normal behaviors; that is, these individuals will be prevented from resting, migrating, or foraging while they are in the trawl net. However, these behaviors are expected to resume as soon as the turtles are returned to the water (the time it takes from initial capture to when the net is hauled and the sea turtle is released). These turtles are expected to have a stress response and be fatigued and may also experience minor, recoverable, injuries as a result of net haul back or handling. However, as established herein, the temporary and limited nature of these effects means that the behavioral disruption and temporary stress response would not affect an individual sea turtle's fitness (i.e., survival or reproduction); this is because effects will only be experienced for a few minutes and not affect the animal's overall health.

The capture of loggerhead sea turtles will not reduce the numbers of loggerhead sea turtles in any subpopulation or the DPS as a whole. As any effects to individual loggerhead sea turtles will be minor and temporary, impacts to the health, reproductive capacity, or fitness of any individuals are not anticipated. Similarly, as the capture of loggerhead sea turtles will not affect the fitness of any individual, no effects to reproduction are anticipated over the course of the action. The capture of loggerhead sea turtles will not affect the distribution of loggerhead sea turtles in the action area or affect the distribution of Northwest Atlantic DPS of loggerhead sea turtles throughout their range. Because there will be no reduction in numbers, reproduction, or distribution of loggerhead sea turtles, the project will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for recovery and eventual delisting). The actions will not affect loggerheads in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent loggerheads from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) there will be no mortalities; (2) there will be no change the status or trends of any recovery unit or the DPS as a whole; (3) there will be no effect on the levels of genetic heterogeneity in any recovery unit or the DPS as a whole; (4) there will be no effect on reproductive output; (5) the action will have insignificant and temporary effects on the distribution of Northwest Atlantic DPS of loggerhead sea turtles in the action area (limited to the time it is captured) and no effect on its distribution throughout its range; and, (6) the actions will have no effect on the ability of loggerheads to shelter and only an insignificant effect on individual foraging loggerheads.

In certain instances, an action may not reduce appreciably the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed action will not reduce appreciably the likelihood that loggerhead sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed action will affect the likelihood that the Northwest Atlantic DPS of loggerheads can rebuild to a point where listing is no longer appropriate. In 2008, NMFS and the USFWS issued a Recovery Plan for the Northwest Atlantic population of loggerheads (NMFS and USFWS 2008). The plan includes demographic recovery criteria as well as a list of tasks that must be accomplished. Demographic recovery criteria are included for each of the five recovery units. These criteria focus on sustained increases in the number of nests laid and the number of nesting females in each recovery unit, an increase in abundance on foraging grounds, and ensuring that trends in neritic strandings are not increasing at a rate greater than trends in in-water abundance. The recovery tasks focus on protecting habitats, minimizing and managing predation and disease, and minimizing anthropogenic mortalities.

The Northwest Atlantic DPS of loggerheads has a stable trend. This action will not change the status or trend of the Northwest Atlantic DPS of loggerhead sea turtles. As explained above, the proposed action will not result in any mortality and will not result in any reduction in future reproductive output. Because there will be no effect on numbers or reproductive output, the action will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. As such, the proposed action will not affect the likelihood that the demographic criteria will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; all effects to habitat will be insignificant or extremely unlikely; therefore, the proposed action will have no effect on the likelihood that habitat based recovery criteria will be achieved. The proposed action will also not affect the ability of any of the recovery tasks to be accomplished.

The effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the action will not prevent the DPS from growing in a way that leads to recovery and the action will not change the rate at which recovery can occur. This is the case because the action will not result in the serious injury or mortality of any individuals, will not affect the fitness or reproductive output of any individuals, or otherwise have consequences on the status or growth of the DPS or its potential for recovery. Therefore, based on the analysis presented above, the proposed action will not reduce appreciably the likelihood that the Northwest Atlantic DPS of loggerhead sea turtles can be brought to the point at which they are no longer listed as threatened; that is, the proposed action will not appreciably reduce the likelihood of recovery of the Northwest Atlantic DPS of loggerhead sea turtles.

Based on the analysis presented herein, the proposed action is not likely to reduce appreciably the survival and recovery of the Northwest Atlantic DPS of loggerhead sea turtles. These conclusions were made in consideration of the threatened status of Northwest Atlantic DPS loggerhead sea turtles, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of loggerhead sea turtles in the action area.

8.2.2 North Atlantic DPS of Green Sea Turtles

The North Atlantic DPS of green sea turtles is listed as threatened under the ESA. As described in Section 4 *Status of the Species*, the North Atlantic DPS of green sea turtles is the largest of the 11 green turtle DPSs with an estimated abundance of over 167,000 adult females from 73 nesting sites. All major nesting populations demonstrate long-term increases in abundance (Seminoff et al. 2015). In 2021, green turtle nest counts on the 27-core index beaches in Florida reached more than 24,000 nests recorded. Green sea turtles face numerous threats on land and in the water that affect the survival of all age classes. While the threats of pollution, habitat loss through coastal development, beachfront lighting, and fisheries bycatch continue for this DPS, the DPS appears to be somewhat resilient to future perturbations. As described in Section 5 *Environmental Baseline* and Section 7 *Cumulative Effects*, green sea turtles in the action area are exposed to pollution and experience vessel strike and fisheries bycatch. As noted in Section 7 *Cumulative Effects* of this Opinion, we have not identified any cumulative effects different from those considered in Section 4.2 *Status of the Species* and Section 5.0 *Environmental Baseline* of this Opinion, inclusive of how those activities may contribute to climate change.

There are four regions that support high nesting concentrations in the North Atlantic DPS: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo), United States (Florida), and Cuba. Using data from 48 nesting sites in the North Atlantic DPS, nester abundance was estimated at 167,528 total nesters (Seminoff et al. 2015). The years used to generate the estimate varied by nesting site but were between 2005 and 2012. The largest nesting site (Tortuguero, Costa Rica) hosts 79 percent of the estimated nesting. It should be noted that not all female turtles nest in a given year (Seminoff et al. 2015). Nesting in the area has increased considerably since the 1970s, and nest count data from 1999-2003 suggested that 17,402-37,290 females nested there per year (Seminoff et al. 2015). In 2010, an estimated 180,310 nests were laid at Tortuguero, the highest level of green sea turtle nesting estimated since the start of nesting track surveys in 1971. This equated to somewhere between 30,052 and 64,396 nesters in 2010

(Seminoff et al. 2015). Nesting sites in Cuba, Mexico, and the United States were either stable or increasing (Seminoff et al. 2015). More recent data is available for the southeastern United States. Nest counts at Florida's core index beaches have ranged from less than 300 to almost 41,000 in 2019. The Index Nesting Beach Survey (INBS) is carried out on a subset of beaches surveyed during the Statewide Nesting Beach Survey (SNBS) and is designed to measure trends in nest numbers. The nest trend in Florida shows the typical biennial peaks in abundance and has been increasing (https://myfwc.com/research/wildlife/sea- turtles/nesting/beach-survey-totals/). The SNBS is broader but is not appropriate for evaluating trends. In 2019, approximately 53,000 green turtle nests were recorded in the SNBS (https://myfwc.com/research/wildlife/sea-turtles/nesting/). Seminoff et al. (2015) estimated total nester abundance for Florida at 8,426 turtles.

NMFS recognizes that the nest count data available for green sea turtles in the Atlantic indicates increased nesting at many sites. However, we also recognize that the nest count data, including data for green sea turtles in the Atlantic, only provides information on the number of females currently nesting, and is not necessarily a reflection of the number of mature females available to nest or the number of immature females that will reach maturity and nest in the future.

In Section 6 *Effects of the Action* above, we determined that 1 North Atlantic DPS green sea turtle is likely to be captured during the closed codend portion of the bottom trawl surveys and no more than 1 North Atlantic DPS green sea turtle is likely to be temporarily captured during the open codend portion. We anticipate that the green sea turtle captured during the closed codend portion will be removed from the water alive and that this individual will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We anticipate that the green sea turtle temporarily captured during the open codend portion will pass through the net, change swimming behavior due to the presence of the net, glance off the net, or if the net needs to be hauled back to release the turtle, a subset of these may be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We determined that all other effects of the action would be insignificant or extremely unlikely. No serious injury or mortality of any green sea turtle is anticipated to result from the proposed action.

The capture of North Atlantic DPS of green sea turtles will temporarily prevent them from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the turtle is returned to the water. The capture and release of a green sea turtle will not reduce the numbers of green sea turtles in the action area, in any subpopulation or the species as a whole over the course of the action. As any effects to individual green sea turtles will be minor and temporary; there are not anticipated to be any impacts to the health, reproductive capacity, or fitness of the individual. Similarly, as the capture of a green sea turtle will not affect the fitness of any individual, no effects to reproduction are anticipated over the course of the action. The capture of green sea turtles will not affect the distribution of green sea turtles in the action area or affect the distribution of sea turtles throughout their range over the course of the action.

Based on the information provided above, the capture and release of 2 North Atlantic DPS of green sea turtles over the 4 year life of the project, will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect green sea turtles in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent green sea turtles from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) there will be no mortality to any individual (2) the capture of 2 green sea turtles will not change the status or trends of the species as a whole; (4) there will be no effect on the levels of genetic heterogeneity in any recovery unit or the DPS as a whole; (5) there will be no effect on reproductive output of the species as a whole; (6) the action will have insignificant and temporary effects on the distribution of 2 green sea turtles in the action area (limited to the time it is captured) and no effect on its distribution throughout its range; and (7) the action will have no effect on the ability of green sea turtles to shelter and only an insignificant effect on individual foraging green sea turtles.

In certain instances, an action may not reduce appreciably the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed action will not reduce appreciably the likelihood that green sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed action will affect the likelihood that the species can rebuild to a point where listing is no longer appropriate. A Recovery Plan for green sea turtles was published by NMFS and USFWS in 1991. The plan outlines the steps necessary for recovery and the criteria which, once met, would ensure recovery. In order to be delisted, green sea turtles must experience sustained population growth, as measured in the number of nests laid per year, over time. Additionally, “priority one” recovery tasks must be achieved and nesting habitat must be protected (through public ownership of nesting beaches) and stage class mortality must be reduced. Here, we consider whether this proposed action will affect the population size and/or trend in a way that would affect the likelihood of recovery.

The proposed actions will not appreciably reduce the likelihood of survival of green sea turtles. Also, it is not expected to modify, curtail or destroy the range of the species since it will not result in a reduction in the number of green sea turtles in any geographic area and since it will not affect the overall distribution of green sea turtles other than to cause minor temporary adjustments in behaviors in the action area. As explained above, the proposed actions will not result in any mortality and is not expected to affect the persistence of green sea turtles or the species trend. The actions will not affect nesting habitat. The effects of the proposed actions will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the actions will not prevent the DPS from growing in a way that leads to recovery, and the actions will not change the rate at which recovery can occur. This is the case because the action will not result in the serious injury or mortality of individuals, will not affect the fitness or reproductive output of any individuals, or have other consequences on the status or growth of the DPS or its potential for recovery. Therefore, based on the analysis presented above, the proposed actions will not appreciably reduce the likelihood that green sea turtles can be brought to the point at which they are no longer listed as endangered or threatened; that is, the proposed action will not appreciably reduce the likelihood of recovery of green sea turtles.

Despite the threats faced by individual green sea turtles inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of the status of the species rangewide and in the action area, the environmental baseline, cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change. Based on the analysis presented herein, the proposed actions, resulting in the non-lethal capture of 2 green sea turtles over 4 years, is not likely to appreciably reduce the likelihood of both the survival and recovery of green sea turtles. These conclusions were made in consideration of the threatened status of green sea turtles, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of green sea turtles in the action area.

8.2.3 Leatherback Sea Turtles

Our effects analysis determined that all effects of the proposed action to leatherback sea turtles are insignificant or extremely unlikely to occur. We concluded that, with the incorporation of vessel strike risk avoidance measures that are part of the proposed action, strike of a leatherback sea turtle is extremely unlikely. No entanglement or other effects are expected to result from the deployment of any of the survey equipment, including the sonar on the HabCam, the other camera systems, or the trawl surveys carried out with open or closed codends. We also determined that effects to habitat and prey are insignificant or discountable. Because all effects to leatherback sea turtles are insignificant or discountable, the proposed action is not likely to adversely affect leatherback sea turtles. By definition, an action that is not likely to adversely affect a species is also not likely to jeopardize the continued existence of the species. Therefore, because there are no adverse effects of the action to these species, no further consideration in this section of the Opinion is necessary.

8.2.4 Kemp's Ridley Sea Turtles

Kemp's ridley sea turtles are listed as a single species classified as endangered under the ESA. They occur in the Atlantic Ocean and Gulf of Mexico, the only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963, NMFS and USFWS 2015, USFWS and NMFS 1992).

Nest count data provides the best available information on the number of adult females nesting each year. As is the case with other sea turtle species, nest count data must be interpreted with caution given that these estimates provide a minimum count of the number of nesting Kemp's ridley sea turtles. In addition, the estimates do not account for adult males or juveniles of either sex. Without information on the proportion of adult males to females and the age structure of the population, nest counts cannot be used to estimate the total population size (Meylan 1982, Ross 1996). Nevertheless, the nesting data does provide valuable information on the extent of Kemp's ridley nesting and the trend in the number of nests laid. It is the best proxy we have for estimating population changes.

Following a significant, unexplained one-year decline in 2010, Kemp's ridley sea turtle nests in Mexico reached a record high of 21,797 in 2012 (Gladys Porter Zoo nesting database, unpublished data). In 2013 and 2014, there was a second significant decline in Mexico nests, with only 16,385 and 11,279 nests recorded, respectively. In 2015, nesting in Mexico improved to 14,006 nests, and in 2016 overall numbers increased to 18,354 recorded nests. There was a record high nesting season in 2017, with 24,570 nests recorded (J. Pena, pers. comm. to NMFS SERO PRD, August 31, 2017 as cited in NMFS 2020(c)) and decreases observed in 2018 and again in 2019. In 2019, there were 11,140 nests in Mexico. It is unknown whether this decline is related to resource fluctuation, natural population variability, effects of catastrophic events like the Deepwater Horizon oil spill affecting the nesting cohort, or some other factor. A small nesting population is also emerging in the United States, primarily in Texas. From 1980-1989, there were an average of 0.2 nests/year at Padre Island National Seashore (PAIS), rising to 3.4 nests/year from 1990-1999, 44 nests/year from 2000-2009, and 110 nests per year from 2010-2019. There was a record high of 353 nests in 2017 (NPS 2020). It is worth noting that nesting in Texas has paralleled the trends observed in Mexico, characterized by a significant decline in 2010, followed by a second decline in 2013-2014, but with a rebound in 2015-2017 (NMFS 2020c) and decreases in nesting in 2018 and 2019 (NPS 2020).

Estimates of the adult female nesting population reached a low of approximately 250-300 in 1985 (NMFS and USFWS 2015, TEWG 2000). Gallaway et al. (2016) developed a stock assessment model for Kemp's ridley to evaluate the relative contributions of conservation efforts and other factors toward this species' recovery. Terminal population estimates for 2012 summed over ages 2 to 4, ages 2+, ages 5+, and ages 9+ suggest that the respective female population sizes were 78,043 (SD = 14,683), 152,357 (SD = 25,015), 74,314 (SD =10,460), and 28,113 (SD = 2,987) (Gallaway et al. 2016). Using the standard IUCN protocol for sea turtle assessments, the number of mature individuals was recently estimated at 22,341 (Wibbels and Bevan 2019). The calculation took into account the average annual nests from 2016-2018 (21,156), a clutch frequency of 2.5 per year, a remigration interval of 2 years, and a sex ratio of 3.17 females: 1 male. Based on the data in their analysis, the assessment concluded the current population trend is unknown (Wibbels and Bevan 2019). However, some positive outlooks for the species include recent conservation actions, including the expanded TED requirements in the shrimp fishery (84 FR 70048, December 20, 2019) and a decrease in the amount of shrimping off the coast of Tamaulipas and in the Gulf of Mexico (NMFS and USFWS 2015).

Genetic variability in Kemp's ridley turtles is considered to be high, as measured by nuclear DNA analyses (i.e., microsatellites) (NMFS et al. 2011). If this holds true, then rapid increases in population over one or two generations would likely prevent any negative consequences in the genetic variability of the species (NMFS et al. 2011). Additional analysis of the mtDNA taken from samples of Kemp's ridley turtles at Padre Island, Texas, showed six distinct haplotypes, with one found at both Padre Island and Rancho Nuevo (Dutton et al. 2006).

Fishery interactions/bycatch are the main threat to the species. The species' limited range and low global abundance make its resilience to future perturbation low. The status of Kemp's ridley sea turtles in the action area is the same as described in Section 4 *Status of the Species*. As described in Section 4.2 *Environmental Baseline* and Section 5.0 *Cumulative Effects* of this Opinion, fisheries bycatch and vessel strike are likely to continue to occur in the action area over the life of the project. As noted in Section 7.0 *Cumulative Effects* of this Opinion, we have not identified any cumulative effects different from those considered in the Section 4.2 *Status of the Species* and Section 5.0 *Environmental Baseline* of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 6.7, climate change may result in changes in the distribution or abundance of Kemp's ridley sea turtles in the action area over time, but such changes are not anticipated over the short life of this project; we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

In Section 6.0 *Effects of the Action* above, we determined that 2 Kemp's ridley sea turtles are likely to be captured during the closed codend portion of the bottom trawl surveys and no more than 4 Kemp's ridley sea turtles are likely to be temporarily captured during the open codend portion. We anticipate that all of the Kemp's ridley sea turtles captured during the closed codend portion will be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We anticipate that the Kemp's ridley sea turtles temporarily captured during the open codend portion will pass through the net, change swimming behavior due to the presence of the net, glance off the net, or and if the net needs to be hauled back to release the turtle, a subset of these may be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We determined that all other effects of the action would be insignificant or extremely unlikely. No serious injury or mortality of any Kemp's ridley sea turtle is anticipated to result from the proposed action.

The capture of Kemp's ridley sea turtles will temporarily prevent these sea turtles from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the turtles are returned to the water. The capture of Kemp's ridley sea turtles will not reduce the numbers of Kemp's ridley sea turtles in the action area, in any subpopulation or the species as a whole over the course of the action. As any effects to individual Kemp's ridley sea turtles will be minor and temporary there are not anticipated to be any impacts to the health, reproductive capacity, or fitness of any individuals. Similarly, as the capture of Kemp's ridley sea turtles will not affect the fitness of any individual, no effects to reproduction are anticipated over the course of the action. The capture of Kemp's ridley sea turtles will not affect the distribution of Kemp's ridley sea turtles in the action area or affect the distribution of sea turtles throughout their range over the course of the action. As any effects to individual Kemp's ridley sea turtles will be minor and temporary there are not anticipated to be any population level impacts.

Based on the information provided above, the capture and release of 6 Kemp's ridley sea turtles over 4 years will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The proposed action will not affect Kemp's ridleys in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent Kemp's ridleys from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) no mortality will occur; (2) the action will not result in any change in the status or trends of the species as a whole; (3) there will be no effect on the levels of genetic heterogeneity in the population; (4) there will be no effect on reproductive output that the loss of this individual will not change the status or trends of the species; (5) the action will have insignificant and temporary effects on the distribution of Kemp's ridley sea turtles in the action area (limited to the time it is captured) and no effect on its distribution throughout its range; and, (6) the actions will have no effect on the ability of Kemp's ridleys to shelter and only an insignificant effect on individual foraging Kemp's ridleys.

In certain instances, an action may not reduce appreciably the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed action will not reduce appreciably the likelihood that Kemp's ridley sea turtles will survive in the wild. Here, we consider the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed action will affect the likelihood that Kemp's ridleys can rebuild to a point where listing is no longer appropriate. In 2011, NMFS and the USFWS issued a recovery plan for Kemp's ridleys (NMFS *et al*. 2011). The plan includes a list of criteria necessary for recovery. These include:

1. An increase in the population size, specifically in relation to nesting females[25];
2. An increase in the recruitment of hatchlings[26];
3. An increase in the number of nests at the nesting beaches;
4. Preservation and maintenance of nesting beaches (i.e. Rancho Nuevo, Tepehuajes, and Playa Dos); and,
5. Maintenance of sufficient foraging, migratory, and inter-nesting habitat.

Kemp's ridley sea turtles have an increasing trend. This action will not change the status or trend of the Kemp's ridley sea turtles. As explained above, the proposed action will not result in any mortality and will not result in any reduction in future reproductive output. Because there will be no effect on numbers or reproductive output, the action will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. As such, the proposed action will not affect the likelihood that criteria one, two or three will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; therefore, the proposed actions will have no effect on the likelihood that recovery criteria four will be met. All effects to habitat will be insignificant or extremely unlikely to occur; therefore, the proposed actions will have no effect on the likelihood that criteria five will be met.

[25] A population of at least 10,000 nesting females in a season (as measured by clutch frequency per female per season) distributed at the primary nesting beaches in Mexico (Rancho Nuevo, Tepehuajes, and Playa Dos) is attained in order for downlisting to occur; an average of 40,000 nesting females per season over a 6-year period by 2024 for delisting to occur.

[26] Recruitment of at least 300,000 hatchlings to the marine environment per season at the three primary nesting beaches in Mexico (Rancho Nuevo, Tepehuajes, and Playa Dos).

The effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the action will not prevent the DPS from growing in a way that leads to recovery and the action will not change the rate at which recovery can occur. This is the case because the action will not result in the serious injury or mortality of any individuals, will not affect the fitness or reproductive output of any individuals, or otherwise have consequences on the status or growth of the DPS or its potential for recovery. Therefore, based on the analysis presented above, the proposed action will not reduce appreciably the likelihood that Kemp's ridley sea turtles can be brought to the point at which they are no longer listed as endangered or threatened; that is; the proposed action will not appreciably reduce the likelihood of recovery of Kemp's ridley sea turtles.

Despite the threats faced by individual Kemp's ridley sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed action in light of the status of the species, *Environmental Baseline* and *Cumulative Effects* explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions; the conclusions reached above do not change. Based on the analysis presented herein, the proposed action, resulting in the non-lethal capture of 6 Kemp's ridley sea turtles over the 4-year survey period, is not likely to appreciably reduce the likelihood of both the survival and recovery of this species. These conclusions were made in consideration of the endangered status of Kemp's ridley sea turtles, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance and distribution of Kemp's ridleys in the action area.

8.3 Atlantic sturgeon

In the Section 6.0 *Effects of the Action*, we estimated that the closed codend portion of the bottom trawl survey will result in the capture of up to 25 Atlantic sturgeon (1 Gulf of Maine DPS, 14 New York Bight DPS, 6 Chesapeake Bay DPS, 3 South Atlantic DPS, and 1 Carolina DPS) (Table 6.5.4.1) and the open codend portion will result in the temporary capture of up to 58 Atlantic sturgeon (1 Gulf of Maine DPS, 32 New York Bight DPS, 13 Chesapeake Bay DPS, 8 South Atlantic DPS, and 4 Carolina DPS) (Table 6.5.4.2) over the 4-year survey period. We do not expect the entanglement or capture of any Atlantic sturgeon in any other survey gear and do not expect any effects to Atlantic sturgeon from exposure to the sonar operated on the HabCam surveys. We concluded that project vessel strikes to Atlantic sturgeon are extremely unlikely to occur. We also determined that effects to habitat and prey are insignificant or extremely unlikely. In this section, we discuss the likely consequences of these effects to individual Atlantic sturgeon and the populations those individuals represent.

8.3.1 Gulf of Maine DPS of Atlantic sturgeon

The Gulf of Maine DPS is listed as threatened. While Atlantic sturgeon occur in several rivers in the Gulf of Maine DPS, recent spawning has only been documented in the Kennebec River. There are no abundance estimates for the Gulf of Maine DPS as a whole. The estimated effective population size of the Kennebec River is less than 70 adults, which suggests a relatively small spawning population (NMFS 2022). NMFS estimated adult and subadult abundance of the Gulf of Maine DPS based on available information for the genetic composition and the estimated abundance of Atlantic sturgeon in marine waters (Damon-Randall et al. 2013, Kocik et al. 2013) and concluded that subadult and adult abundance of the Gulf of Maine DPS was 7,455 sturgeon (NMFS 2013). This number encompasses many age classes since, across all DPSs, subadults can be as young as one year old when they first enter the marine environment, and adults can live as long as 64 years (Balazik et al. 2012a; Hilton et al. 2016).

Gulf of Maine origin Atlantic sturgeon are subject to numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage or for the DPS as a whole. The ASMFC stock assessment concluded that the abundance of the Gulf of Maine DPS is “depleted” relative to historical levels. The Commission also noted that the Gulf of Maine is particularly data poor among all five DPSs. The assessment concluded that there is a 51 percent probability that the abundance of the Gulf of Maine DPS has increased since implementation of the 1998 fishing moratorium. The Commission also concluded that there is a relatively high likelihood (74 percent probability) that mortality for the Gulf of Maine DPS exceeds the mortality threshold used for the assessment (ASMFC 2017). However, the Commission noted that there was considerable uncertainty related to these numbers, particularly concerning trends data for the Gulf of Maine DPS. For example, the stock assessment notes that it was not clear if: (1) the percent probability for the trend in abundance for the Gulf of Maine DPS is a reflection of the actual trend in abundance or of the underlying data quality for the DPS; and, (2) the percent probability that the Gulf of Maine DPS exceeds the mortality threshold actually reflects lower survival or was due to increased tagging model uncertainty owing to low sample sizes and potential emigration.

As described in the 5-Year Review for the Gulf of Maine DPS (NMFS 2022), the demographic risk for the DPS is “moderate”[27] because of its low productivity (i.e., relatively few adults compared to historical levels), low abundance (i.e., only one known spawning population and low DPS abundance, overall), and limited spatial distribution (i.e., limited spawning habitat within the one river known to support spawning). There is also new information indicating genetic bottlenecks as well as low levels of inbreeding. However, the recovery potential is considered high.

The effects of the action are in addition to ongoing threats in the action area, which include incidental capture/bycatch in state and federal fisheries, vessel strikes, coastal development, habitat loss, contaminants, and climate change. Entanglement in fishing gear and vessel strikes as described in Section 5.0 *Environmental Baseline* are expected to continue to occur in the action area over the life of the proposed project. As noted in Section 7.0 *Cumulative Effects* of this Opinion, we have not identified any cumulative effects different from those considered in the Section 4.2 *Status of the Species* and Section 5.0 *Environmental Baseline* of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 6.7, given the short duration of the proposed action (4 years), we do not expect any change in the

27 84 FR 18243; April 30, 2019 - Listing and Recovery Priority Guidelines.

abundance or seasonal distribution of Atlantic sturgeon in the action area as a result of climate change over the life of the proposed project.

In the Section 6.0 *Effects of the Action* above, we determined that no more than 1 Gulf of Maine DPS Atlantic sturgeon are likely to be captured during the closed codend portion of the bottom trawl surveys and no more than 1 Gulf of Maine DPS Atlantic sturgeon are likely to be temporarily captured during the open codend portion. We anticipate that all of the Gulf of Maine DPS Atlantic sturgeon captured during the closed codend portion will be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We anticipate that the Gulf of Maine DPS Atlantic sturgeon temporarily captured during the open codend portion will pass through the net, change swimming behavior due to the presence of the net, glance off the net, or if the net needs to be hauled back to release the sturgeon, a subset of these may be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We determined that all other effects of the action would be insignificant or extremely unlikely. No serious injury or mortality of any Gulf of Maine DPS Atlantic sturgeon is anticipated to result from the proposed action. We do not expect the field sampling methods for the proposed project to result in any changes in the abundance, or reproduction of Atlantic sturgeon in the action area; changes in distribution of individuals will be minor and temporary as a result of the capture in the trawl. All effects to Atlantic sturgeon from impacts to habitat and prey will be insignificant.

Atlantic sturgeon captured and released in the trawl survey may experience minor injuries (i.e., scrapes, abrasions); however, they are expected to make a complete recovery without any impairment to future fitness. Capture will temporarily prevent these individuals from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the sturgeon are returned to the water; for trawls the length of capture will be no more than the time the staff scientist monitoring the video feed sees a sturgeon entering the net (max closed codend tow time is 20 minutes) and the time the net is hauled on deck plus a short handling period on board the vessel. The capture of sturgeon will not reduce the number of Gulf of Maine DPS Atlantic sturgeon in the action area or the numbers of Gulf of Maine DPS Atlantic sturgeon as a whole. Similarly, as the capture of Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of Atlantic sturgeon is also not likely to affect the distribution of Atlantic sturgeon throughout their range. As any effects to individual Atlantic sturgeon removed from the trawl gear will be minor and temporary without any mortality or effects on reproduction, we do not anticipate any population level impacts.

The proposed project will not result in the mortality of any Gulf of Maine DPS Atlantic sturgeon. As such, there will be no reduction in individual fitness and no effects on reproductive potential. The proposed action is not likely to reduce distribution, because the action will not impede Gulf of Maine DPS Atlantic sturgeon from accessing any seasonal aggregation areas, including foraging, spawning, or overwintering grounds.

Based on the information provided above, the proposed action will not appreciably reduce the likelihood of survival of the Gulf of Maine DPS (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect the Gulf of Maine DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in consequences to the environment which would prevent Atlantic sturgeon from completing their entire life cycle or completing essential behaviors including reproducing, foraging and sheltering. This is the case because: (1) the proposed action will not result in any mortality and associated loss of potential future reproduction; (2) the proposed action will not change the status or trends of the species as a whole; (3) there will be no effect on the levels of genetic heterogeneity in the population; (4) there will be no change to the overall distribution of Gulf of Maine DPS Atlantic sturgeon in the action area or throughout their range; and, (5) the action will have no effect on individual foraging or sheltering Gulf of Maine DPS Atlantic sturgeon.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might appreciably reduce its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the Gulf of Maine DPS of Atlantic sturgeon will survive in the wild, which includes consideration of recovery potential. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the improvement in status such that listing under Section 4(a) as "in danger of extinction throughout all or a significant portion of its range" (endangered) or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range…" (threatened) is no longer appropriate. Thus, we have considered whether the proposed action will appreciably reduce the likelihood that Gulf of Maine DPS Atlantic sturgeon can rebuild to a point where the Gulf of Maine DPS of Atlantic sturgeon is no longer likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

No Recovery Plan for the Gulf of Maine DPS has been published. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. In January 2018, we published a Recovery Outline for the five DPSs of Atlantic sturgeon (NMFS 2018[28]). This outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. The outline provides a preliminary strategy for recovery of the species.

We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting, and migrations of all individuals. For Gulf of Maine DPS Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter

[28] Available online at: https://media.fisheries.noaa.gov/dam-migration/ats_recovery_outline.pdf; last accessed March 1, 2024

and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. As described in the vision statement in the Recovery Outline, subpopulations of all five Atlantic sturgeon DPSs 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. Here, we consider whether this proposed action will reduce the Gulf of Maine DPS likelihood of recovery.

This action will not change the status or trend of the Gulf of Maine DPS. The proposed action will not affect the distribution of Atlantic sturgeon across the historical range. The proposed action will not result in mortality or reduction in future reproductive output beyond what was considered in the *Environmental Baseline* and will not impair the species' resiliency, genetic diversity, recruitment, or year class strength. The proposed action will have only insignificant effects on habitat and forage and will not impact habitat in a way that makes additional growth of the population less likely, that is, it will not reduce the habitat's carrying capacity. This is because impacts to forage will be insignificant or extremely unlikely. For these reasons, the action will not reduce the likelihood that the Gulf of Maine DPS can recover. Therefore, the proposed action will not appreciably reduce the likelihood that the Gulf of Maine DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened; that is, the proposed action will not appreciably reduce the likelihood of recovery of the Gulf of Maine DPS. Based on the analysis presented herein, the proposed action is not likely to appreciably reduce the likelihood of both the survival and recovery of this species. These conclusions were made in consideration of the status of the Gulf of Maine DPS of Atlantic sturgeon, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of the Gulf of Maine DPS of Atlantic sturgeon in the action area.

8.3.2 New York Bight DPS of Atlantic sturgeon

The New York Bight DPS is listed as endangered. While Atlantic sturgeon occur in several rivers in the New York Bight, recent spawning has only been documented in the Hudson and Delaware Rivers. The essential physical features necessary to support spawning and recruitment are also present in the Connecticut and Housatonic Rivers (82 FR 39160; August 17, 2017).

However, there is no current evidence that spawning is occurring nor are there studies underway to investigate spawning occurrence in those rivers; except one recent study where YOY fish were captured in the Connecticut River (Savoy et al. 2017). Genetic analysis suggests that the YOY belonged to the South Atlantic DPS and at this time, we do not know if these fish were the result of a single spawning event due to unique straying of the adults from the South Atlantic DPS's spawning rivers. NMFS estimated adult and subadult abundance of the New York Bight DPS based on available information for the genetic composition and the estimated abundance of Atlantic sturgeon in marine waters (Damon-Randall et al. 2013, Kocik et al. 2013) and concluded that subadult and adult abundance of the New York Bight DPS was 34,566 sturgeon

(NMFS 2013). This number encompasses many age classes since, across all DPSs, subadults can be as young as one year old when they first enter the marine environment, and adults can live as long as 64 years (Balazik et al. 2012a; Hilton et al. 2016).

The 2017 ASMFC stock assessment determined that abundance of the New York Bight DPS is "depleted" relative to historical levels (ASMFC 2017). The assessment also determined there is a relatively high probability (75 percent) that the New York Bight DPS abundance has increased since the implementation of the 1998 fishing moratorium, and a 31 percent probability that mortality for the New York Bight DPS exceeds the mortality threshold used for the assessment (ASMFC 2017). The Commission noted, however, there is significant uncertainty in relation to the trend data. Moreover, new information suggests that the Commission's conclusions primarily reflect the status and trend of only the DPS's Hudson River spawning population.

New York Bight DPS origin Atlantic sturgeon are subject to numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. The largest single source of mortality appears to be capture as bycatch in commercial fisheries operating in the marine environment. Because early life stages and juveniles do not leave the river, they are not impacted by fisheries occurring in federal waters. Bycatch and mortality also occur in state fisheries; however, the primary fishery that impacted juvenile sturgeon (the shad fishery) has now been closed and there is no indication that it will reopen soon. New York Bight DPS Atlantic sturgeon are killed as a result of other anthropogenic activities in the Hudson, Delaware, and other rivers within the New York Bight as well; sources of potential mortality include vessel strikes and entrainment in dredges.

The effects of the action are in addition to ongoing threats in the action area, which include incidental capture in state and federal fisheries, vessel strikes, coastal development, habitat loss, contaminants, and climate change. Entanglement in fishing gear and vessel strikes as described in Section 5.0 *Environmental Baseline* are expected to continue to occur in the action area over the life of the proposed action. As noted in Section 7.0 *Cumulative Effects* of this Opinion, we have not identified any cumulative effects different from those considered in Section 4.2 *Status of the Species* and Section 5.0 *Environmental Baseline* of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 6.7, climate change may result in a northward shift in distribution of sturgeon over time; however, given the short duration of the proposed action (4 years), we do not expect any change in the abundance or seasonal distribution of sturgeon in the action area over the life of the proposed project.

In Section 6.0 *Effects of the Action* above, we determined that no more than 14 New York Bight DPS Atlantic sturgeon are likely to be captured during the closed codend portion of the bottom trawl surveys and no more than 32 New York Bight DPS Atlantic sturgeon are likely to be temporarily captured during the open codend portion. We anticipate that all of the New York Bight DPS Atlantic sturgeon captured during the closed codend portion will be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We anticipate that the New York Bight DPS Atlantic sturgeon temporarily captured during the open codend portion will pass through the net, change swimming behavior due to the presence of the net, glance off the net, or if the net needs to be hauled back to release the sturgeon, a subset of these may be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We determined that all other effects of the action would be insignificant or extremely unlikely. No serious injury or mortality of any New York Bight DPS Atlantic sturgeon is anticipated to result from the proposed action. We do not expect the field sampling methods for the proposed project to result in any changes in the abundance, or reproduction of Atlantic sturgeon in the action area; changes in distribution of individuals will be minor and temporary as a result of the capture in the trawl. All effects to Atlantic sturgeon from impacts to habitat and prey will be insignificant.

Atlantic sturgeon captured and released in the trawl survey may experience minor injuries (i.e., scrapes, abrasions); however, they are expected to make a complete recovery without any impairment to future fitness. Capture will temporarily prevent these individuals from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the sturgeon are returned to the water; for trawls the length of capture will be no more than the time the staff scientist monitoring the video feed sees a sturgeon entering the net (max closed codend tow time is 20 minutes) and the time the net is hauled on deck plus a short handling period on board the vessel. The capture of sturgeon will not reduce the number of New York Bight DPS Atlantic sturgeon in the action area or the numbers of New York Bight DPS Atlantic sturgeon as a whole. Similarly, as the capture of Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of Atlantic sturgeon is also not likely to affect the distribution of Atlantic sturgeon throughout their range. As any effects to individual Atlantic sturgeon removed from the trawl gear will be minor and temporary without any mortality or effects on reproduction, we do not anticipate any population level impacts.

The proposed project will not result in the mortality of any New York Bight DPS Atlantic sturgeon. As such, there will be no reduction in individual fitness and no effects on reproductive potential. The proposed action is not likely to reduce distribution, because the action will not impede New York Bight DPS Atlantic sturgeon from accessing any seasonal aggregation areas, including foraging, spawning, or overwintering grounds.

Based on the information provided above, the proposed action will not appreciably reduce the likelihood of survival of the New York Bight DPS (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect the New York Bight DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in consequences to the environment which would prevent Atlantic sturgeon from completing their entire life cycle or completing essential behaviors including reproducing, foraging and sheltering. This is the case because: (1) the proposed action will not result in any mortality and the associated loss of potential future reproduction; (2) the proposed action will not change the status or trends of the species as a whole; (3) there will be no effect on the levels of genetic heterogeneity in the population; (4) there will be no change to the overall distribution of New York Bight DPS Atlantic sturgeon in the action area or throughout their range; and, (5) the action will have no effect on individual foraging or sheltering New York Bight DPS Atlantic sturgeon.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might appreciably reduce its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the New York Bight DPS of Atlantic sturgeon will survive in the wild, which includes consideration of recovery potential. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the improvement in status such that listing under Section 4(a) as "in danger of extinction throughout all or a significant portion of its range" (endangered) or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range…" (threatened) is no longer appropriate. Thus, we have considered whether the proposed action will appreciably reduce the likelihood that New York Bight DPS Atlantic sturgeon can rebuild to a point where the New York Bight DPS of Atlantic sturgeon is no longer in danger of extinction throughout all or a significant portion of its range.

No Recovery Plan for the New York Bight DPS has been published. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. In January 2018, we published a Recovery Outline for the five DPSs of Atlantic sturgeon (NMFS 2018[29]). This outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. The outline provides a preliminary strategy for recovery of the species. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting, and migrations of all individuals. For New York Bight DPS Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. As described in the vision statement in the Recovery Outline, subpopulations of all five Atlantic sturgeon DPSs 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. Here, we consider whether this proposed action will reduce the New York Bight DPS likelihood of recovery.

This action will not change the status or trend of the New York Bight DPS. The proposed action will not affect the distribution of Atlantic sturgeon across the historical range. The proposed action will not result in mortality or reduction in future reproductive output beyond what was

[29] Available online at: https://media.fisheries.noaa.gov/dam-migration/ats_recovery_outline.pdf; last accessed March 1, 2024.

considered in the *Environmental Baseline* and will not impair the species' resiliency, genetic diversity, recruitment, or year class strength. The proposed action will have only insignificant effects on habitat and forage and will not impact habitat in a way that makes additional growth of the population less likely, that is, it will not reduce the habitat's carrying capacity. This is because impacts to forage will be insignificant or extremely unlikely. For these reasons, the action will not reduce the likelihood that the New York Bight DPS can recover. Therefore, the proposed action will not appreciably reduce the likelihood that the New York Bight DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as endangered; that is, the proposed action will not appreciably reduce the likelihood of recovery of the New York Bight DPS. Based on the analysis presented herein, the proposed action is not likely to appreciably reduce the likelihood of both the survival and recovery of this species. These conclusions were made in consideration of the status of the New York Bight DPS of Atlantic sturgeon, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of the New York Bight DPS of Atlantic sturgeon in the action area.

8.3.3 Chesapeake Bay DPS of Atlantic sturgeon

The Chesapeake Bay DPS is listed as endangered. While Atlantic sturgeon occur in several rivers in the Chesapeake Bay DPS, at the time of listing spawning was only known to occur in the James River. Since the listing, there is evidence of additional spawning populations in the Chesapeake Bay DPS, including the Pamunkey River, a tributary of the York River, and in Marshyhope Creek, a tributary of the Nanticoke River (Hager et al. 2014, Kahn et al. 2014, Richardson and Secor 2016, Secor et al. 2021). Detections of acoustically-tagged adult Atlantic sturgeon along with historical evidence suggests that Atlantic sturgeon belonging to the Chesapeake Bay DPS may be spawning in the Mattaponi and Rappahannock rivers as well (Hilton et al. 2016, ASMFC 2017, Kahn et al. 2019). However, information for these populations is limited and the research is ongoing.

Chesapeake Bay DPS Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently no census nor enough information to establish a trend, for any life stage, for the James River spawning population, or for the DPS as a whole. However, the NEAMAP data indicates that the estimated ocean population of Chesapeake Bay DPS Atlantic sturgeon is 8,811 sub-adult and adult individuals (2,203 adults and 6,608 subadults). The ASMFC (2017) stock assessment determined that abundance of the Chesapeake Bay DPS is "depleted" relative to historical levels. The assessment, while noting significant uncertainty in trend data, also determined that there is a relatively low probability (36 percent) that abundance of the Chesapeake Bay DPS has increased since the implementation of the 1998 fishing moratorium, and a 30 percent probability that mortality for the Chesapeake Bay DPS exceeds the mortality threshold used for the assessment (ASMFC 2017).

As described in the 5-Year Review for the Chesapeake Bay DPS (NMFS 2022), the demographic risk for the DPS 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 three 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). There is also new information indicating genetic bottlenecks as well as low levels of inbreeding. However, the recovery potential is considered high.

The effects of the action are in addition to ongoing threats in the action area, which include incidental capture in state and federal fisheries, vessel strikes, coastal development, habitat loss, contaminants, and climate change. Entanglement in fishing gear and vessel strikes as described in Section 5.0 *Environmental Baseline* are expected to continue to occur in the action area over the life of the proposed action. As noted in Section 7.0 *Cumulative Effects* s of this Opinion, we have not identified any cumulative effects different from those considered in Section 4.2 *Status of the Species* and Section 5.0 *Environmental Baseline* of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 6.7, climate change may result in a northward shift in distribution of sturgeon over time; however, given the short duration of the proposed action (4 years), we do not expect any change in the abundance or seasonal distribution of sturgeon in the action area over the life of the proposed project.

In Section 6.0 *Effects of the Action* above, we determined that no more than 6 Chesapeake Bay DPS Atlantic sturgeon are likely to be captured during the closed codend portion of the bottom trawl surveys and no more than 13 Chesapeake Bay DPS Atlantic sturgeon are likely to be temporarily captured during the open codend portion. We anticipate that all of the Chesapeake Bay DPS Atlantic sturgeon captured during the closed codend portion will be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We anticipate that the Chesapeake Bay DPS Atlantic sturgeon temporarily captured during the open codend portion will pass through the net, change swimming behavior due to the presence of the net, glance off the net, or if the net needs to be hauled back to release the sturgeon, a subset of these may be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We determined that all other effects of the action would be insignificant or extremely unlikely. No serious injury or mortality of any Chesapeake Bay DPS Atlantic sturgeon is anticipated to result from the proposed action. We do not expect the field sampling methods for the proposed project to result in any changes in the abundance, or reproduction of Atlantic sturgeon in the action area; changes in distribution of individuals will be minor and temporary as a result of the capture in the trawl. All effects to Atlantic sturgeon from impacts to habitat and prey will be insignificant.

Atlantic sturgeon captured and released in the trawl survey may experience minor injuries (i.e., scrapes, abrasions); however, they are expected to make a complete recovery without any impairment to future fitness. Capture will temporarily prevent these individuals from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the sturgeon are returned to the water; for trawls the length of capture will be no more than the time the staff scientist monitoring the video feed sees a sturgeon entering the net (max closed codend tow time is 20 minutes) and the time the net is hauled on deck plus a short handling period on board the vessel. The capture of sturgeon will not reduce the number of Chesapeake Bay DPS Atlantic sturgeon in the action area or the numbers of Chesapeake Bay DPS Atlantic sturgeon as a whole. Similarly, as the capture of Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of Atlantic sturgeon is also not likely to affect the distribution of Atlantic sturgeon throughout their range. As any effects to individual live Atlantic sturgeon removed from the trawl gear will be minor and temporary without any mortality or effects on reproduction, we do not anticipate any population level impacts.

The proposed project will not result in the mortality of any Chesapeake Bay DPS Atlantic sturgeon. As such, there will be no reduction in individual fitness and no effects on reproductive potential. The proposed action is not likely to reduce distribution, because the action will not impede Chesapeake Bay DPS Atlantic sturgeon from accessing any seasonal aggregation areas, including foraging, spawning, or overwintering grounds.

Based on the information provided above, the proposed action will not appreciably reduce the likelihood of survival of the Chesapeake Bay DPS (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect the Chesapeake Bay DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in consequences to the environment which would prevent Atlantic sturgeon from completing their entire life cycle or completing essential behaviors including reproducing, foraging and sheltering. This is the case because: (1) the proposed action will not result in any mortality and associated loss of potential future reproduction; (2) the proposed action will not change the status or trends of the species as a whole; (3) there will be no effect on the levels of genetic heterogeneity in the population; (4) there will be no change to the overall distribution of Chesapeake Bay DPS Atlantic sturgeon in the action area or throughout their range; and, (5) the action will have no effect on individual foraging or sheltering Chesapeake Bay DPS Atlantic sturgeon.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might appreciably reduce its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the Chesapeake Bay DPS of Atlantic sturgeon will survive in the wild, which includes consideration of recovery potential. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the improvement in status such that listing under Section 4(a) as "in danger of extinction throughout all or a significant portion of its range" (endangered) or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range…" (threatened) is no longer appropriate. Thus, we have considered whether the proposed action will appreciably reduce the likelihood that Chesapeake Bay DPS Atlantic sturgeon can rebuild to a point where the Chesapeake Bay DPS of Atlantic sturgeon is no longer in danger of extinction throughout all or a significant portion of its range.

No Recovery Plan for the Chesapeake Bay DPS has been published. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. In January 2018, we published a Recovery Outline for the five

DPSs of Atlantic sturgeon (NMFS 2018[30]). This outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. The outline provides a preliminary strategy for recovery of the species. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting, and migrations of all individuals. For Chesapeake Bay DPS Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. As described in the vision statement in the Recovery Outline, subpopulations of all five Atlantic sturgeon DPSs 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. Here, we consider whether this proposed action will reduce the Chesapeake Bay DPS likelihood of recovery.

This action will not change the status or trend of the Chesapeake Bay DPS. The proposed action will not affect the distribution of Atlantic sturgeon across the historical range. The proposed action will not result in mortality or reduction in future reproductive output beyond what was considered in the *Environmental Baseline* and will not impair the species' resiliency, genetic diversity, recruitment, or year class strength. The proposed action will have only insignificant effects on habitat and forage and will not impact habitat in a way that makes additional growth of the population less likely, that is, it will not reduce the habitat's carrying capacity. This is because impacts to forage will be insignificant or extremely unlikely. For these reasons, the action will not reduce the likelihood that the Chesapeake Bay DPS can recover. Therefore, the proposed action will not appreciably reduce the likelihood that the Chesapeake Bay DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as endangered; that is, the proposed action will not appreciably reduce the likelihood of recovery of the Chesapeake Bay DPS. Based on the analysis presented herein, the proposed action is not likely to appreciably reduce the likelihood of both the survival and recovery of this species. These conclusions were made in consideration of the status of the Chesapeake Bay DPS of Atlantic sturgeon, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of the Chesapeake Bay DPS of Atlantic sturgeon in the action area.

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[30] Available online at: https://media.fisheries.noaa.gov/dam-migration/ats_recovery_outline.pdf; last accessed March 1, 2024.

8.3.4 Carolina DPS of Atlantic sturgeon

The Carolina DPS is listed as endangered. Atlantic sturgeon from the Carolina DPS spawn in the rivers of North Carolina south to the Cooper River, South Carolina. There are currently seven spawning subpopulations within the Carolina DPS: Roanoke River, Tar-Pamlico River, Neuse River, Northeast Cape Fear and Cape Fear Rivers, Waccamaw and Great Pee Dee Rivers, Black River, Santee and Cooper Rivers. NMFS estimated adult and subadult abundance of the Carolina DPS based on available information for the genetic composition and the estimated abundance of Atlantic sturgeon in marine waters (Damon-Randall et al. 2013, Kocik et al. 2013) and concluded that subadult and adult abundance of the Carolina DPS was 1,356 sturgeon (339 adults and 1,017 subadults) (NMFS 2013). This number encompasses many age classes since, across all DPSs, subadults can be as young as two years old when they first enter the marine environment, and adults can live as long as 64 years (Balazik et al. 2012; Hilton et al. 2016).

Very few data sets are available that cover the full potential life span of an Atlantic sturgeon. The ASMFC concluded for the Stock Assessment that it could not estimate abundance of the Carolina DPS or otherwise quantify the trend in abundance because of the limited available information. However, the Stock Assessment was a comprehensive review of the available information, and used multiple methods and analyses to assess the status of the Carolina DPS and the coast wide stock of Atlantic sturgeon. For example, the Stock Assessment Subcommittee defined a benchmark, the mortality threshold, against which mortality for the coast wide stock of Atlantic sturgeon as well as for each DPS were compared[31] to assess whether the current mortality experienced by the coast wide stock and each DPS is greater than what it can sustain. This information informs the current trend of the Carolina DPS.

In the Stock Assessment, the ASMFC concluded that abundance of the Carolina DPS is "depleted" relative to historical levels and there is a relatively low probability (36 percent) that abundance of the Carolina DPS has increased since the implementation of the 1998 fishing moratorium. The ASMFC also concluded that there is a relatively low likelihood (25 percent probability) that mortality for the Carolina DPS does not exceed the mortality threshold used for the Stock Assessment (ASMFC 2017).

The effects of the action are in addition to ongoing threats in the action area, which include incidental capture in state and federal fisheries, boat strikes, coastal development, habitat loss, contaminants, and climate change. Entanglement in fishing gear and vessel strikes as described in Section 5.0 *Environmental Baseline*, are expected to continue to occur in the action area over the life of the proposed action. As noted in Section 7.0 *Cumulative Effects* of this Opinion, we have not identified any cumulative effects different from those considered in the Section 4.2 *Status of the Species* and Section 5.0 *Environmental Baseline* of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 6.7, climate change may result in a northward shift in distribution of sturgeon over time; however, given the short duration of the proposed action (4 years), we do not expect any change in the abundance or seasonal distribution of sturgeon in the action area over the life of the proposed project.

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[31] The analysis considered both a coast wide mortality threshold and a region-specific mortality threshold to evaluate the sensitivity of the model to differences in life history parameters among the different DPSs (e.g., Atlantic sturgeon in the northern region are slower growing, longer lived; Atlantic sturgeon in the southern region are faster growing, shorter lived).

In the Section 6.0 *Effects of the Action* above, we determined that no more than 1 Carolina DPS Atlantic sturgeon are likely to be captured during the closed codend portion of the bottom trawl surveys and no more than 4 Carolina DPS Atlantic sturgeon are likely to be temporarily captured during the open codend portion. We anticipate that all of the Carolina DPS Atlantic sturgeon captured during the closed codend portion will be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We anticipate that the Carolina DPS Atlantic sturgeon temporarily captured during the open codend portion will pass through the net, change swimming behavior due to the presence of the net, glance off the net, or and if the net needs to be hauled back to release the sturgeon, a subset of these may be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We determined that all other effects of the action would be insignificant or extremely unlikely. No serious injury or mortality of any Carolina DPS Atlantic sturgeon is anticipated to result from the proposed action. We do not expect the field sampling methods for the proposed project to result in any changes in the abundance, or reproduction of Atlantic sturgeon in the action area; changes in distribution of individuals will be minor and temporary as a result of the capture in the trawl. All effects to Atlantic sturgeon from impacts to habitat and prey will be insignificant.

Atlantic sturgeon captured and released in the trawl survey may experience minor injuries (i.e., scrapes, abrasions); however, they are expected to make a complete recovery without any impairment to future fitness. Capture will temporarily prevent these individuals from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the sturgeon are returned to the water; for trawls the length of capture will be no more than the time the staff scientist monitoring the video feed sees a sturgeon entering the net (max closed codend tow time is 20 minutes) and the time the net is hauled on deck plus a short handling period on board the vessel. The capture of sturgeon will not reduce the number of Carolina DPS Atlantic sturgeon in the action area or the numbers of Carolina DPS Atlantic sturgeon as a whole. Similarly, as the capture of live Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of Atlantic sturgeon is also not likely to affect the distribution of Atlantic sturgeon throughout their range. As any effects to individual Atlantic sturgeon removed from the trawl gear will be minor and temporary without any mortality or effects on reproduction, we do not anticipate any population level impacts.

The proposed project will not result in the mortality of any Carolina DPS Atlantic sturgeon. There will be no effects on reproduction of any Carolina DPS Atlantic sturgeon. The proposed action is not likely to reduce distribution, because the action will not impede Carolina DPS Atlantic sturgeon from accessing any seasonal aggregation areas, including foraging, spawning, or overwintering grounds.

Based on the information provided above, the proposed action will not appreciably reduce the likelihood of survival of the Carolina DPS (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect the Carolina DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in consequences to the environment which would prevent Atlantic sturgeon from completing their entire life cycle or completing essential behaviors including reproducing, foraging and sheltering. This is the case because: (1) the proposed action will not result in any mortality and associated loss of potential future reproduction; (2) the proposed action will not change the status or trends of the species as a whole; (3) there will be no effect on the levels of genetic heterogeneity in the population; (4) there will be no change to the overall distribution of Carolina DPS Atlantic sturgeon in the action area or throughout their range; and, (5) the action will have no effect on individual foraging or sheltering Carolina DPS Atlantic sturgeon.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might appreciably reduce its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the Carolina DPS of Atlantic sturgeon will survive in the wild, which includes consideration of recovery potential. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the improvement in status such that listing under Section 4(a) as "in danger of extinction throughout all or a significant portion of its range" (endangered) or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range…" (threatened) is no longer appropriate. Thus, we have considered whether the proposed action will appreciably reduce the likelihood that Carolina DPS Atlantic sturgeon can rebuild to a point where the Carolina DPS of Atlantic sturgeon is no longer in danger of extinction throughout all or a significant portion of its range.

No Recovery Plan for the Carolina DPS has been published. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. In January 2018, we published a Recovery Outline for the five DPSs of Atlantic sturgeon (NMFS 2018[32]). This outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. The outline provides a preliminary strategy for recovery of the species. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting, and migrations of all individuals. For Carolina DPS Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. As described in the vision statement in the Recovery Outline, subpopulations of all five Atlantic sturgeon DPSs must be present across the historical range. These subpopulations must be of sufficient size and genetic diversity to support

[32] Available online at: https://media.fisheries.noaa.gov/dam-migration/ats_recovery_outline.pdf; last accessed March 1, 2024.

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. Here, we consider whether this proposed action will reduce the Carolina DPS likelihood of recovery.

This action will not change the status or trend of the Carolina DPS. The proposed action will not affect the distribution of Atlantic sturgeon across the historical range. The proposed action will not result in mortality or reduction in future reproductive output of the Carolina DPS and will not impair the species' resiliency, genetic diversity, recruitment, or year class strength. The proposed action will have only insignificant effects on habitat and forage and will not impact habitat in a way that makes additional growth of the population less likely, that is, it will not reduce the habitat's carrying capacity. This is because impacts to forage will be insignificant or extremely unlikely. For these reasons, the action will not reduce the likelihood that the Carolina DPS can recover. Therefore, the proposed action will not appreciably reduce the likelihood that the Carolina DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as endangered; that is, the proposed action will not appreciably reduce the likelihood of recovery of the Carolina DPS. Based on the analysis presented herein, the proposed action is not likely to appreciably reduce the likelihood of both the survival and recovery of this species. These conclusions were made in consideration of the status of the Carolina DPS of Atlantic sturgeon, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of the Carolina DPS of Atlantic sturgeon in the action area.

8.3.5 South Atlantic DPS of Atlantic sturgeon

The South Atlantic DPS Atlantic sturgeon is listed as endangered and Atlantic sturgeon originate from at least six rivers where spawning potentially still occurs. Secor (2002) estimates that 8,000 adult females were present in South Carolina prior to 1890. In Georgia, prior to the collapse of the fishery in the late 1800s, the sturgeon fishery was the third largest fishery. Secor (2002) estimated from U.S. Fish Commission landing reports that approximately 11,000 spawning females were likely present in Georgia prior to 1890. At the time of listing, only six spawning subpopulations were thought to have existed in the South Atlantic DPS: Combahee River, Edisto River, Savannah River, Ogeechee River, Altamaha River (including the Oconee and Ocmulgee tributaries), and the Satilla River. Three of the spawning subpopulations in the South Atlantic DPS are relatively robust and are considered the second (Altamaha River) and third (Combahee/Edisto River) largest spawning subpopulations across all five DPSs. Peterson *et al.* (2008) estimated the number of spawning adults in the Altamaha River was 324 (95 percent CI: 143-667) in 2004 and 386 (95 percent CI: 216-787) in 2005. Bahr and Peterson (2016) estimated the age-1 juvenile abundance in the Savannah River from 2013-2015 at 528 in 2013, 589 in 2014, and 597 in 2015. No census of the number of Atlantic sturgeon in any of the other spawning rivers or for the DPS as a whole is available. However, the NEAMAP data indicates that the estimated ocean population of South Atlantic DPS Atlantic sturgeon sub-adults and adults is 14,911 individuals (3,728 adults and 11,183 subadults).

The 2017 ASMFC stock assessment determined that abundance of the South Atlantic DPS is "depleted" relative to historical levels (ASMFC 2017). Due to a lack of suitable indices, the assessment was unable to determine the probability that the abundance of the South Atlantic DPS has increased since the implementation of the 1998 fishing moratorium. However, it was estimated that there is a 40 percent probability that mortality for the South Atlantic DPS exceeds the mortality threshold used for the assessment (ASMFC 2017). We note that the Commission expressed significant uncertainty in relation to the trends data.

The effects of the action are in addition to ongoing threats in the action area, which include incidental capture in state and federal fisheries, vessel strikes, coastal development, habitat loss, contaminants, and climate change. Entanglement in fishing gear and vessel strikes as described in Section 5.0 *Environmental Baseline*, are expected to continue to occur in the action area over the life of the proposed action. As noted in Section 7.0 *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different from those considered in Section 4.2 *Status of the Species* and Section 5.0 *Environmental Baseline* of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 6.7, climate change may result in a northward shift in distribution of sturgeon over time; however, given the short duration of the proposed action (4 years), we do not expect any change in the abundance or seasonal distribution of sturgeon in the action area over the life of the proposed project.

In Section 6.0 *Effects of the Action* above, we determined that no more than 3 South Atlantic DPS Atlantic sturgeon are likely to be captured during the closed codend portion of the bottom trawl surveys and no more than 8 South Atlantic DPS Atlantic sturgeon are likely to be temporarily captured during the open codend portion. We anticipate that all of the South Atlantic DPS Atlantic sturgeon captured during the closed codend portion will be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We anticipate that the South Atlantic DPS Atlantic sturgeon temporarily captured during the open codend portion will pass through the net, change swimming behavior due to the presence of the net, glance off the net, or if the net needs to be hauled back to release the sturgeon, a subset of these may be removed from the water alive and that these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We determined that all other effects of the action would be insignificant or extremely unlikely. No serious injury or mortality of any South Atlantic DPS Atlantic sturgeon is anticipated to result from the proposed action. We do not expect the field sampling methods for the proposed project to result in any changes in the abundance, or reproduction of Atlantic sturgeon in the action area; changes in distribution of individuals will be minor and temporary as a result of the capture in the trawl. All effects to Atlantic sturgeon from impacts to habitat and prey will be insignificant.

Atlantic sturgeon captured and released in the trawl survey may experience minor injuries (i.e., scrapes, abrasions); however, they are expected to make a complete recovery without any impairment to future fitness. Capture will temporarily prevent these individuals from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the sturgeon are returned to the water; for trawls the length of capture will be no more than the time the staff scientist monitoring the video feed sees a sturgeon entering the net (max closed codend tow time is 20 minutes) and the time the net is hauled on deck plus a short handling period on board the vessel. The capture of sturgeon will not reduce the number of South Atlantic DPS Atlantic sturgeon in the action area or the numbers of South Atlantic DPS Atlantic sturgeon as a whole. Similarly, as the capture of Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live Atlantic sturgeon is also not likely to affect the distribution of Atlantic sturgeon throughout their range. As any effects to individual Atlantic sturgeon removed from the trawl gear will be minor and temporary without any mortality or effects on reproduction, we do not anticipate any population level impacts.

The proposed project will not result in the mortality of any South Atlantic DPS Atlantic sturgeon. There will be no effects on reproduction of any South Atlantic DPS Atlantic sturgeon. The proposed action is not likely to reduce distribution, because the action will not impede South Atlantic DPS Atlantic sturgeon from accessing any seasonal aggregation areas, including foraging, spawning, or overwintering grounds.

Based on the information provided above, the proposed action will not appreciably reduce the likelihood of survival of the South Atlantic DPS (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect the South Atlantic DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in consequences to the environment which would prevent Atlantic sturgeon from completing their entire life cycle or completing essential behaviors including reproducing, foraging and sheltering. This is the case because: (1) the proposed action will not result in any mortality and associated loss of potential future reproduction; (2) the proposed action will not change the status or trends of the species as a whole; (3) there will be no effect on the levels of genetic heterogeneity in the population; (4) there will be no change to the overall distribution of South Atlantic DPS Atlantic sturgeon in the action area or throughout their range; and, (5) the action will have no effect on individual foraging or sheltering South Atlantic DPS Atlantic sturgeon.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might appreciably reduce its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the South Atlantic DPS of Atlantic sturgeon will survive in the wild, which includes consideration of recovery potential. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the improvement in status such that listing under Section 4(a) as "in danger of extinction throughout all or a significant portion of its range" (endangered) or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range…" (threatened) is no longer appropriate. Thus, we have considered whether the proposed action will appreciably reduce the likelihood that South Atlantic DPS Atlantic sturgeon can rebuild to a point where the South Atlantic DPS of Atlantic sturgeon is no longer in danger of extinction throughout all or a significant portion of its range.

No Recovery Plan for the South Atlantic DPS has been published. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. In January 2018, we published a Recovery Outline for the five DPSs of Atlantic sturgeon (NMFS 2018[33]). This outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. The outline provides a preliminary strategy for recovery of the species. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting, and migrations of all individuals. For South Atlantic DPS Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. As described in the vision statement in the Recovery Outline, subpopulations of all five Atlantic sturgeon DPSs 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. Here, we consider whether this proposed action will reduce the South Atlantic DPS likelihood of recovery.

This action will not change the status or trend of the South Atlantic DPS. The proposed action will not affect the distribution of Atlantic sturgeon across the historical range. The proposed action will not result in mortality or reduction in future reproductive output beyond what was considered in the *Environmental Baseline* and will not impair the species' resiliency, genetic diversity, recruitment or year class strength. The proposed action will have only insignificant effects on habitat and forage and will not impact habitat in a way that makes additional growth of the population less likely, that is, it will not reduce the habitat's carrying capacity. For these reasons, the action will not reduce the likelihood that the South Atlantic DPS can recover. Therefore, the proposed action will not appreciably reduce the likelihood that the South Atlantic DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as endangered; that is, the proposed action will not appreciably reduce the likelihood of recovery of the South Atlantic DPS. Based on the analysis presented herein, the proposed action is not likely to appreciably reduce the likelihood of both the survival and recovery of this species. These conclusions were made in consideration of the status of the South Atlantic DPS of Atlantic sturgeon, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of the South Atlantic DPS of Atlantic sturgeon in the action area.

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[33] Available online at: https://media.fisheries.noaa.gov/dam-migration/ats_recovery_outline.pdf; last accessed March 1, 2024.

9.0 CONCLUSION

After reviewing the current status of the ESA-listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is our biological opinion that the proposed action is likely to adversely affect but is not likely to jeopardize the continued existence of Northwest Atlantic DPS loggerhead, North Atlantic DPS green and Kemp's ridley sea turtles and Atlantic sturgeon from the Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs. The proposed action is not likely to adversely affect leatherback sea turtles or blue, fin, sei, sperm, or North Atlantic right whales. We have determined that the project will have no effect on giant manta rays, oceanic white tip sharks, shortnose sturgeon, hawksbill sea turtles, the Gulf of Maine DPS of Atlantic salmon or critical habitat designated for the North Atlantic right whale.

10.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species of fish or wildlife, respectively, without a permit or exemption. In the case of threatened species, Section 4(d) of the ESA directs the agency to issue regulations it considers necessary and advisable for the conservation of the species and leaves it to the Secretary's discretion whether and to what extent to extend the statutory 9(a)(1) ‘‘take’’ prohibitions to such species.

"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 (80 FR 26832). Harm, as explained above, 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, feeding, or sheltering. NMFS, as we have explained, has not yet defined "harass" under the ESA in regulation, but has issued 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 behavior patterns which include, but are not limited to, breeding, feeding, or sheltering" (NMFS PD 02-110-19). We considered NMFS' interim definition of harassment in evaluating whether the proposed activities are likely to result in harassment of ESA listed species. Incidental take statements serve a number of functions, including providing reinitiation triggers for all anticipated take, providing exemptions from the Section 9 prohibitions against take for endangered species and from any prohibition on take extended to threatened species by 4(d) regulations, and identifying reasonable and prudent measures with implementing terms and conditions that will minimize the impact of anticipated incidental take and monitor incidental take that occurs.

The measures described below are non-discretionary, and must be undertaken by DOE and their grantee(s) so that they become binding conditions for the exemption in Section 7(o)(2) to apply. DOE has a continuing duty to regulate the activity covered by this Incidental Take Statement. If DOE (1) fails to assume and implement the terms and conditions, or (2) fails to require the grantee to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms and conditions that are included in any grants, permits and/or contracts, the protective coverage of Section 7(o)(2) may lapse. The protective coverage of Section 7(o)(2) also may lapse if DOE, CFF, or their contractors fails to comply with the terms and conditions and the minimization and mitigation measures included in the Incidental Take Statement as well as those described in the proposed action and set forth in Section 3.0 of this opinion as we consider those measures necessary and appropriate to minimize take but have not restated them here for efficiency. In order to monitor the impact of incidental take, DOE must report the progress of the action and its impact on the species to us as specified in the Incidental Take Statement [50 CFR §402.14(i)(3)] (See U.S. Fish and Wildlife Service and National Marine Fisheries Service's Joint Endangered Species Act Section 7 Consultation Handbook (1998) at 4-49).

10.1 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 C.F.R. §402.14(i)(1)(i)). As explained in Section 6.0 *Effects of the Action*, we anticipate the temporary capture and minor, recoverable, injury of Northwest Atlantic DPS loggerhead, North Atlantic DPS green and Kemp's ridley sea turtles and Atlantic sturgeon from the Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs in open and closed codend trawl surveys of fisheries resources. No other sources of incidental take are anticipated. We anticipate no more than the amount and type of take described below to result from the proposed action.

Trawl Survey

We calculated the number of sea turtles and Atlantic sturgeon likely to be captured in trawl gear over the period that the surveys are planned based on available information on capture and injury/mortality rates in similar surveys. No take of any ESA-listed whales in the surveys is anticipated or exempted.

The following amount of incidental take is exempted over the duration of the planned open and closed codend trawl survey (four survey years):

Species	**Trawl Survey**		
	Capture, Minor Injury		**Serious Injury/Mortality**
	Open Codend	Closed Codend	
Gulf of Maine DPS Atlantic sturgeon	1	1	None
New York Bight DPS Atlantic sturgeon	32	14	None
Chesapeake Bay DPS Atlantic sturgeon	13	6	None
South Atlantic DPS Atlantic sturgeon	8	3	None
Carolina DPS Atlantic sturgeon	4	1	None
NA DPS green sea turtle	1	1	None
Kemp's ridley sea turtle	4	2	None
Leatherback sea turtle	None	None	None

NWA DPS Loggerhead sea turtle	6	3	None

10.2 Effects of the Take

In this opinion, we determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to jeopardize the continued existence of any ESA-listed species under NMFS' jurisdiction.

10.3 Reasonable and Prudent Measures

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 is likely to 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, necessary or appropriate reasonable and prudent measures, and terms and conditions to implement the measures, must be provided. Only incidental take specified in this ITS that would not occur but for the agency actions described in this Opinion, 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), provided that, pursuant to Section 7(o) of the ESA, such taking is in compliance with the terms and conditions of the ITS. This ITS for sea turtles and sturgeon is effective upon issuance, and the action agencies and applicant may receive the benefit of the sea turtle and sturgeon take exemption as long as they are complying with the applicable terms and conditions.

Reasonable and prudent measures (RPMs) are measures to minimize the impact (i.e., amount or extent) of incidental take (50 C.F.R. §402.02). The RPMs determined to be necessary and appropriate and implementing terms and conditions are specified as required by 50 CFR 402.14 (i)(1) to minimize the impact of incidental take of ESA-listed species by the proposed action, to monitor document and report that incidental take, and to specify the procedures to be used to handle or dispose of any individuals of a species actually taken. The RPMs and their terms and conditions are nondiscretionary for the action agencies and applicant. In addition to the minimization measures specified in Section 3.0, the RPMs and terms and conditions must be undertaken by DOE so that they become binding conditions on the applicant for the exemption in Section 7(o)(2) to apply.

NMFS has determined that the RPMs identified here are necessary and appropriate to minimize impacts of incidental take that might otherwise result from the proposed action, to monitor, document, and report incidental take that does occur, to specify the procedures to be used to handle or dispose of any individual listed species taken.

Please note that these RPMs and Terms and Conditions are in addition to the measures that DOE and CFF have committed to employ during the project (see the *Description of the Proposed Action*). In some cases, the RPMs and Terms and Conditions provide additional detail or clarity to measures that are part of the proposed action. A failure to implement the proposed action as identified in Section 3.0 of this Opinion would be a change in the action that may render the conclusions of this Opinion and the take exemption inapplicable to the activities carried out, and may necessitate reinitiation of consultation.

We have determined that all of the RPMs and Terms and Conditions are reasonable and prudent and necessary and appropriate to minimize or document and report the level of incidental take associated with the proposed action. None of the RPMs or the Terms and Conditions that implement them alter the basic design, location, scope, duration, or timing of the action and all of them involve only minor changes (50 CFR§ 402.14(i)(2)). A copy of this ITS must be on board all survey vessels.

Reasonable and Prudent Measures

We have determined the following reasonable and prudent measures are necessary and appropriate to minimize, document, and report the impacts of incidental take of threatened and endangered species that occur during implementation of the proposed action:

1. DOE must notify NMFS GARFO-PRD before annual sampling commences and again upon completion of the sampling activities for the year.

2. Effects to ESA-listed species must be minimized during survey activities. Sea turtles and Atlantic sturgeon caught during the surveys must be handled and resuscitated according to established procedures.

3. Effects to, or interactions with, ESA-listed species must be documented during all phases of the proposed action, and all incidental take must be reported to NMFS GARFO-PRD.

Terms and Conditions

To be exempt from the prohibitions of Section 9 of the ESA, DOE and CFF (the grantee and applicant), must comply with the following terms and conditions, which implement the RPMs above. These include the take minimization, monitoring, and reporting measures required by the Section 7 regulations (50 C.F.R. §402.14(i)). These terms and conditions are non-discretionary; that is, if DOE fails to ensure compliance with these terms and conditions and the RPMs they implement, and/or CFF fails to implement them, the protective coverage of Section 7(o)(2) may lapse.

1. To implement RPM #1, DOE must contact NMFS GARFO-PRD (nmfs.gar.incidental-take@noaa.gov) within 48 hours of beginning and ending of annual sampling.

2. To implement the requirement of RPM #2, at least one of the survey staff onboard the trawl survey vessels must have completed NMFS Northeast Fisheries Observer Program (NEFOP) training within the last 5 years or other training in protected species identification and safe handling (inclusive of taking genetic samples from Atlantic sturgeon); documentation of training must be submitted to NMFS GARFO-PRD (nmfs.gar.incidental-take@noaa.gov) at least 7 calendar days prior to the start of the trawl surveys and at any later time that a different NEFOP trained observer is deployed on the survey. If CFF will deploy non-NEFOP trained survey personnel in lieu of NEFOP-trained observers, CFF must submit a plan to NMFS GARFO-PRD describing the training that will be provided to those survey observers. This Observer Training Plan for Trawl Surveys must be submitted as soon as possible after issuance of this Opinion but

no later than 15 calendar days prior to the start of trawl surveys for which a non-NEFOP trained observer will be deployed. CFF must obtain NMFS GARFO-PRD's concurrence with this observer training plan prior to the deployment of the non-NEFOP trained observer on any trawl surveys. This plan must include a description of the elements of the training (i.e., curriculum, virtual or hands on, etc.) and identify who will carry out the training and their qualifications. Once the training is complete, confirmation of the training and a list of trained survey staff must be submitted to NMFS GARFO-PRD; this list must be updated if additional staff are trained for future surveys. In all cases, a list of trained survey staff must be submitted to NMFS GARFO-PRD at least one business day prior to the beginning of the survey.

3. To implement the requirements of RPM #2, any sea turtles or Atlantic sturgeon captured, collected, or entangled in the trawl survey gear must be identified and prioritized for safe handling. Any sea turtles or Atlantic sturgeon must be documented as outlined below. Obtaining biological data and samples for sturgeon or turtles brought onto the survey vessel must occur as outlined below. Live, uninjured animals should be returned to the water as quickly as possible after completing the required handling and documentation. Annually, consult https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic#biological-opinion---take-reporting for any updates to relevant forms.
    a. Reference materials for identification, disentanglement, safe handling, and genetic sampling procedures must be available on board the survey vessel (available at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic).
    b. The *Sturgeon and Sea Turtle Take Standard Operating Procedures* must be followed (https://www.fisheries.noaa.gov/s3/2023-09/Sturgeon-Sea-Turtle-Take-SOPs-external-09132023.pdf).
    c. Survey vessels must have a passive integrated transponder (PIT) tag reader onboard capable of reading 134.2 kHz and 125 kHz encrypted tags (e.g., Biomark GPR Plus Handheld PIT Tag Reader) and this reader must be used to scan any captured sea turtles and sturgeon for tags. Any recorded tags must be recorded on the take reporting form (see below).
    d. Genetic samples must be taken from all Atlantic sturgeon brought back to the survey vessel (alive or dead) to allow for identification of the DPS of origin of captured individuals and tracking of the amount of incidental take. This must be done in accordance with the *Procedures for Obtaining Sturgeon Fin Clips* (https://www.fisheries.noaa.gov/s3/2023-09/Sturgeon-Genetics-Sampling-Revised-September-2023.pdf).
        i. Fin clips must be sent to a NMFS approved laboratory capable of performing genetic analysis and assignment to DPS of origin. To the extent authorized by law, DOE is responsible for the cost of the genetic analysis. DOE has arrangements in place to cover the costs of shipping and analysis of any samples. Results of genetic analysis, including assigned DPS of origin must be submitted to NMFS GARFO-PRD within 6 months of the sample collection.

ii. Subsamples of all fin clips and accompanying metadata form must be held and submitted to the Atlantic Coast Sturgeon Tissue Research Repository on a quarterly basis. The *Sturgeon Genetic Sample Submission Form* is available for download at: https://media.fisheries.noaa.gov/2021-02/Sturgeon%20Genetic%20Sample%20Submission%20sheet%20for%20S7_v1.1_Form%20to%20Use.xlsx?null).

e. All sea turtles and Atlantic sturgeon brought back to the survey vessel must be documented with required measurements and photographs. The animal's condition and any marks or injuries must be described. This information must be entered as part of the record for each incidental take. A *NMFS Take Report Form* must be filled out for each individual sturgeon and sea turtle (https://www.fisheries.noaa.gov/s3/2023-11/Take-Report-Form-11142023.pdf) and submitted to NMFS GARFO-PRD as described below.

4. To implement the requirements of RPM #2, all sea turtles and Atlantic sturgeon entangled, captured, or collected in the trawl gear must be handled and resuscitated (if unresponsive) according to established protocols and whenever at-sea conditions are safe for those handling and resuscitating the animal(s) to do so. Specifically:
    a. Priority must be given to the handling and resuscitation of any sea turtles or sturgeon that are captured in the trawl gear being used, if conditions at sea are safe to do so. Handling times for these species should be minimized (i.e., kept to 15 minutes or less) to limit the amount of stress placed on the animals.
    b. All survey vessels must have copies of the *Sea Turtle Handling & Resuscitation Measures* found at 50 CFR 223.206(d)(1) prior to the commencement of any on-water activity (https://media.fisheries.noaa.gov/dam-migration/sea_turtle_handling_and_resuscitation_measures.pdf). These handling and resuscitation procedures must be carried out any time a sea turtle is incidentally captured and brought onboard the vessel during the proposed actions.
    c. If any sea turtles that appear injured, sick, or distressed, are caught and retrieved in fisheries survey gear, survey staff must immediately contact the Greater Atlantic Region Marine Animal Hotline at 866-755-6622 for further instructions and guidance on handling the animal, and potential coordination of transfer to a rehabilitation facility. If unable to contact the hotline (e.g., due to distance from shore or lack of ability to communicate via phone), the United States Coast Guard (USCG) should be contacted via VHF marine radio on Channel 16. If required, hard-shelled sea turtles (i.e., non-leatherbacks) may be held on board for up to 24 hours following handling instructions provided by the Hotline, prior to transfer to a rehabilitation facility.
    d. Attempts must be made to resuscitate any Atlantic sturgeon that are unresponsive or comatose by providing a running source of water over the gills as described in the *Sturgeon Resuscitation Guidelines* (https://media.fisheries.noaa.gov/dam-migration/sturgeon_resuscitation_card_06122020_508.pdf).
    e. Provided that appropriate cold storage facilities are available on the survey vessel, following the report of a dead sea turtle or sturgeon to NMFS GARFO-PRD, and if NMFS GARFO-PRD requests, any dead sea turtle or Atlantic sturgeon must be

retained on board the survey vessel for transfer to an appropriately permitted partner or facility on shore as safe to do so.

f. Any live sea turtles or Atlantic sturgeon caught and retrieved in gear used in any fisheries survey must ultimately be released as quickly as possible following the required handling and documentation.

5. To implement the requirements of RPM #3, CFF must notify NMFS GARFO-PRD as soon as possible following any interactions with or observations of listed species, including entanglement, capture, or collection in the trawl gear for both open and closed codend tows. Specifically:
    a. NMFS GARFO-PRD must be notified within 24 hours of any interaction with a sea turtle or sturgeon (nmfs.gar.incidental-take@noaa.gov*)*. If notifying GARFO via email within 24 hours is not feasible due to communication constraints, the information can be reported via phone to NMFS GARFO-PRD (978-281-9328) and followed up via email. The report must include at a minimum: (1) survey name and applicable information (e.g., vessel name, station number); (2) GPS coordinates describing the location of the interaction (in decimal degrees); (3) gear type involved; (4) tow time, gear configuration and any other pertinent gear information; (5) time and date of the interaction; and (6) identification of the animal to the species level. Additionally, the e-mail must transmit a completed *NMFS Take Report Form* (https://www.fisheries.noaa.gov/s3/2023-11/Take-Report-Form-11142023.pdf) and a photographs or videos of the animal. Reports of Atlantic sturgeon take must include a statement as to whether a fin clip sample for genetic sampling was taken. Fin clip samples are required in all cases to document the DPS of origin; the only exception to this requirement is when additional handling of the sturgeon would result in an imminent risk of injury to the fish or the survey personnel handling the fish, we expect such incidents to be limited to capture and handling of sturgeon in extreme weather. If reporting within 24 hours is not possible due to distance from shore or lack of ability to communicate via phone or email, reports must be submitted as soon as possible; late reports must be submitted with an explanation for the delay.
    b. In the event that personnel involved in the Project discover a stranded, entangled, injured, or dead ESA-listed species (e.g. marine mammal, sea turtle, listed fish), CFF must immediately report the observation to NMFS GARFO-PRD via the NMFS Greater Atlantic Stranding Hotline (866-755-6622). Reports of listed fish should only be sent to nmfs.gar.incidental-take@noaa.gov. If notification to the hotline to report a marine mammal or sea turtle is not feasible due to communication constraints, the report can be made to the USCG via Channel 16. Additionally, DOE or CFF must report the incident to NMFS GARFO-PRD (nmfs.gar.incidental-take@noaa.gov) as soon as feasible. Note, the stranding hotline may request the report be sent to the local stranding network response team. The report must include: (A) Contact information (name, phone number, organization, project, etc.), time, date, and location (coordinates) of the first discovery (and updated location information if known and applicable); (B) Species identification (if known) or description of the animal(s) involved; (C) Condition of the animal(s) (including carcass condition if the animal is dead); (D)

Observed behaviors of the animal(s), if alive; (E) If available, photographs or video footage of the animal(s); and (F) General circumstances under which the animal was discovered. Staff responding to the Hotline call will provide any instructions for handling or disposing of any injured or dead animals, which may include coordination of transport to shore, particularly for injured sea turtles.

c. In the event of a suspected or confirmed vessel strike of any ESA-listed species (e.g. marine mammal, sea turtle, listed fish) by any vessel associated with the Project, DOE or CFF must immediately report the incident to NMFS GARFO-PRD via the NMFS Greater Atlantic Stranding Hotline (866-755-6622). Reports of listed fish should only be sent to nmfs.gar.incidental-take@noaa.gov. If notifying GARFO is not feasible due to communication constraints, the report can be made to the USCG via Channel 16. Separately, DOE or CFF must report the incident to NMFS GARFO-PRD (nmfs.gar.incidental-take@noaa.gov) as soon as feasible. The report must include: (A) Time, date, and location (coordinates) of the incident; (B) Species identification (if known) or description of the animal(s) involved (i.e., identifiable features including animal color, presence of dorsal fin, body shape and size); (C) Vessel strike reporter information (name, affiliation, email for person completing the report); (D) Vessel strike witness (if different than reporter) information (name, affiliation, phone number, platform for person witnessing the event); (E) Vessel name and/or MMSI number; (F) Vessel size and motor configuration (inboard, outboard, jet propulsion); (G) Vessel's speed leading up to and during the incident; (H) Vessel's course/heading and what operations were being conducted (if applicable); (I) Part of vessel that struck the animal (if known); (J) Vessel damage notes; (K) Status of survey gear in use at time of strike; (L) If animal was seen before strike event; (M) behavior of animal before strike event; (N) Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike; (O) Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike; (P) Estimated (or actual, if known) size and length of animal that was struck; (Q) Description of the behavior of the marine mammal immediately preceding and following the strike; (R) If available, description of the presence and behavior of any other marine mammals immediately preceding the strike; (S) Other animal details if known (e.g., length, sex, age class); (T) Behavior or estimated fate of the animal post-strike (*e.g.*, dead, injured but alive, injured and moving, external visible wounds (linear wounds, propeller wounds, non-cutting blunt-force trauma wounds), blood or tissue observed in the water, status unknown, disappeared); (U) To the extent practicable, photographs or video footage of the animal(s); and (V) Any additional notes the witness may have from the interaction. For any numerical values provided (i.e., location, animal length, vessel length etc.), please provide if values are actual or estimated.

d. Within 60 days of completion of annual survey activities, a report must be sent to NMFS GARFO-PRD that compiles all information on any observations and interactions with ESA-listed species. This report must also contain information on all survey activities that took place during the season including vessel activity, location of gear set, duration of soak/trawl, and total effort. The report must include a summary of all ESA-listed species that are recorded on the video feed during open and closed codend trawl tows, including location, depth and speed of net at time of observation, species identification (if known), start and end time of detection, any entanglement/interaction/contact with the trawl net, and description of behavior. The report on survey activities must be comprehensive of all activities, regardless of whether ESA-listed species were observed. This report must be submitted by email to nmfs.gar.incidental-take@noaa.gov.

6. To implement the requirements of RPMs #1-3, DOE must exercise its authority to assess the implementation of measures to minimize and monitor incidental take of ESA-listed species during activities described in this Opinion. If any term and condition(s) is/are not being complied with, DOE, as appropriate, must immediately notify NMFS GARFO-PRD and take effective action to ensure prompt implementation.

As explained above, reasonable and prudent measures are measures to minimize the amount or extent of incidental take (50 C.F.R. §402.02) that must be implemented in order for the incidental take exemption to be effective. The reasonable and prudent measures and terms and conditions are specified, as required by 50 CFR 402.14 (i)(1)(ii), (iii) and (iv), to document the incidental take by the proposed action, minimize the impact of that take on ESA-listed species. We document our consideration of these requirements for reasonable and prudent measures and terms and conditions here. We have determined that all of these RPMs and associated terms and conditions are reasonable and necessary or appropriate, to minimize or document take and that they all comply with the minor change rule. That is, none of these RPMs or their implementing terms and conditions alter the basic design, location, scope, duration, or timing of the action, and all involve only minor changes.

RPMs 1 - 2/Term and Conditions 1 - 5
Documenting the effects of project activities and any take that occurs is essential to ensure that reinitiation of consultation occurs if the amount or extent of take identified in the ITS is exceeded. Some measures for documenting and reporting take are included in the proposed action. The requirements of Term and Conditions 1, 2, 3, 4, and 5 enhance or clarify those requirements. Documentation and timely reporting of observations of whales, sea turtles, and Atlantic sturgeon is important to monitoring the amount or extent of actual take compared to the amount or extent of take exempted. The reporting requirements included here will allow us to track the progress of the action and associated take. Proper identification and handling of any sturgeon and sea turtles that are captured in the survey gear is essential for documenting take and to minimize the extent of that take (i.e., reducing the potential for further stress, injury, or mortality). The measures identified here are consistent with established best practices for proper handling and documentation of these species. Identifying existing tags helps to monitor take by identifying individual animals. Requiring genetic samples (fin clips) from all Atlantic sturgeon and that those samples be analyzed to determine the DPS of origin is essential for monitoring actual take as genetic analysis is the only way to identify the DPS of origin for subadult and adult Atlantic sturgeon captured in the ocean. Taking fin clips is not expected to increase stress or result in any injury of Atlantic sturgeon; effects of taking the fin clips are consistent with the effects of the fisheries surveys addressed in this Opinion (i.e., harassment and minor, recoverable injury). The requirements for observer qualifications in Term and Condition 2 are necessary and

appropriate to ensure that handling and documentation of sturgeon and turtles collected in the trawl survey is done by appropriately trained personnel, which will minimize the extent of take by reducing the risk of unintentional stress or injury that could result from inappropriate or extended handling of captured individuals.

RPM 1 - 3/Term and Condition 6

Term and Condition 6 is reasonable and necessary or appropriate to minimize and monitor incidental take. Measures to minimize and monitor incidental take, whether part of the proposed action or this ITS, first must be implemented in order to achieve the beneficial results anticipated in this Opinion for ESA-listed species. The action agency exercising their authority to assess and ensure compliance with the measures to avoid, minimize, monitor, and report incidental take of ESA-listed species, including the measures that were incorporated into the description of the proposed action is an essential component of ensuring that incidental take is minimized and monitored. Likewise, such measures once implemented must be effective at minimizing and monitoring incidental take consistent with the analysis. While the measures described as part of the proposed action and in the ITS are consistent with best practices in other industries, and are anticipated to be practicable and functional, gathering information in situ through observation, inspection, and assessment may confirm expectations or reveal room for improvement in a measure's design or performance, or in DOE, CFF, or their contractors implementation and compliance.

11.0 CONSERVATION RECOMMENDATIONS

In addition to Section 7(a)(2), which requires agencies to ensure that all projects will not jeopardize the continued existence of listed species, Section 7(a)(1) of the ESA places a responsibility on all federal agencies to "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species." Conservation Recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information in furtherance of these identified purposes. As such, NMFS recommends that the DOE implement the following Conservation Recommendations consistent with their authorities:

1. If a North Atlantic right whale is sighted with no visible injuries or entanglement at any time by project personnel, DOE or CFF must immediately report the sighting to NMFS; if immediate reporting is not possible, the report must be submitted as soon as possible but no later than 24 hours after the initial sighting.
    a. To report the sighting, download and complete the *Real-Time North Atlantic Right Whale Reporting Template* spreadsheet found here: https://www.fisheries.noaa.gov/resource/document/template-datasheet-real-time-north-atlantic-right-whale-acoustic-and-visual. Save the spreadsheet as a .csv file and email it to NMFS NEFSC-PSD (ne.rw.survey@noaa.gov) and NMFS GARFO-PRD (nmfs.gar.incidental-take@noaa.gov).
    b. If unable to report a sighting through the spreadsheet within 24 hours, call the Greater Atlantic Region Hotline (Maine through Virginia) 866-755-6622 with the observation information provided below.

c. Observation information: Report the following information: the time (note time format), date (MM/DD/YYYY), location (latitude/longitude in decimal degrees; coordinate system used) of the observation, number of whales, animal description/certainty of observation (follow up with photos/video if taken), reporter's contact information, and project name.
d. If unable to report via the template or the regional hotline, enter the sighting via the WhaleAlert app (http://www.whalealert.org/). If this is not possible, report the sighting to the U.S. Coast Guard via channel 16. The report to the Coast Guard must include the same information as would be reported to the Hotline (see above).

2. If a non-North Atlantic right whale large whale is observed, report the sighting via WhaleAlert app (http://www.whalealert.org/) as soon as possible but within 24 hours.

12.0 REINITIATION OF CONSULTATION

This concludes formal consultation on the effects of DOE's proposed funding to CFF to conduct the "Surveying Commercial Fish Species and Habitat in Wind Farm Areas Using a Suite of Non-Lethal Survey Methods" research project. As 50 C.F.R. §402.16 states, reinitiation of formal consultation is required and shall be requested by the Federal action agency or by the Service, 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.

13.0 LITERATURE CITED

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50 CFR 402.02. Interagency Cooperation - Endangered Species Act of 1973, As Amended. Definitions. August 27, 2019.

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64 FR 9449. Atlantic Sturgeon Fishery; Moratorium in Exclusive Economic Zone. February 26, 1999.

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81 FR 42268. Endangered and Threatened Wildlife and Plants: Final Listing Determination on the Proposal To List the Nassau Grouper as Threatened Under the Endangered Species Act. June 29, 2016.

81 FR 4837. Endangered and Threatened Species; Critical Habitat for Endangered North Atlantic Right Whale. February 26, 2016.

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