UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
https://www.fisheries.noaa.gov/region/southeast

01/27/2023

F/SER31:DMB
SERO-2022-01768
https://doi.org/10.25923/6k6q-g771

James Duffy, Project Manager
United States Department of the Interior
Fish and Wildlife Service
1875 Century Boulevard
Atlanta, Georgia 30345

Ref.: Amendment to the 2019 Biological Opinion on the Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute, Marine Recreational Fishery Statistical Data Collection Survey in the State of Florida (SERO-2019-00012)

Dear James Duffy,

The enclosed amended Biological Opinion (Opinion) responds to your request for reinitiation of consultation with us, the National Marine Fisheries Service (NMFS), pursuant to Section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. § 1531 et seq.) for the above-referenced action. The amended Opinion has been given the tracking number SERO-2022-01768. Please use this tracking number in all future correspondence related to this action.

The amended Opinion:

1. considers the effects of financial assistance provided by the United States Fish and Wildlife Service (USFWS) to the Florida Fish and Wildlife Conservation Commission (FWC) Fish and Wildlife Research Institute (FWRI) for fishery independent monitoring of recreationally important finfish in Florida waters pursuant to the USFWS's Wildlife and Sport Fish Restoration grant program (the proposed action);
2. considers the following ESA-listed species: green sea turtle (North Atlantic and South Atlantic Distinct Population Segments [DPSs]), hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), smalltooth sawfish (U.S. DPS), Gulf sturgeon, shortnose sturgeon, Atlantic sturgeon (South Atlantic DPS), Nassau grouper, and giant manta ray;
3. considers the following critical habitats: smalltooth sawfish (U.S. DPS), Gulf sturgeon, and Atlantic sturgeon (South Atlantic DPS); and
4. is based on information provided by the USFWS, the FWC FWRI, and the published literature cited within.

NMFS concludes that:

1. the proposed action will have no effect on critical habitat for smalltooth sawfish (U.S. DPS);
2. the proposed action is not likely to adversely affect hawksbill sea turtle, leatherback sea turtle, shortnose sturgeon, Nassau grouper, and giant manta ray.

3. the proposed action is not likely to adversely affect critical habitat for loggerhead sea turtle (Northwest Atlantic DPS), Atlantic sturgeon (South Atlantic DPS), and Gulf sturgeon; and
4. the proposed action is likely to adversely affect but is not likely to jeopardize the continued existence of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), smalltooth sawfish (U.S. DPS), Gulf sturgeon, and Atlantic sturgeon (South Atlantic DPS).

NMFS is also providing an amended Incidental Take Statement (ITS) with this Opinion. The amended ITS:

1. describes Reasonable and Prudent Measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with the proposed action; and
2. specifies Terms and Conditions, including monitoring and reporting requirements with which the USFWS must comply, to carry out the Reasonable and Prudent Measures.

We look forward to further cooperation with you on other projects to ensure the conservation of our threatened and endangered marine species and critical habitat. If you have any questions regarding this consultation, please contact Dana M. Bethea, Consultation Biologist, by email at Dana.Bethea@noaa.gov.

Sincerely,

FAY.VIRGINIA.M.1365817320
Digitally signed by FAY.VIRGINIA.M.1365817320
Date: 2023.01.27 13:46:38 -05'00'

for Andrew J. Strelcheck
Regional Administrator

Enclosures:
NMFS Amended Biological Opinion SERO-2022-01768
Appendix A: NMFS Original Biological Opinion SERO-2019-00012
Appendix B: Sea Turtle, Smalltooth Sawfish, and Sturgeon Safe Handling and Release
Appendix C: NOAA's Careful Release Protocols for Sea Turtle Release with Minimal Injury
Appendix D: Protected Species Incidental Take Form
Appendix E: Take Tracking Sheet

cc: C. Marion (USFWS)
File: 1514-22.I

Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency: United States Fish and Wildlife Service

Applicant: Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute

Activity: Marine Recreational Fishery Statistical Data Collection Survey in the State of Florida

Location: State of Florida

Consulting Agency: National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Protected Resources Division, St. Petersburg, Florida

Tracking Number: SERO-2022-01768
https://doi.org/10.25923/6k6q-g771

Approved by: for FAY.VIRGINIA.M.1365817320 Digitally signed by FAY.VIRGINIA.M.1365817320 Date: 2023.01.27 13:47:09 -05'00'

Andrew J. Strelcheck, Regional Administrator
NMFS, Southeast Regional Office
St. Petersburg, Florida

Date Issued: 01/27/2023

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ACRONYMS, ABBREVIATIONS, AND UNITS OF MEASURE

2020 SARBO	the 2020 South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States, SERO-2019-03111
ac	Acre(s)
APPS	NMFS Authorizations and Permits for Protected Species database
ASMFC	Atlantic States Marine Fisheries Commission
BOEM	Bureau of Ocean Energy Management
°C	Degrees Celsius
CCL	Curved carapace length
CFR	Code of Federal Regulations
CHEU	Charlotte Harbor Estuary Unit of smalltooth sawfish critical habitat’
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm	Centimeter(s)
CPUE	Catch per unit effort
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved oxygen
DPS	Distinct Population Segment
DWH	Deepwater Horizon
ECO	Environmental Consultation Organizer
EFH	Essential Fish Habitat
ESA	Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 et seq.)
FP	Fibropapillomatosis disease
°F	Degrees Fahrenheit
ft	Foot/feet
FR	Federal Register
ft^2	Square foot/feet
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
g	gram(s)
GADNR	Georgia Department of Natural Resources
in	Inch(es)
IPCC	Intergovernmental Panel on Climate Change
JAXBO	the biological opinion on the authorization of minor in-water activities throughout the geographic area of jurisdiction of the U.S. Army Corps of Engineers Jacksonville District, including Florida and the U.S. Caribbean, SER-2015-17616
kg	Kilogram(s)
km	Kilometer(s)
km^2	Square kilometer(s)

kt	Knot(s)
lb	Pounds (s)
LDWF	Louisiana Department of Wildlife and Fisheries
m	Meter(s)
mg/L	Milligrams per liter
MHW	Mean High Water
mi	Mile(s)
mi^2	Square mile(s)
mm	Millimeter(s)
MMF	Marine Megafuana Foundation
NAD 83	North American Datum of 1983
NCWRC	North Carolina Wildlife Resources Commission
nm	Nautical mile(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
Opinion	Biological Opinion, Conference Biological Opinion, or Draft Biological Opinion
oz	Ounce(s)
PDCs	Project Design Criteria
PLCs	Perfluorinated chemicals
PCBs	Polychlorinated biphenyls
ppt	Parts per thousand
SAV	Submerged Aquatic Vegetation
SCL	Straight carapace length
SCDNR	South Carolina Department of Natural Resources
SERO PRD	NMFS Southeast Regional Office Protected Resources Division
SSRIT	Smalltooth Sawfish Recovery Implementation Team
STSSN	Sea Turtle Stranding and Salvage Network
TED	Turtle exclusion device
TL	Total length
TWEG	Turtle Expert Working Group
U.S.	United States of America
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
YOY	Young of the year

1 INTRODUCTION

1.1 Overview

Section 7(a)(2) of the ESA, requires that each federal agency ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. Section 7(a)(2) requires federal agencies to consult with the appropriate Secretary in carrying out these responsibilities. The NMFS and the USFWS share responsibilities for administering the ESA. Consultations on most ESA-listed marine species and their critical habitat are conducted between the federal action agency and NMFS.

Consultation is required when a federal action agency determines that a proposed action "may affect" ESA-listed species or critical habitat. Informal consultation is concluded after NMFS (hereafter, may also be referred to as we, us, or our) issues a Letter of Concurrence that determines that the action is "not likely to adversely affect" ESA-listed species or critical habitat. Formal consultation is concluded after we issue a Biological Opinion (hereafter, referred to as an/the Opinion) that identifies whether a proposed action is "likely to jeopardize the continued existence of an ESA-listed species" or "destroy or adversely modify critical habitat," in which case Reasonable and Prudent Alternatives to the action as proposed must be identified to avoid these outcomes. An Opinion often states the amount or extent of anticipated incidental take of ESA-listed species that may occur, develops Reasonable and Prudent Measures necessary to reduce the effects of the anticipated incidental take, and lists the Terms and Conditions to implement those measures. An Opinion may also develop Conservation Recommendations that help benefit ESA-listed species. An Opinion may not authorize incidental destruction or adverse modification of critical habitat.

Reinitiation of consultation is required where discretionary Federal involvement or control over the action has been retained or is authorized by law and one of four conditions occurs: (1) the amount of or extent of the incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16).

The initial consultation on the proposed action concluded with NMFS's Biological Opinion, SERO-2019-00012, dated July 23, 2019, and hereafter referred to as "SERO-2019-00012" or the "original Opinion" (Appendix A). Consultation was reinitiated in 2022 as a result of the occurrence of two of the conditions set forth above, including the exceedance of authorized take limits for green sea turtles and smalltooth sawfish during any consecutive 3-year period under the original Opinion. In addition, the proposed action has been modified in a manner that causes effects to critical habitat not previously considered. The modified proposed action includes expanded survey locations within Pensacola Bay, Santa Rosa Sound, Choctawhatchee Bay, St. Andrew Sound, St. Joseph Bay, and the Big Bend, which are located within the boundary of critical habitat for the Northwest Atlantic DPS of loggerhead sea turtle.

This document represents NMFS's amended Opinion on the remaining elements of the FWC FWRI (the applicant) Marine Recreational Fishery Statistical Data Collection Survey in the State of Florida with the expanded survey locations pursuant to the USWFS's Wildlife and Sport Fish Restoration grant program (the proposed action). Our amended Opinion considers the following listed species: green sea turtle (North Atlantic DPS and South Atlantic DPS), hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), smalltooth sawfish (U.S. DPS), Gulf sturgeon, shortnose sturgeon, Atlantic sturgeon (South Atlantic DPS), Nassau grouper, and giant manta ray. Our amended Opinion considers the following critical habitats: smalltooth sawfish (U.S. DPS), Gulf sturgeon, and Atlantic sturgeon (South Atlantic DPS). Our amended Opinion is based on information provided by the USFWS, the applicant, and the published literature cited within. We conclude that the proposed action will have no effect on critical habitat for smalltooth sawfish (U.S. DPS) and is not likely to adversely affect hawksbill sea turtle, leatherback sea turtle, shortnose sturgeon, Nassau grouper, giant manta ray, and critical habitat for loggerhead sea turtle (Northwest Atlantic DPS), Atlantic sturgeon (South Atlantic DPS), and Gulf sturgeon. We also conclude that the proposed action is likely to adversely affect but is not likely to jeopardize the continued existence of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), smalltooth sawfish (U.S. DPS), Gulf sturgeon, and Atlantic sturgeon (South Atlantic DPS).

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 the amended Opinion and 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.

1.2 Consultation History

The following is the consultation history for the amended Opinion with the tracking number SERO-2022-01768 Florida Fishery Independent Monitoring (FIM) Survey Reinitiation, which is a reinitiation of our Opinion with the tracking number SERO-2019-00012 Florida FIM Survey (dated July 23, 2019).

On June 10, 2022, NMFS met with the USFWS to discuss reinitiating the SERO-2019-00012 consultation based on the addition of new survey locations and the exceedance of take exempted by the original Opinion. We agreed to work with the USFWS to reinitiate SERO-2019-00012 and pre-consultation reinitiation was conducted under tracking number INQ-2022-00168.

On July 5, 2022, we received the draft descriptions of the additional survey locations in northwest Florida.

On July 18 and 22, 2022, we requested additional information related to the 2018-2020 incidental capture data and draft descriptions of the additional survey locations in northwest Florida.

On July 27, 2022, we received final response and reinitiated formal consultation that day.

On October 18, 2022, we requested additional information related to sampling timing in the additional survey locations during our internal quality control review process. We received final response on October 25, 2022.

2 PROPOSED ACTION

2.1 Project Details

2.1.1 Project Description

The USFWS proposes to provide annual financial assistance to the FWC FWRI for fishery independent monitoring of recreationally important finfish in Florida waters pursuant to the USWFS's Wildlife and Sport Fish Restoration grant program (hereafter, referred to as the Florida FIM Survey). The Florida FIM Survey has been operating in some capacity since 1985 with funding provided by a USFWS Wildlife and Sport Fish Restoration grant. A history of the Florida FIM Survey is described in the original Opinion and is incorporated herein by reference.

The Florida FIM Survey design (monthly stratified random sampling), gear (21.3-m seine, 183-m seine, and 6.1-m otter trawl without a TED), and sample work up (environmental and species data) are the same as described in SERO-2019-00012, and are incorporated herein by reference as part of this amended Opinion. The applicant proposes to expand the survey to include additional sampling locations in northwest Florida; the applicant is not proposing any changes to the survey design, gear, or sample work up described in SERO-2019-00012 (see Section 2.2 of the original Opinion).

2.1.2 Best Practices

The Florida FIM Survey best practices are the same as the "Minimization Measures" described in SERO-2019-00012 and are restated below.

The Florida FIM Survey is conducted by professional fishery biologists, trained fishery technicians, and follows a highly structured scientific protocol. All Florida FIM Survey activities are characterized by 100% professional observer coverage; no gear is left to soak unattended. All Florida FIM Survey sampling is conducted during daylight hours, between 1 hour after sunrise and 1 hour before sunset.

Otter trawl tow-time (doors in-doors out) will not exceed 5 minutes during river sampling or 10 minutes during bay sampling. The trawl speed shall be set to tow approximately 0.1 nm in 5 minutes during river sampling and 0.2 nm in 10 minutes during bay sampling (approximately 1.2 kts).

All vessels associated with the Florida FIM Survey will operate at “Idle / No Wake” speeds at all times while operating in water depths where the draft of the vessel provides less than a 4-ft clearance from the bottom and in all depths after a protected species has been observed in or has recently departed from the area.

The Florida FIM Survey Procedure Manual[1] includes a section on how to avoid and handle protected species encounters. Protected species are avoided completely when possible and handled quickly and carefully when encountered. Additionally, the Florida FIM Survey adheres strictly to the NOAA Fisheries safe handling and release protocols (Appendix B and C). Staff conducting the survey currently report all protected species encounters to NMFS using the NMFS SERO Endangered Species Take Report Form (https://forms.gle/85fP2da4Ds9jEL829).

2.2 Action Area

The action area considered in SERO-2019-00012 includes the following sampling locations: Apalachicola Bay (29.723ºN, 84.807ºW); Cedar Key (29.177ºN, 83.095ºW); Tampa Bay (27.751ºN, 82.539ºW); Charlotte Harbor (26.729ºN, 82.128ºW); the southern IRL (27.189ºN, 80.199ºW); the northern IRL (28.309ºN, 80.662ºW); and northeast Florida (30.311ºN, 81.653ºW).

In response to emerging issues, including the need for data for the management of spotted sea trout and various reef fishes, the Florida FIM Survey will expand to include the following additional locations in northwest Florida: Pensacola Bay (30.417ºN, 87.131ºW); Santa Rosa Sound (30.402ºN, 86.776ºW); Choctawhatchee Bay (30.445ºN, 86.348ºW); St. Andrew Bay (30.147ºN, 85.694ºW); St. Joseph Bay (29.777ºN, 85.334ºW); and the Big Bend (29.967ºN, 83.789ºW).

The Florida FIM Survey will be conducted over a wide range of habitats encompassing different bottom types, shoreline types, and open estuarine areas in each location listed above. In addition to sampling in the major estuaries of these locations, tidally-influenced portions of the rivers that flow into these locations are also sampled. For the purposes of this amended Opinion, the action area includes all the locations described in SERO-2019-00012, which are incorporated herein by reference, as well as the additional locations described below.

[1] FWC-FWRI. 2016. Fisheries-Independent Monitoring Program Procedure Manual. Florida Fish and Wildlife Research Institute. St. Petersburg, Florida.

2.2.1 Pensacola Bay

The Florida FIM Survey sampled Pensacola Bay and its tributaries in 2017-2019. At present, FWC FWRI does not plan to sample in this location in 2023; however, this may change in the future as additional data is needed for sportfish management (**Figure 1**).

Pensacola Bay is a 373-km^2 drowned river estuary located in the westernmost Florida Panhandle. It is connected to the Gulf of Mexico by a single, deep channel (Caucus Channel) and is minimally influenced by tides (0.5-m tidal range). Major habitat types in Pensacola Bay include bayous, marshes, seagrass beds, and oyster beds. Mean depth is 3-m and bottom substrates are mostly sand and mud. Benthic vegetation consists of seagrasses including *Halodule wrightii*, *Thalassia testudinum*, and *Syringodium filiforme*. Shoreline vegetation consists of marsh grasses such as *Juncus roemerianus*, S*partina alterniflora*, and *Spartina patens*. Freshwater inflow comes from the Escambia, Blackwater, Yellow, and East rivers. Riverine bottom substrates are mostly sand and mud and benthic vegetation at the river mouths consists of *Vallisneria americana* and *Ruppia maritima*.

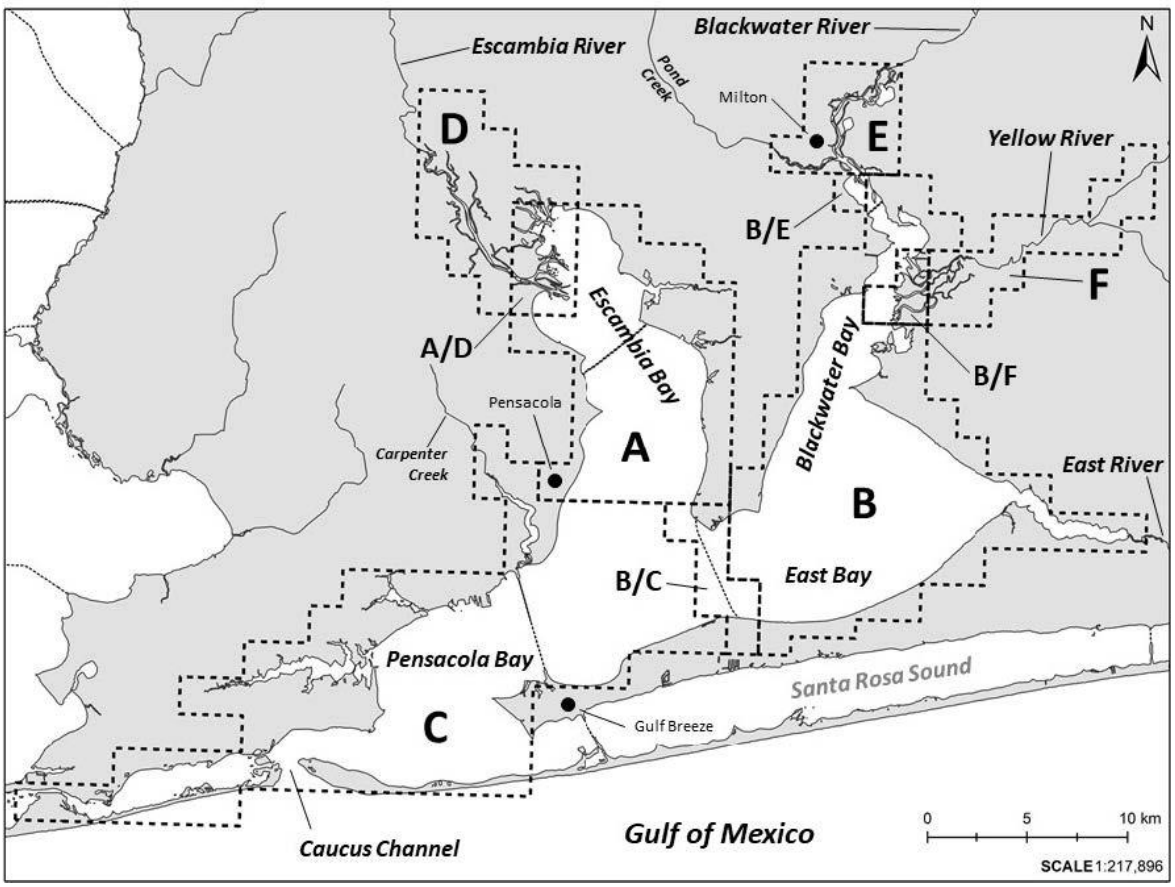

Figure 1. Map of Pensacola Bay sampling area. Zones are labeled A–F. Zones labeled with two letters (e.g., Zone B/C) are transitional areas between bay and river zones.

2.2.2 Santa Rosa Sound

The Florida FIM Survey has sampled Santa Rosa Sound and its tributaries in 1992-1997 and 2017. FWC FWRI plans to begin sampling in this location in 2023 and will continue to sample in this location into the future to support sportfish management.

Santa Rosa Sound is a 109-km^2 lagoon connecting Pensacola Bay to the west and Choctawhatchee Bay to the east (**Figure 2**). The lagoon has no tidal tributaries for direct freshwater input and is connected to the Gulf of Mexico by a deep pass west of Santa Rosa Island. Benthic substrate is mostly sand and bottom vegetation consists primarily of seagrasses such as *Halodule wrightii* and *Thalassia testudinum*. Seagrass beds covered nearly 25% of the lagoon in 1960, but less than half now remains because of wastewater discharge, dredging, and beach modifications. Shoreline vegetation consists primarily of the marsh grasses *Spartina alterniflora* and *Panicum hemitomon*.

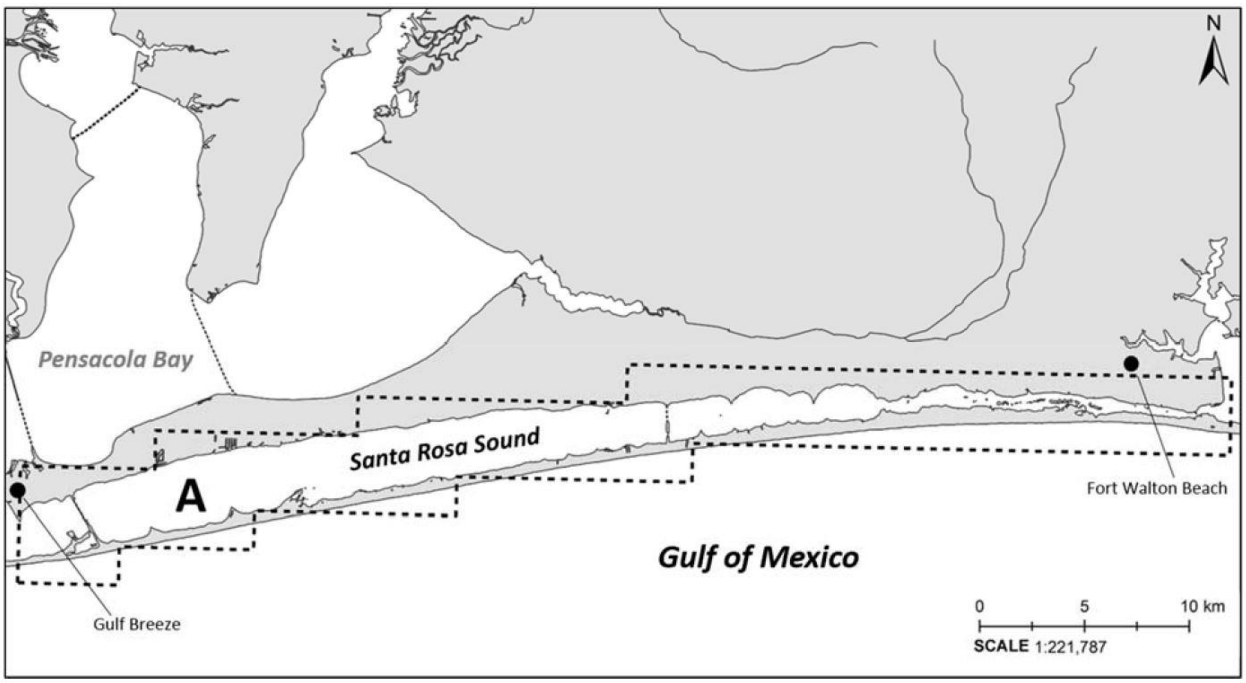

Figure 2. Map of Santa Rosa Sound sampling area.

2.2.3 Choctawhatchee Bay

The Florida FIM Survey has sampled Choctawhatchee Bay and its tributaries (as needed for management) in 1992-1997 and 2017. The FWC FWRI plans to begin sampling in this location in 2023 and will continue to sample in this location into the future to support sportfish management.

Choctawhatchee Bay is a 334-km^2 estuary located in the central Florida Panhandle that is connected to the Gulf of Mexico by a shallow, man-made channel, East Pass, near the city of Destin (**Figure 3**). Tidal influence is minimal and tidal ranges are small, from 0.15 to 0.5-m. Major habitat types include tidal marshes, seagrass beds, bayous, and oyster beds.

Choctawhatchee Bay is moderately deep with water depths ranging from 3 to 13-m and benthic substrate that is mostly sand, mud, and shell. Benthic vegetation is predominantly *Halodule wrightii* with patches of *Ruppia maritima* and *Thalassia testudinum*. Shoreline vegetation consists mostly of the marsh grasses *Juncus roemerianus*, *Spartina alterniflora*, and *Scirpus* spp. Choctawhatchee Bay is highly stratified, and salinity is driven primarily by freshwater inflow from the Choctawhatchee River. Major habitat types in the Choctawhatchee River include shoreline snags, tributary valley lakes, spring runs, and tidal marshes. The river is bordered by hardwood swamps in its upper reaches and stands of *Spartina cynosuroides* in its lower reaches.

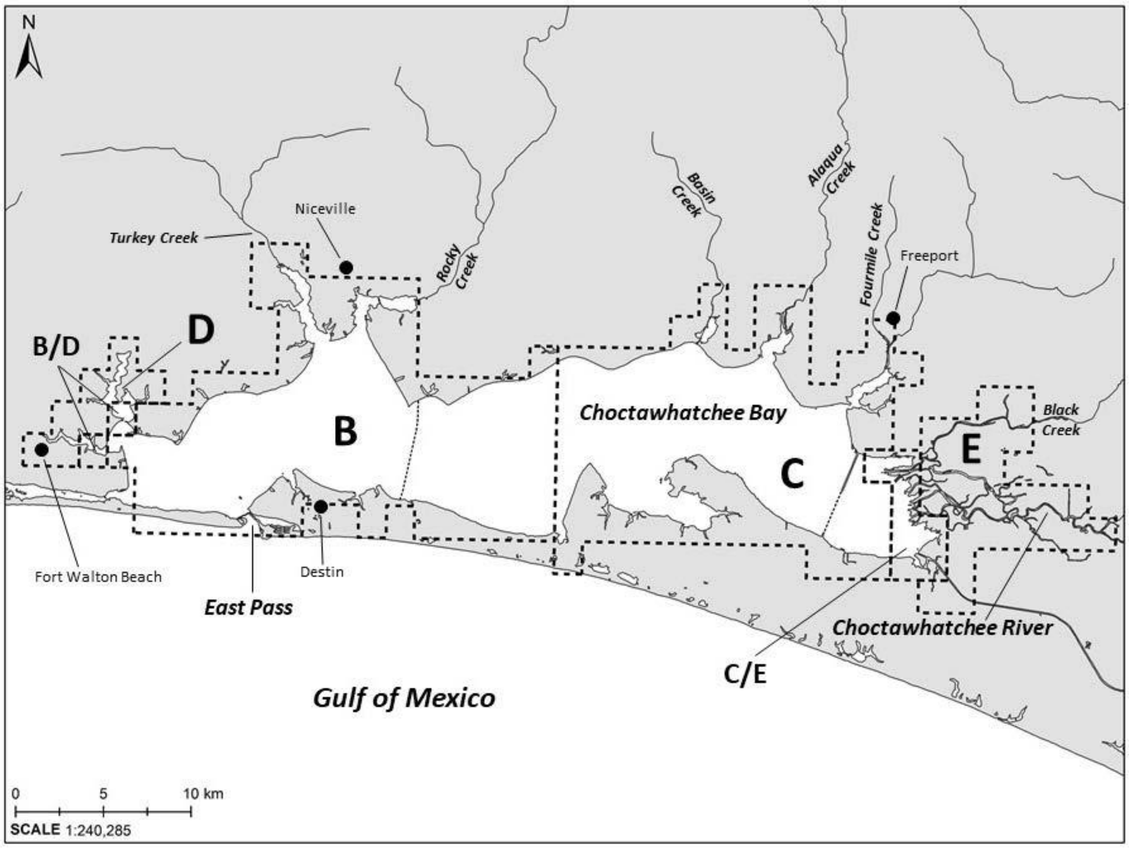

Figure 3. Map of the Choctawhatchee Bay sampling area. Bay zones are labeled B-C. River zones are labeled D-E. Zones labeled with two letters (e.g., Zone B/D) are transitional areas between bay and river zones.

2.2.4 St. Andrew Bay

The Florida FIM Survey has conducted annual sampling in St. Andrew Bay since 2008 and FWC FWRI plans to continue sampling in this location into the future. At the time of the original Opinion, the USFWS did not request formal ESA consultation for St. Andrew Bay because this area was considered under a separate consultation for a Sport Fish Restoration grant. However, after recent programmatic discussions with us, the USFWS has determined that the most appropriate course of action moving forward is to include these efforts under the new Opinion to cover all inshore sampling within the statewide monitoring program.

St. Andrew Bay is a 277-km^2 system made up of 4 connected estuaries in the central Florida Panhandle (**Figure 4**). St. Andrew Bay is connected to the Gulf of Mexico by 2 channels, East Pass and West Pass, and is minimally influenced by tides, with an average tidal range of only 0.4-m. The estuary is also connected to Choctawhatchee Bay to the west and St. Joseph Bay and Apalachicola Bay to the east via the Gulf Intracoastal Waterway. St. Andrew Bay is characterized by deep, clear waters and sandy bottom substrate. Major habitat types in St. Andrew Bay include bayous, seagrass beds, and tidal marshes. Shoreline vegetation consists primarily of *Juncus roemerianus* and *Spartina alterniflora*. Limited freshwater inflow comes primarily from Econfina Creek and smaller tributaries such as Burnt Mill Creek, Crooked Creek, and Wetappo Creek. Wastewater treatment and electric plant discharges also contribute some freshwater into the bay. With such limited freshwater inflow, the waters of St. Andrew Bay are clear and highly saline, ideal for the growth of seagrasses such as *Thalassia testudinum*, *Halodule wrightii*, and *Syringodium filiforme*. Seagrass coverage in St. Andrew Bay appears to be on the rebound since lows observed in the 1990s.

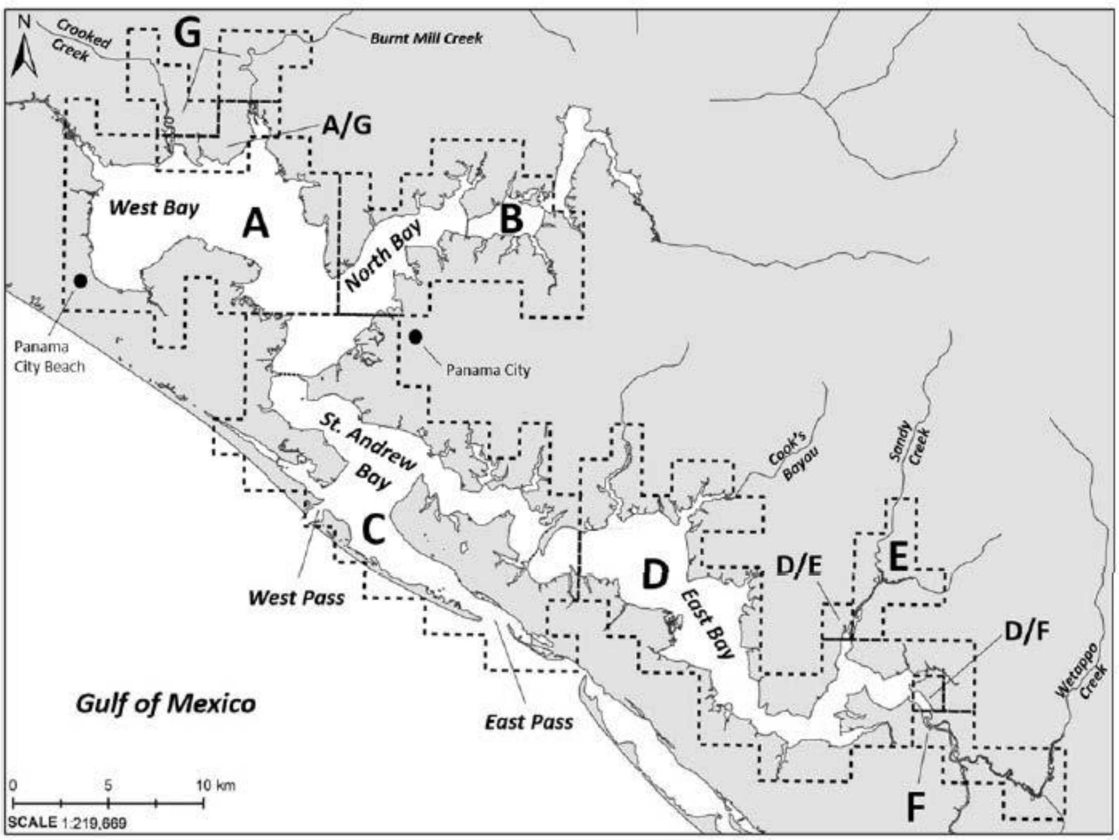

Figure 4. Map of St. Andrew Bay sampling area. Bay zones are labeled A-D. River zones are labeled E-G. Zones labeled with two letters (e.g., Zone A/G) are transitional areas between bay and river zones.

2.2.5 St. Joseph Bay

The Florida FIM Survey conducted (as needed for management) sampling in St. Joseph Bay area in 2017-2019. At present, the FWC FWRI does not plan to sample in this location in 2023; however, this may change in the future as additional data are needed for sportfish management.

St. Joseph Bay is a 178-km^2 non-estuarine lagoon located in the central Florida Panhandle (**Figure 5**). The lagoon is connected to the Gulf of Mexico via a 2.7-km northern pass near the city of St. Joe Beach and connected to the Gulf Intracoastal Waterway via the Gulf County Canal on its east coast. In 2018, Hurricane Michael cut through Cape San Blas and opened two inlets, creating new connections between St. Joseph Bay and the Gulf of Mexico. St. Joseph Bay is characterized by deep waters in the north, with an average depth of 6.4-m, and shallower waters in the south, with an average depth of 0.9-m. Major habitat types in St. Joseph Bay include seagrass beds and marshes, and bottom substrate consists mostly of sand with minor heavy mineral composites such as silt and clay. Habitat types on the shore of St. Joseph Bay include flatwoods, interdunal swales, coastal scrub, beachfront, and maritime hammock. St. Joseph Bay has no large freshwater inputs; freshwater comes primarily from storm water drainage. As a result, St. Joseph Bay has relatively clear, high salinity waters that are ideal for the growth of seagrass such as *Thalassia testudinum, Halodule wrightii,* and *Syringodium filiforme.* Intensive development and nonpoint source pollution have increased nutrient loads in St. Joseph Bay and caused a decline in seagrass coverage.

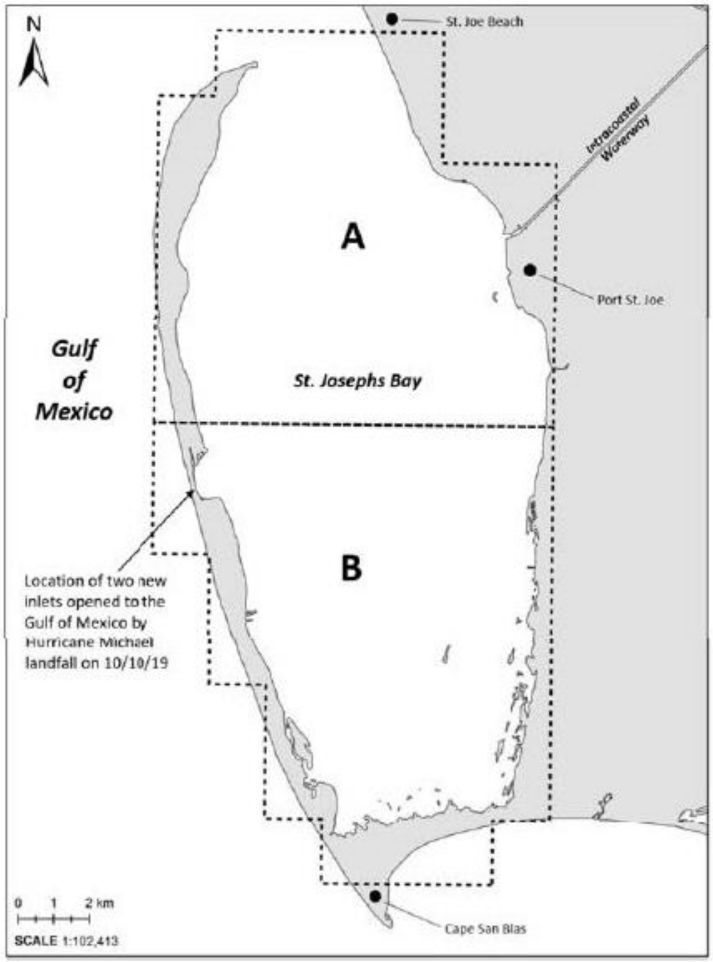

Figure 5. Map of St. Joseph Bay sampling area. Bay zones are labeled A-B.

2.2.6 The Big Bend

The Florida FIM Survey has conducted annual sampling in the Big Bend area since 2008. FWC FWRI will continue to sample in this location into the future. At the time of the original Opinion, the USFWS made the determination that formal ESA consultation was not needed for the Big Bend area, a much smaller survey area because this area was considered under a separate consultation for a USFWS Sport Fish Restoration grant. However, after recent discussions, the USFWS has determined that the most appropriate course of action moving forward is to include these efforts under the new Opinion to cover all inshore sampling within our statewide monitoring program.

The Big Bend area is located in the region where the St. Marks, Econfina, and Steinhatchee rivers empty into the Gulf of Mexico (**Figure 6**). The Big Bend is considered an open coastal estuarine system. Submerged aquatic vegetation is plentiful throughout the Big Bend, consisting of broad expanses of *Halodule wrightii*, *Thalassia testudinum*, and *Syringodium filiforme*, although other species are present. Shoreline habitats consist primarily of marsh grasses, oyster bars, and mud flats.

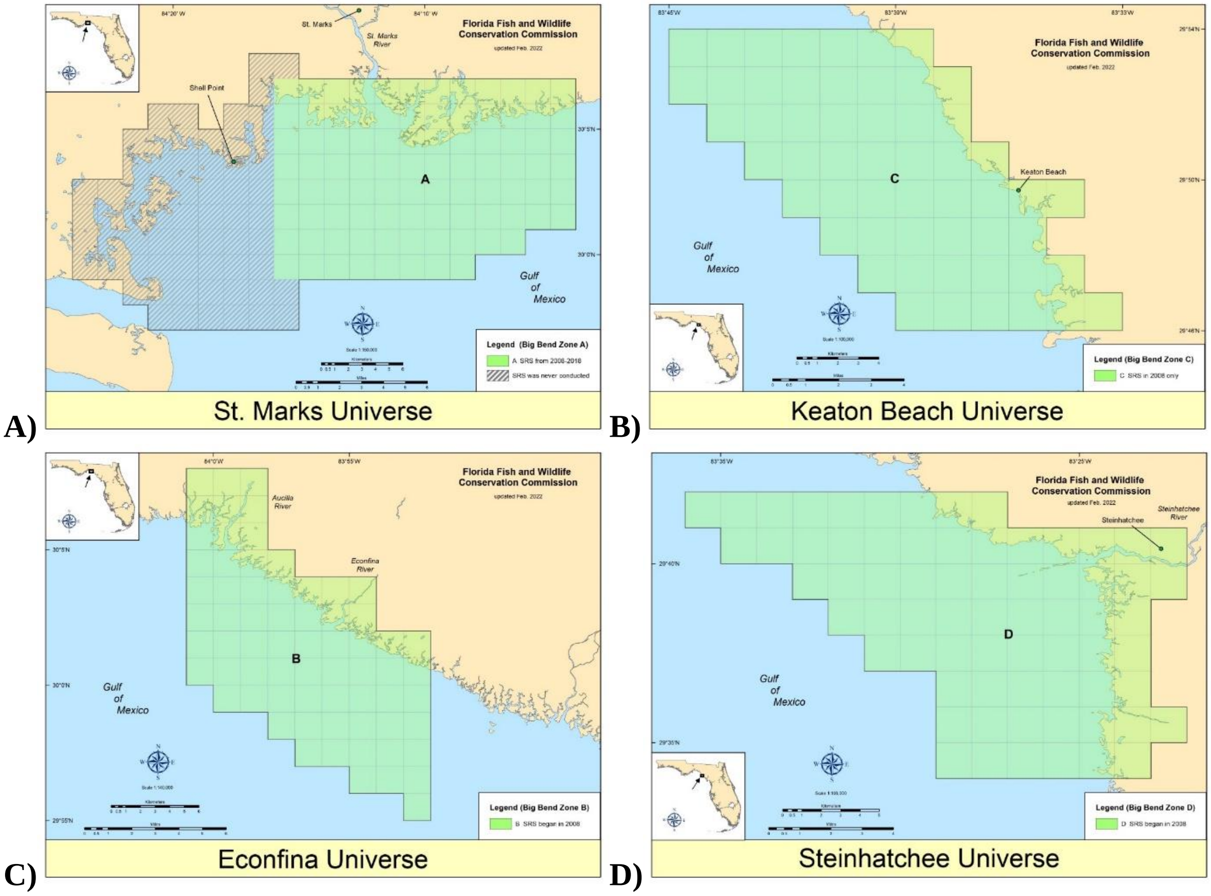

Figure 6. Map of the Big Bend sampling area: (A) St. Marks River, (B) Econfina River, (C) Keaton Beach, and (D) Steinhatchee River.

3 EFFECTS DETERMINATIONS

Please note the following abbreviations are only used in **Table 1** and **Table 2** and are not, therefore, included in the list of acronyms above: E = endangered; T = threatened; LAA = likely to adversely affect; NLAA = may affect, not likely to adversely affect; NE = no effect.

3.1 Effects Determinations for ESA-Listed Species

3.1.1 Agency Effects Determination(s)

We have assessed the ESA-listed species that may be present in the action area and our determination of the modified proposed action's potential effects is shown in **Table 1** below, which replaces our previous effects determinations for ESA-listed species contained in the original Opinion.

Table 1. ESA-listed Species in the Action Area and Effect Determinations

Species	ESA Listing Status	Listing Rule/Date	Most Recent Recovery Plan/Outline Date	USWFS Effect Determination	NMFS Effect Determination
Sea Turtles					
Green (North Atlantic DPS)	T	81 FR 20057/ April 6, 2016	October 1991	LAA	LAA
Green (South Atlantic DPS)	T	81 FR 20057/ April 6, 2016	October 1991	LAA	LAA
Kemp's ridley	E	35 FR 18319/ December 2, 1970	September 2011	LAA	LAA
Leatherback	E	35 FR 8491/ June 2, 1970	April 1992	NLAA	NLAA
Loggerhead (Northwest Atlantic DPS)	T	76 FR 58868/ September 22, 2011	December 2008	LAA	LAA
Hawksbill	E	35 FR 8491/ June 2, 1970	December 1993	NLAA	NLAA
Fishes					
Smalltooth sawfish (U.S. DPS)	E	68 FR 15674/ April 1, 2003	January 2009	LAA	LAA
Gulf sturgeon (Atlantic sturgeon, Gulf subspecies)	T	56 FR 49653/ September 30, 1991	September 1995	LAA	LAA
Shortnose sturgeon	E	32 FR 4001/ March 11, 1967	December 1998	NLAA	NLAA
Atlantic sturgeon (South Atlantic DPS)	E	77 FR 5914/ February 6, 2012	N/A	LAA	LAA
Nassau grouper	T	81 FR 42268/ June 29, 2016	2018	NLAA	NLAA
Giant manta ray	T	83 FR 2916/ January 22, 2018	2019	NLAA	NLAA

3.1.2 Effects Analysis for ESA-Listed Species Not Likely to be Adversely Affected by the Proposed Action

Hawksbill sea turtle, leatherback sea turtle, shortnose sturgeon, Nassau grouper, and giant manta ray are not likely to be adversely affected by any activities conducted during the Florida FIM Survey. While these species may be susceptible to capture by gear used during survey activities and vessel strike, we believe these effects are extremely unlikely to occur. First, there has never been a documented interaction, including captures in survey gear and vessel strikes, between these species and the Florida FIM Survey. Next, while actively sampling, vessels move very slowly (i.e., up to 2.5 kt) or remain idle. Vessels transiting to and from port or between survey stations could travel at greater speeds. However, the biologists (i.e., at least the captain and a designated lookout) watch for objects in the path of the vessel at all times. If one of these species is seen, the vessel's course can be immediately altered or speed reduced (or both) to avoid incidental collisions. Because the Florida FIM program effectively has 100% observer coverage and because there has never been a documented vessel strike or capture of these ESA-listed species, it is likely that none has occurred. Therefore, hawksbill sea turtle, leatherback sea turtle, shortnose sturgeon, Nassau grouper, and giant manta will not be discussed further in this Opinion.

3.1.3 ESA-Listed Species Likely to be Adversely Affected by the Proposed Action

We have determined that green sea turtle (North Atlantic DPS and South Atlantic DPS), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), smalltooth sawfish (U.S. DPS), Gulf sturgeon, and Atlantic sturgeon (South Atlantic DPS) are likely to be adversely affected by the Florida FIM Survey and thus require further analysis. We provide greater detail on the potential effects to these species from the Florida FIM Survey in the Effects of the Action (Section 6.1) and whether those effects, when considered in the context of the Status of the Species (Section 4.1), the Environmental Baseline (Section 5), and the Cumulative Effects (Section 7), are likely to likely to jeopardize the continued existence of these species in the wild.

3.2 Effects Determinations for Critical Habitat

3.2.1 Agency Effects Determination(s)

We have assessed the critical habitats that overlap with the action area and our determination of the modified proposed action's potential effects is shown in **Table 2** below, which replaces our previous effects determinations for critical habitat contained in the original Opinion.

Table 2. Critical Habitat(s) in the Action Area and Effect Determinations

Species	Critical Habitat Unit in the Action Area	Critical Habitat Rule/Date	USFWS Effect Determination	NMFS Effect Determination
Sea Turtles				
Loggerhead sea turtle (Northwest Atlantic Ocean DPS)	LOGG-N-31 Reproductive	79 FR 39856/ July 10, 2014	NLAA	NLAA
Loggerhead sea turtle (Northwest Atlantic Ocean DPS)	LOGG-N-32 Reproductive	79 FR 39856/ July 10, 2014	NLAA	NLAA

Species	Critical Habitat Unit in the Action Area	Critical Habitat Rule/Date	USFWS Effect Determination	NMFS Effect Determination
Loggerhead sea turtle (Northwest Atlantic Ocean DPS)	LOGG-N-33 Reproductive	79 FR 39856/ July 10, 2014	NLAA	NLAA
Fishes				
Smalltooth sawfish (U.S. DPS)	Charlotte Harbor Estuary Unit	74 FR 45353/ September 2, 2009	NLAA	NE
Atlantic sturgeon (South Atlantic DPS)	31. St. Marys River, GA/FL	82 FR 39160/ August 17, 2017	NLAA	NLAA
Gulf sturgeon	Unit 9	68 FR 13370/ March 19, 2003	NLAA	NLAA
Gulf sturgeon	Unit 10	68 FR 13370/ March 19, 2003	NLAA	NLAA
Gulf sturgeon	Unit 11	68 FR 13370/ March 19, 2003	NLAA	NLAA
Gulf sturgeon	Unit 12	68 FR 13370/ March 19, 2003	NLAA	NLAA

The proposed action occurs within critical habitat of the U.S. DPS of smalltooth sawfish (Charlotte Harbor Estuary Unit). As stated in SERO-2019-00012, we determined that the Florida FIM Survey would have no effect on critical habitat for the U.S. DPS of smalltooth sawfish. None of the new locations occur within the boundary of critical habitat for the U.S. DPS of smalltooth sawfish; therefore, consistent with our original Opinion, we conclude that the Florida FIM Survey will have no effect on critical habitat for the U.S. DPS of smalltooth sawfish.

3.2.2 Effects Analysis for Critical Habitat Not Likely to be Adversely Affected by the Proposed Action

3.2.2.1 Loggerhead Sea Turtle Critical Habitat

Due to the additional locations in northwest Florida, the Florida FIM Survey will now occur within nearshore reproductive habitat for the Northwest Atlantic DPS of loggerhead sea turtle (Units LOGG-N-31, LOGG-N-32, and LOGG-N-33). We believe nearshore reproductive habitat is the only habitat type that may be affected by the proposed action. The physical and biological features of nearshore reproductive habitat are defined as a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season. The following primary constituent elements support this habitat: 1) nearshore waters with direct proximity to nesting beaches that support critical aggregations of nesting turtles (e.g., highest density nesting beaches) to 1.6-km offshore; 2) waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and 3) waters with minimal man-made structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.

The Florida FIM Survey will not affect nearshore waters with direct proximity to nesting beaches that support critical aggregations of nesting turtles to 1.6-km offshore. While the Florida FIM Survey will occur in these waters, we believe that otter trawl and seine sampling will not affect this primary constituent element in any way.

During deployment of survey gear, the Florida FIM Survey could obstruct transit through the surf zone and outward toward open water. We believe the effect of otter trawl and seine sampling to this primary constituent element will be so small as to be unmeasurable, and therefore, insignificant. During deployment of these gears, a relatively small fraction of the total transit route area through the surf zone outward toward open water (or vice versa) may be temporarily obstructed. However, these survey gears would obstruct a small area when compared to the surrounding area that would remain unobstructed (6.1-m otter trawl, 21.3-m center bag seine, and 183-m center bag seine). Additionally, once the gear is removed, the transit route will immediately become unobstructed. Thus, the temporary loss of habitat due to the deployment of survey gear is not likely to adversely affect this primary constituent element.

During deployment of survey gear, the Florida FIM Survey may increase the presence of submerged man-made structures that could promote nearshore predator concentration, disrupt the wave patterns necessary for orientation, and/or create excessive longshore currents. We believe the effect of otter trawl and seine sampling to this primary constituent element will be so small as to be unmeasurable, and therefore, insignificant. These gears are deployed temporarily for relatively short amounts of time; the otter trawl has 5 to 10-minute tow time (depending on survey location) at a tow speed of approximately 1.2 kts and the seines are set by hand and immediately hauled. Due to the short duration of the gear deployment, it is unlikely that their presence will promote nearshore predator concentration, disrupt the wave patterns necessary for orientation, and/or create excessive longshore currents. Thus, the increase in submerged man-made structures due to the deployment of survey gear is not likely to adversely affect this primary constituent element.

3.2.2.2 Gulf Sturgeon Critical Habitat

Effects to Gulf sturgeon critical habitat were analyzed in SERO-2019-00012, and are incorporated herein by reference. Based on that analysis, we have determined that the Florida FIM Survey as currently proposed is not likely to adversely affect Gulf sturgeon critical habitat.

3.2.2.3 Atlantic Sturgeon Critical Habitat

Effects to Atlantic sturgeon critical habitat were analyzed in Section 3.2.2 of the original Opinion, and are incorporated herein by reference. Based on that analysis, we have determined that the Florida FIM Survey as currently proposed is not likely to adversely affect Atlantic sturgeon critical habitat.

4 STATUS OF ESA-LISTED SPECIES CONSIDERED FOR FURTHER ANALYSIS

4.1 Rangewide Status of the Species Considered for Further Analysis

4.1.1 Sea Turtles

4.1.1.1 General Threats Faced by All Sea Turtle Species

Sea turtles face numerous natural and man-made threats that shape their status and affect their ability to recover. Many of the threats are either the same or similar in nature for all listed sea turtle species. The threats identified in this section are discussed in a general sense for all sea turtles. Threat information specific to a particular species are then discussed in the corresponding status sections where appropriate.

Fisheries

Incidental bycatch in commercial fisheries is identified as a major contributor to past declines, and threat to future recovery, for all of the sea turtle species (NMFS and USFWS 1991; NMFS and USFWS 1992; NMFS and USFWS 1993; NMFS and USFWS 2008b; NMFS et al. 2011). Domestic fisheries often capture, injure, and kill sea turtles at various life stages. Sea turtles in the pelagic environment are exposed to U.S. Atlantic pelagic longline fisheries. Sea turtles in the benthic environment in waters off the coastal United States are exposed to a suite of other fisheries in federal and state waters. These fishing methods include trawls, gillnets, purse seines, hook-and-line gear (including bottom longlines and vertical lines [e.g., bandit gear, handlines, and rod-reel]), pound nets, and trap fisheries. Refer to the Environmental Baseline section of this Opinion for more specific information regarding federal and state managed fisheries affecting sea turtles within the action area). The Southeast U.S. shrimp fisheries have historically been the largest fishery threat to benthic sea turtles in the southeastern United States, and continue to interact with and kill large numbers of sea turtles each year.

In addition to domestic fisheries, sea turtles are subject to direct as well as incidental capture in numerous foreign fisheries, further impeding the ability of sea turtles to survive and recover on a global scale. For example, pelagic stage sea turtles, especially loggerheads and leatherbacks, circumnavigating the Atlantic are susceptible to international longline fisheries including the Azorean, Spanish, and various other fleets (Aguilar et al. 1994; Bolten et al. 1994). Bottom longlines and gillnet fishing are known to occur in many foreign waters, including (but not limited to) the northwest Atlantic, western Mediterranean, South America, West Africa, Central America, and the Caribbean. Shrimp trawl fisheries are also occurring off the shores of numerous foreign countries and pose a significant threat to sea turtles similar to the impacts seen in U.S. waters. Many unreported takes or incomplete records by foreign fleets make it difficult to characterize the total impact that international fishing pressure is having on listed sea turtles. Nevertheless, international fisheries represent a continuing threat to sea turtle survival and recovery throughout their respective ranges.

Non-Fishery In-Water Activities

There are also many non-fishery impacts affecting the status of sea turtle species, both in the ocean and on land. In nearshore waters of the United States, the construction and maintenance of federal navigation channels has been identified as a source of sea turtle mortality. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly and can entrain and kill sea turtles. Sea turtles entering coastal or inshore areas have also been affected by entrainment in the cooling-water systems of electrical generating plants. Other nearshore threats include harassment or injury resulting from private and commercial vessel operations, military detonations and training exercises, in-water construction activities, and scientific research activities.

Coastal Development and Erosion Control

Coastal development can deter or interfere with nesting, affect nesting success, and degrade nesting habitats for sea turtles. Structural impacts to nesting habitat include the construction of buildings and pilings, beach armoring and renourishment, and sand extraction (Bouchard et al. 1998; Lutcavage et al. 1997). These factors may decrease the amount of nesting area available to females and change the natural behaviors of both adults and hatchlings, directly or indirectly, through loss of beach habitat or changing thermal profiles and increasing erosion, respectively (Ackerman 1997; Witherington et al. 2003; Witherington et al. 2007). In addition, coastal development is usually accompanied by artificial lighting which can alter the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings that are drawn away from the water (Witherington and Bjorndal 1991). In-water erosion control structures such as breakwaters, groins, and jetties can impact nesting females and hatchlings as they approach and leave the surf zone or head out to sea by creating physical blockage, concentrating predators, creating longshore currents, and disrupting of wave patterns.

Environmental Contamination

Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g., DDT, PCBs, and PFCs), and others that may cause adverse health effects to sea turtles (Garrett 2004; Grant and Ross 2002; Hartwell 2004; Iwata et al. 1993). Acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges may directly injure individuals through skin contact with oils (Geraci 1990), inhalation at the water's surface and ingesting compounds while feeding (Matkin and Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area.

The April 20, 2010, explosion of the Deepwater Horizon oil rig affected sea turtles in the Gulf of Mexico. An assessment has been completed on the injury to Gulf of Mexico marine life, including sea turtles, resulting from the spill (DWH Trustees 2015a). Following the spill, juvenile Kemp's ridley, green, and loggerhead sea turtles were found in *Sargassum* algae mats in the convergence zones, where currents meet and oil collected. Sea turtles found in these areas were often coated in oil or had ingested oil or both. The spill resulted in the direct mortality of many sea turtles and may have had sublethal effects or caused environmental damage that will impact other sea turtles into the future. Information on the spill impacts to individual sea turtle species is presented in the Status of the Species sections for each species.

Marine debris is a continuing problem for sea turtles. Sea turtles living in the pelagic environment commonly eat or become entangled in marine debris (e.g., tar balls, plastic bags/pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts where debris and their natural food items converge. This is especially problematic for sea turtles that spend all or significant portions of their life cycle in the pelagic environment (i.e., leatherbacks, juvenile loggerheads, and juvenile green turtles).

Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

Climate change impacts on sea turtles currently cannot be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of sea turtles may result (NMFS and USFWS 2007b). In sea turtles, sex is determined by the ambient sand temperature (during the middle third of incubation) with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007b).

The effects from increased temperatures may be intensified on developed nesting beaches where shoreline armoring and construction have denuded vegetation. Erosion control structures could potentially result in the permanent loss of nesting beach habitat or deter nesting females (NRC 1990a). These impacts will be exacerbated by sea level rise. If females nest on the seaward side of the erosion control structures, nests may be exposed to repeated tidal overwash (NMFS and USFWS 2007c). Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Baker et al. 2006; Daniels et al. 1993; Fish et al. 2005). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006; Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish, etc.) which could ultimately affect the primary foraging areas of sea turtles.

Other Threats

Predation by various land predators is a threat to developing nests and emerging hatchlings. The major natural predators of sea turtle nests are mammals, including raccoons, dogs, pigs, skunks, and badgers. Emergent hatchlings are preyed upon by these mammals as well as ghost crabs, laughing gulls, and the exotic South American fire ant (*Solenopsis invicta*). In addition to natural predation, direct harvest of eggs and adults from beaches in foreign countries continues to be a problem for various sea turtle species throughout their ranges (NMFS and USFWS 2008b).

Diseases, toxic blooms from algae and other microorganisms, and cold stunning events are additional sources of mortality that can range from local and limited to wide-scale and impacting hundreds or thousands of animals.

4.1.1.2 Green Sea Turtle (North Atlantic DPS and South Atlantic DPS)

The green sea turtle was originally listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations, which were listed as endangered. On April 6, 2016, the original listing was replaced with the listing of 11 DPSs (81 FR 20057 2016) (**Figure 7**). The Mediterranean, Central West Pacific, and Central South Pacific DPSs were listed as endangered. The North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific DPSs were listed as threatened. For the purposes of this consultation, only the South Atlantic DPS and North Atlantic DPS will be considered, as they are the only two DPSs with individuals occurring in the Atlantic Ocean and Gulf of Mexico waters of the United States.

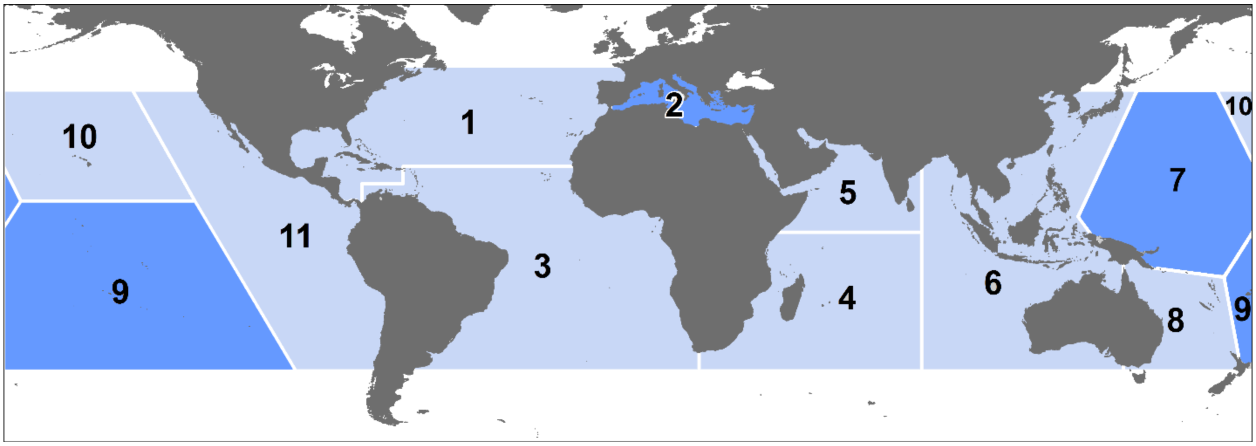

Figure 7. Threatened (light) and endangered (dark) green turtle DPSs: 1. North Atlantic, 2. Mediterranean, 3. South Atlantic, 4. Southwest Indian, 5. North Indian, 6. East Indian-West Pacific, 7. Central West Pacific, 8. Southwest Pacific, 9. Central South Pacific, 10. Central North Pacific, and 11. East Pacific.

Species Description and Distribution

The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lb (159 kg) with a SCL of greater than 3.3 ft (1 m). Green sea turtles have a smooth carapace with 4 pairs of lateral (or costal) scutes and a single pair of elongated prefrontal scales between the eyes. They typically have a black dorsal surface and a white ventral surface, although the carapace of green sea turtles in the Atlantic Ocean has been known to change in color from solid black to a variety of shades of grey, green, or brown and black in starburst or irregular patterns (Lagueux 2001).

With the exception of post-hatchlings, green sea turtles live in nearshore tropical and subtropical waters where they generally feed on marine algae and seagrasses. They have specific foraging grounds and may make large migrations between these forage sites and natal beaches for nesting (Hays et al. 2001). Green sea turtles nest on sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands in more than 80 countries worldwide (Hirth 1997). The 2 largest nesting populations are found at Tortuguero, on the Caribbean coast of Costa Rica (part of the North Atlantic DPS), and Raine Island, on the Pacific coast of Australia along the Great Barrier Reef.

Differences in mitochondrial DNA properties of green sea turtles from different nesting regions indicate there are genetic subpopulations (Bowen et al. 1992; FitzSimmons et al. 2006). Despite the genetic differences, sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. Within U.S. waters individuals from both the North Atlantic DPS and South Atlantic DPS can be found on foraging grounds. While there are currently no in-depth studies available to determine the percent of North Atlantic DPS and South Atlantic DPS individuals in any given location, two small-scale studies provide an insight into the degree of mixing on the foraging grounds. An analysis of cold-stunned green turtles in St. Joseph Bay, Florida (northern Gulf of Mexico) found approximately 4% of individuals came from nesting stocks in the South Atlantic DPS (specifically Suriname, Aves Island, Brazil, Ascension Island, and Guinea Bissau) (Foley et al. 2007). On the Atlantic coast of

Florida, a study on the foraging grounds off Hutchinson Island found that approximately 5% of the turtles sampled came from the Aves Island/Suriname nesting assemblage, which is part of the South Atlantic DPS (Bass and Witzell 2000). All of the individuals in both studies were benthic juveniles. Available information on green turtle migratory behavior indicates that long distance dispersal is only seen for juvenile turtles. This suggests that larger adult-sized turtles return to forage within the region of their natal rookeries, thereby limiting the potential for gene flow across larger scales (Monzón-Argüello et al. 2010). While all of the mainland U.S. nesting individuals are part of the North Atlantic DPS, the U.S. Caribbean nesting assemblages are split between the North Atlantic DPS and South Atlantic DPS. Nesters in Puerto Rico are part of the North Atlantic DPS, while those in the U.S. Virgin Islands are part of the South Atlantic DPS. We do not currently have information on what percent of individuals on the U.S. Caribbean foraging grounds come from which DPS.

North Atlantic DPS Distribution

The North Atlantic DPS boundary is illustrated in **Figure 7**. Four regions support nesting concentrations of particular interest in the North Atlantic DPS: Costa Rica (Tortuguero); Mexico (Campeche, Yucatan, and Quintana Roo); United States (Florida); and Cuba. By far the most important nesting concentration for green turtles in this DPS is Tortuguero, Costa Rica. Nesting also occurs in the Bahamas, Belize, Cayman Islands, Dominican Republic, Haiti, Honduras, Jamaica, Nicaragua, Panama, Puerto Rico, Turks and Caicos Islands, and North Carolina, South Carolina, Georgia, and Texas, U.S. In the eastern North Atlantic, nesting has been reported in Mauritania (Fretey 2001).

The complete nesting range of North Atlantic DPS green sea turtles within the southeastern United States includes sandy beaches between Texas and North Carolina, as well as Puerto Rico (Dow et al. 2007; NMFS and USFWS 1991). The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard south through Broward counties.

In U.S. Atlantic and Gulf of Mexico waters, green sea turtles are distributed throughout inshore and nearshore waters from Texas to Massachusetts. Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984; Hildebrand 1982; Shaver 1994); the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957), Florida Bay and the Florida Keys (Schroeder and Foley 1995), and the Indian River Lagoon system in Florida (Ehrhart 1983); and the Atlantic Ocean off Florida from Brevard through Broward Counties (Guseman and Ehrhart 1992; Wershoven and Wershoven 1992). The summer developmental habitat for green sea turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997). Additional important foraging areas in the western Atlantic include the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, scattered areas along Colombia and Brazil (Hirth 1971), and the northwestern coast of the Yucatán Peninsula.

South Atlantic DPS Distribution

The South Atlantic DPS boundary is shown in **Figure 7**, and includes the U.S. Virgin Islands in the Caribbean. The South Atlantic DPS nesting sites can be roughly divided into four regions: western Africa; Ascension Island; Brazil; and the South Atlantic Caribbean (including Colombia, the Guianas, and Aves Island in addition to the numerous small, island nesting sites).

The in-water range of the South Atlantic DPS is widespread. In the eastern South Atlantic, significant sea turtle habitats have been identified, including green turtle feeding grounds in Corisco Bay, Equatorial Guinea/Gabon (Formia 1999); Congo; Mussulo Bay, Angola (Carr and Carr 1991); as well as Principe Island. Juvenile and adult green turtles utilize foraging areas throughout the Caribbean areas of the South Atlantic, often resulting in interactions with fisheries occurring in those same waters (Dow et al. 2007). Juvenile green turtles from multiple rookeries also frequently utilize the nearshore waters off Brazil as foraging grounds as evidenced from the frequent captures by fisheries (Lima et al. 2010; López-Barrera et al. 2012; Marcovaldi et al. 2009). Genetic analysis of green turtles on the foraging grounds off Ubatuba and Almofala, Brazil show mixed stocks coming primarily from Ascension, Suriname and Trindade as a secondary source, but also Aves, and even sometimes Costa Rica (North Atlantic DPS) (Naro-Maciel et al. 2007; Naro-Maciel et al. 2012). While no nesting occurs as far south as Uruguay and Argentina, both have important foraging grounds for South Atlantic green turtles (Gonzalez Carman et al. 2011; Lezama 2009; López-Mendilaharsu et al. 2006; Prosdocimi et al. 2012; Rivas-Zinno 2012).

Life History Information

Green sea turtles reproduce sexually, and mating occurs in the waters off nesting beaches and along migratory routes. Mature females return to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982; Frazer and Ehrhart 1985) every 2-4 years while males are known to reproduce every year (Balazs 1983). In the southeastern United States, females generally nest between June and September, and peak nesting occurs in June and July (Witherington and Ehrhart 1989b). During the nesting season, females nest at approximately 2-week intervals, laying an average of 3-4 clutches (Johnson and Ehrhart 1996). Clutch size often varies among subpopulations, but mean clutch size is approximately 110-115 eggs. In Florida, green sea turtle nests contain an average of 136 eggs (Witherington and Ehrhart 1989b). Eggs incubate for approximately 2 months before hatching. Hatchling green sea turtles are approximately 2 in (5 cm) in length and weigh approximately 0.9 oz (25 g). Survivorship at any particular nesting site is greatly influenced by the level of man-made stressors, with the more pristine and less disturbed nesting sites (e.g., along the Great Barrier Reef in Australia) showing higher survivorship values than nesting sites known to be highly disturbed (e.g., Nicaragua) (Campell and Lagueux 2005; Chaloupka and Limpus 2005).

After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. This early oceanic phase remains one of the most poorly understood aspects of green sea turtle life history (NMFS and USFWS 2007a). Green sea turtles exhibit particularly slow growth rates of about 0.4-2 in (1-5 cm) per year (Green 1993), which may be attributed to their largely herbivorous, low-net energy diet (Bjorndal 1982). At approximately 8-10 in (20-25 cm) carapace length, juveniles leave the pelagic environment and enter nearshore developmental habitats such as protected lagoons and open coastal areas rich in sea grass and marine algae. Growth studies using skeletochronology indicate that green sea turtles in the western Atlantic shift from the oceanic phase to nearshore developmental habitats after approximately 5-6 years (Bresette et al. 2006; Zug and Glor 1998). Within the developmental habitats, juveniles begin the switch to a more herbivorous diet, and by adulthood feed almost exclusively on seagrasses and algae (Rebel 1974), although some populations are known to also feed heavily on invertebrates (Carballo et al. 2002). Green sea turtles mature slowly, requiring 20-50 years to reach sexual maturity (Chaloupka and Musick 1997; Hirth 1997).

While in coastal habitats, green sea turtles exhibit site fidelity to specific foraging and nesting grounds, and it is clear they are capable of “homing in” on these sites if displaced (McMichael et al. 2003). Reproductive migrations of Florida green sea turtles have been identified through flipper tagging and satellite telemetry. Based on these studies, the majority of adult female Florida green sea turtles are believed to reside in nearshore foraging areas throughout the Florida Keys and in the waters southwest of Cape Sable, and some post-nesting turtles also reside in Bahamian waters as well (NMFS and USFWS 2007a).

Status and Population Dynamics

Accurate population estimates for marine turtles do not exist because of the difficulty in sampling turtles over their geographic ranges and within their marine environments. Nonetheless, researchers have used nesting data to study trends in reproducing sea turtles over time. A summary of nesting trends and nester abundance is provided in the most recent status review for the species (Seminoff et al. 2015), with information for each of the DPSs.

North Atlantic DPS

The North Atlantic DPS is the largest of the 11 green turtle DPSs, with an estimated nester abundance of over 167,000 adult females from 73 nesting sites. Overall this DPS is also the most data rich. Eight of the sites have high levels of abundance (i.e., <1000 nesters), located in Costa Rica, Cuba, Mexico, and Florida. All major nesting populations demonstrate long-term increases in abundance (Seminoff et al. 2015).

Quintana Roo, Mexico, accounts for approximately 11% of nesting for the DPS (Seminoff et al. 2015). In the early 1980s, approximately 875 nests/year were deposited, but by 2000 this increased to over 1,500 nests/year (NMFS and USFWS 2007d). By 2012, more than 26,000 nests were counted in Quintana Roo (J. Zurita, CIQROO, unpublished data, 2013, in Seminoff et al. 2015).

Tortuguero, Costa Rica is by far the predominant nesting site, accounting for an estimated 79% of nesting for the DPS (Seminoff et al. 2015). Nesting at Tortuguero appears to have been increasing since the 1970s, when monitoring began. For instance, from 1971-1975 there were approximately 41,250 average annual emergences documented and this number increased to an average of 72,200 emergences from 1992-1996 (Bjorndal et al. 1999). Troëng and Rankin (2005) collected nest counts from 1999-2003 and also reported increasing trends in the population consistent with the earlier studies, with nest count data suggesting 17,402-37,290 nesting females per year (NMFS and USFWS 2007a). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica population's growing at 4.9% annually.

In the continental United States, green sea turtle nesting occurs along the Atlantic Coast, primarily along the central and southeast coast of Florida (Meylan et al. 1994; Weishampel et al. 2003). Occasional nesting has also been documented along the Gulf coast of Florida (Meylan et al. 1995). Green sea turtle nesting is documented annually on beaches of North Carolina, South Carolina, and Georgia, though nesting is found in low quantities (up to tens of nests) (nesting databases maintained on www.seaturtle.org).

Florida accounts for approximately 5% of nesting for this DPS (Seminoff et al. 2015). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9% at that time. Increases have been even more rapid in recent years. In Florida, index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green sea turtle nesting has generally shown biennial peaks in abundance with a positive trend during the 10 years of regular monitoring (**Figure 8**). According to data collected from Florida's index nesting beach survey from 1989-2021, green sea turtle nest counts across Florida have increased dramatically, from a low of 267 in the early 1990s to a high of 40,911 in 2019. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in 2010 and 2011. The pattern departed from the low lows and high peaks in 2020 and 2021 as well, when 2020 nesting only dropped by half from the 2019 high, while 2021 nesting only increased by a small amount over the 2020 nesting (**Figure 8**).

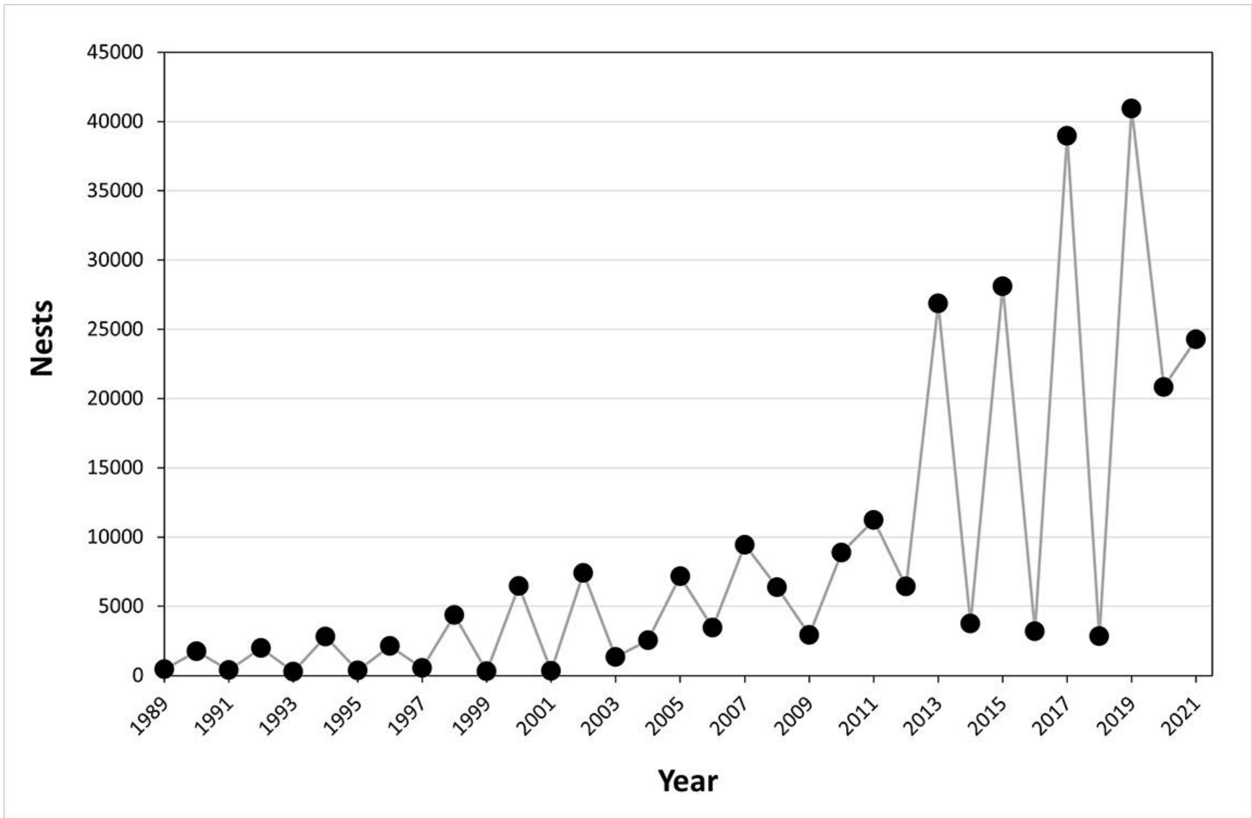

Figure 8. Green sea turtle nesting at Florida index beaches since 1989

Similar to the nesting trend found in Florida, in-water studies in Florida have also recorded increases in green turtle captures at the Indian River Lagoon site, with a 661% increase over 24 years (Ehrhart et al. 2007), and the St Lucie Power Plant site, with a significant increase in the annual rate of capture of immature green turtles (SCL<90 cm) from 1977 to 2002 or 26 years (3,557 green turtles total; M. Bressette, Inwater Research Group, unpublished data; (Witherington et al. 2006).

South Atlantic DPS

The South Atlantic DPS is large, estimated at over 63,000 nesters, but data availability is poor. More than half of the 51 identified nesting sites (37) did not have sufficient data to estimate number of nesters or trends (Seminoff et al. 2015). This includes some sites, such as beaches in French Guiana, which are suspected to have large numbers of nesters. Therefore, while the estimated number of nesters may be substantially underestimated, we also do not know the population trends at those data-poor beaches. However, while the lack of data was a concern due to increased uncertainty, the overall trend of the South Atlantic DPS was not considered to be a major concern as some of the largest nesting beaches such as Ascension Island (United Kingdom), Aves Island (Venezuela), and Galibi (Suriname) appear to be increasing. Others such as Trindade (Brazil), Atol das Rocas (Brazil), and Poilão (Guinea-Bissau) and the rest of Guinea-Bissau seem to be stable or do not have sufficient data to make a determination. Bioko

(Equatorial Guinea) appears to be in decline but has less nesting than the other primary sites (Seminoff et al. 2015).

In the United States, nesting of SA DPS green turtles occurs on the beaches of the U.S. Virgin Islands, primarily on Buck Island. There is insufficient data to determine a trend for Buck Island nesting, and it is a smaller rookery, with approximately 63 total nesters utilizing the beach (Seminoff et al. 2015).

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of the species for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. Green sea turtles also face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (e.g., plastics, petroleum products, petrochemicals), ecosystem alterations (e.g., nesting beach development, beach nourishment and shoreline stabilization, vegetation changes), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 4.1.1.1.

In addition to general threats, green sea turtles are susceptible to natural mortality from FP. FP results in the growth of tumors on soft external tissues (flippers, neck, tail, etc.), the carapace, the eyes, the mouth, and internal organs (gastrointestinal tract, heart, lungs, etc.) of turtles (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). These tumors range in size from 0.04 in (0.1 cm) to greater than 11.81 in (30 cm) in diameter and may affect swimming, vision, feeding, and organ function (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). Presently, scientists are unsure of the exact mechanism causing this disease, though it is believed to be related to both an infectious agent, such as a virus (Herbst et al. 1995), and environmental conditions (e.g., habitat degradation, pollution, low wave energy, and shallow water (Foley et al. 2005). FP is cosmopolitan, but it has been found to affect large numbers of animals in specific areas, including Hawaii and Florida (Herbst 1994; Jacobson 1990; Jacobson et al. 1991).

Cold-stunning is another natural threat to green sea turtles. Although it is not considered a major source of mortality in most cases, as temperatures fall below 46.4°-50°F (8°-10°C) turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989a). During January 2010, an unusually large cold-stunning event in the southeastern United States resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, and hundreds found dead or dying. A large cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,650 green sea turtles found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding, while approximately 1,030 turtles were rehabilitated and released. During this same time frame, approximately 340 green sea turtles were found cold-stunned in Mexico, though approximately 300 of those were subsequently rehabilitated and released.

Whereas oil spill impacts are discussed generally for all species in Section 4.1.1.1, specific impacts of the DWH spill on green sea turtles are considered here. Impacts to green sea turtles occurred to offshore small juveniles only. A total of 154,000 small juvenile greens (36.6% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. A large number of small juveniles were removed from the population, as 57,300 small juveniles greens are estimated to have died as a result of the exposure. A total of 4 nests (580 eggs) were also translocated during response efforts, with 455 hatchlings released (the fate of which is unknown) (DWH Trustees 2015b). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil or dispersants or both, and loss of foraging resources, which could lead to compromised growth and reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic, and the proportion of the population using the northern Gulf of Mexico at any given time is relatively low. Although it is known that adverse impacts occurred and numbers of animals in the Gulf of Mexico were reduced as a result of the Deepwater Horizon oil spill of 2010 (DWH), the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event, as well as the impacts being primarily to smaller juveniles (lower reproductive value than adults and large juveniles), reduces the impact to the overall population. It is unclear what impact these losses may have caused on a population level, but it is not expected to have had a large impact on the population trajectory moving forward. However, recovery of green turtle numbers equivalent to what was lost in the northern Gulf of Mexico as a result of the spill will likely take decades of sustained efforts to reduce the existing threats and enhance survivorship of multiple life stages (DWH Trustees 2015b).

4.1.1.3 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle was listed as endangered on December 2, 1970, under the Endangered Species Conservation Act of 1969, a precursor to the ESA. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Groombridge 1982; TEWG 2000; Zwinenberg 1977).

Species Description and Distribution

The Kemp's ridley sea turtle is the smallest of all sea turtles. Adults generally weigh less than 100 lb (45 kg) and have a carapace length of around 2.1 ft (65 cm). Adult Kemp's ridley shells are almost as wide as they are long. Coloration changes significantly during development from the grey-black dorsum and plastron of hatchlings, a grey-black dorsum with a yellowish-white plastron as post-pelagic juveniles, and then to the lighter grey-olive carapace and cream-white or yellowish plastron of adults. There are 2 pairs of prefrontal scales on the head, 5 vertebral scutes, usually 5 pairs of costal scutes, and generally 12 pairs of marginal scutes on the carapace. In each bridge adjoining the plastron to the carapace, there are 4 scutes, each of which is perforated by a pore.

Kemp's ridley habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 ft (37 m) deep, although they can also be found in deeper offshore waters. These areas support the primary prey species of the Kemp's ridley sea turtle, which consist of swimming crabs, but may also include fish, jellyfish, and an array of mollusks.

The primary range of Kemp's ridley sea turtles is within the Gulf of Mexico basin, though they also occur in coastal and offshore waters of the U.S. Atlantic Ocean. Juvenile Kemp's ridley sea turtles, possibly carried by oceanic currents, have been recorded as far north as Nova Scotia. Historic records indicate a nesting range from Mustang Island, Texas, in the north to Veracruz, Mexico, in the south. Kemp's ridley sea turtles have recently been nesting along the Atlantic Coast of the United States, with nests recorded from beaches in Florida, Georgia, and the Carolinas. In 2012, the first Kemp's ridley sea turtle nest was recorded in Virginia. The Kemp's ridley nesting population had been exponentially increasing prior to the recent low nesting years, which may indicate that the population had been experiencing a similar increase. Additional nesting data in the coming years will be required to determine what the recent nesting decline means for the population trajectory.

Life History Information

Kemp's ridley sea turtles share a general life history pattern similar to other sea turtles. Females lay their eggs on coastal beaches where the eggs incubate in sandy nests. After 45-58 days of embryonic development, the hatchlings emerge and swim offshore into deeper, ocean water where they feed and grow until returning at a larger size. Hatchlings generally range from 1.65-1.89 in (42-48 mm) SCL, 1.26-1.73 in (32-44 mm) in width, and 0.3-0.4 lb (15-20 g) in weight. Their return to nearshore coastal habitats typically occurs around 2 years of age (Ogren 1989), although the time spent in the oceanic zone may vary from 1-4 years or perhaps more (TEWG 2000). Juvenile Kemp's ridley sea turtles use these nearshore coastal habitats from April through November, but they move towards more suitable overwintering habitat in deeper offshore waters (or more southern waters along the Atlantic Coast) as water temperature drops.

The average rates of growth may vary by location, but generally fall within 2.2-2.9 ± 2.4 in per year (5.5-7.5 ± 6.2 cm/year) (Schmid and Barichivich 2006; Schmid and Woodhead 2000). Age to sexual maturity ranges greatly from 5-16 years, though NMFS et al. (2011) determined the best estimate of age to maturity for Kemp's ridley sea turtles was 12 years. It is unlikely that most adults grow very much after maturity. While some sea turtles nest annually, the weighted mean remigration rate for Kemp's ridley sea turtles is approximately 2 years. Nesting generally occurs from April to July. Females lay approximately 2.5 nests per season with each nest containing approximately 100 eggs (Márquez M. 1994).

Population Dynamics

Of the 7 species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the beaches of Rancho Nuevo, Mexico (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s; however, nesting numbers from Rancho Nuevo and adjacent Mexican beaches were below 1,000, with a low of 702 nests in 1985. Yet, nesting steadily increased through the 1990s, and then accelerated during the first decade of the twenty-first century (**Figure 9**), which indicates the species is recovering.

It is worth noting that when the Bi-National Kemp's Ridley Sea Turtle Population Restoration Project was initiated in 1978, only Rancho Nuevo nests were recorded. In 1988, nesting data from southern beaches at Playa Dos and Barra del Tordo were added. In 1989, data from the northern beaches of Barra Ostionales and Tepehuajes were added, and most recently in 1996, data from La Pesca and Altamira beaches were recorded. Currently, nesting at Rancho Nuevo accounts for just over 81% of all recorded Kemp's ridley nests in Mexico. Following a significant, unexplained 1-year decline in 2010, Kemp's ridley nests in Mexico increased to 21,797 in 2012 (Gladys Porter Zoo 2013). From 2013 through 2014, there was a second significant decline, as only 16,385 and 11,279 nests were recorded, respectively. More recent data; however, indicated an increase in nesting. In 2015 there were 14,006 recorded nests, and in 2016 overall numbers increased to 18,354 recorded nests (Gladys Porter Zoo 2016). There was a record high nesting season in 2017, with 24,570 nests recorded (J. Pena, pers. comm., August 31, 2017), but nesting for 2018 declined to 17,945, with another steep drop to 11,090 nests in 2019 (Gladys Porter Zoo data, 2019). Nesting numbers rebounded in 2020 (18,068 nests) and 2021 (17,671 nests) (CONAMP data, 2021). At this time, it is unclear whether the increases and declines in nesting seen over the past decade represents a population oscillating around an equilibrium point or if nesting will decline or increase in the future.

A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 42 in 2004, to a record high of 353 nests in 2017 (National Park Service data). 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, the record nesting in 2017, and then a drop back down to 190 nests in 2019, rebounding to 262 nests in 2020, and back to 195 nests in 2021 (National Park Service data). This year, Kemp's ridley nests were recorded in the Chandeleur Islands of coastal Louisiana (https://www.washingtonpost.com/national/kemps-ridley-sea-turtle-nests-1st-in-75-years-in-louisiana/2022/08/17/0ca8f9b2-1e5a-11ed-9ce6-68253bd31864_story.html).

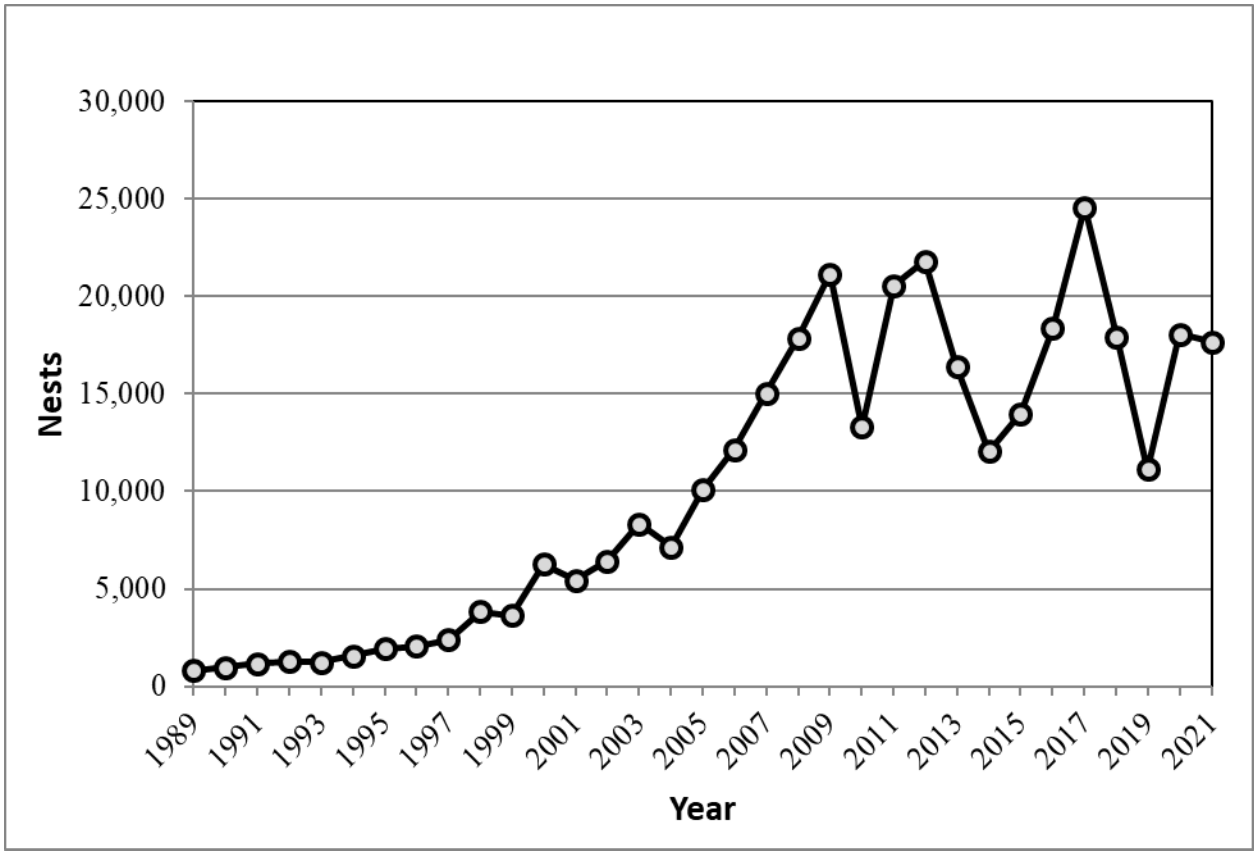

Figure 9. Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2019 and CONAMP data 2020, 2021)

Through modelling, Heppell et al. (2005) predicted the population is expected to increase at least 12-16% per year and could reach at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011) produced an updated model that predicted the population to increase 19% per year and to attain at least 10,000 females nesting on Mexico beaches by 2011. Approximately 25,000 nests would be needed for an estimate of 10,000 nesters on the beach, based on an average 2.5 nests/nesting female. While counts did not reach 25,000 nests by 2015, it is clear that the population has increased over the long term. The increases in Kemp's ridley sea turtle nesting over the last 2 decades is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the United States, and possibly other changes in vital rates (TEWG 1998; TEWG 2000). While these results are encouraging, the species' limited range as well as low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental randomness, all factors which are often difficult to predict with any certainty. Additionally, the significant nesting declines observed in 2010 and 2013-2014 potentially indicate a serious population-level impact, and the ongoing recovery trajectory is unclear.

Threats

Kemp's ridley sea turtles face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 4.1.1.1; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact Kemp's ridley sea turtles.

As Kemp's ridley sea turtles continue to recover and nesting *arribadas* are increasingly established, bacterial and fungal pathogens in nests are also likely to increase. *Arribada* is the Spanish word for "arrival" and is the term used for massive synchronized nesting within the genus *Lepidochelys.* Bacterial and fungal pathogen impacts have been well documented in the large arribadas of the olive ridley at Nancite in Costa Rica (Mo 1988). In some years, and on some sections of the beach, the hatching success can be as low as 5% (Mo 1988). As the Kemp's ridley nest density at Rancho Nuevo and adjacent beaches continues to increase, appropriate monitoring of emergence success will be necessary to determine if there are any density-dependent effects.

Since 2010, we have documented (via the STSSN data, https://www.fisheries.noaa.gov/national/marine-life-distress/sea-turtle-stranding-and-salvage-network) elevated sea turtle strandings in the northern Gulf of Mexico, particularly throughout the Mississippi Sound area. For example, in the first 3 weeks of June 2010, over 120 sea turtle strandings were reported from Mississippi and Alabama waters, none of which exhibited any signs of external oiling to indicate effects associated with the DWH oil spill event. A total of 644 sea turtle strandings were reported in 2010 from Louisiana, Mississippi, and Alabama waters, 561 (87%) of which were Kemp's ridley sea turtles. During March through May of 2011, 267 sea turtle strandings were reported from Mississippi and Alabama waters alone. A total of 525 sea turtle strandings were reported in 2011 from Louisiana, Mississippi, and Alabama waters, with the majority (455) having occurred from March through July, 390 (86%) of which were Kemp's ridley sea turtles. During 2012, a total of 384 sea turtles were reported from Louisiana, Mississippi, and Alabama waters. Of these reported strandings, 343 (89%) were Kemp's ridley sea turtles. During 2014, a total of 285 sea turtles were reported from Louisiana, Mississippi, and Alabama waters, though the data are incomplete. Of these reported strandings, 229 (80%) were Kemp's ridley sea turtles. These stranding numbers are significantly greater than reported in past years; Louisiana, Mississippi, and Alabama waters reported 42 and 73 sea turtle strandings for 2008 and 2009, respectively. It should be noted that stranding coverage has increased considerably due to the DWH oil spill event.

Nonetheless, considering that strandings typically represent only a small fraction of actual mortality, these stranding events potentially represent a serious impact to the recovery and survival of the local sea turtle populations. While a definitive cause for these strandings has not been identified, necropsy results indicate a significant number of stranded turtles from these events likely perished due to forced submergence, which is commonly associated with fishery interactions (B. Stacy, NMFS, pers. comm. to M. Barnette, NMFS PRD, March 2012). Yet, available information indicates fishery effort was extremely limited during the stranding events. The fact that 80% or more of all Louisiana, Mississippi, and Alabama stranded sea turtles in the past 5 years were Kemp's ridleys is notable; however, this could simply be a function of the species' preference for shallow, inshore waters coupled with increased population abundance, as reflected in recent Kemp's ridley nesting increases.

In response to these strandings, and due to speculation that fishery interactions may be the cause, fishery observer effort was shifted to evaluate the inshore skimmer trawl fisheries beginning in 2012. During May-July of that year, observers reported 24 sea turtle interactions in the skimmer trawl fisheries. All but a single sea turtle were identified as Kemp's ridleys (1 sea turtle was an unidentified hardshell turtle). Encountered sea turtles were all very small juvenile specimens, ranging from 7.6-19.0 in (19.4-48.3 cm) CCL. Subsequent years of observation noted additional captures in the skimmer trawl fisheries, including some mortalities. The small average size of encountered Kemp's ridleys introduces a potential conservation issue, as over 50% of these reported sea turtles could potentially pass through the maximum 4-in bar spacing of TEDs currently required in the shrimp fisheries. Due to this issue, a proposed 2012 rule to require 4-in bar spacing TEDs in the skimmer trawl fisheries (77 FR 27411) was not implemented. Following additional gear testing; however, we proposed a new rule in 2016 (81 FR 91097) to require TEDs with 3-in bar spacing for all vessels using skimmer trawls, pusher-head trawls, or wing nets. Ultimately, we published a final rule on December 20, 2019 (84 FR 70048), that requires all skimmer trawl vessels 40 feet and greater in length to use TEDs designed to exclude small sea turtles in their nets effective April 1, 2021. Given the nesting trends and habitat utilization of Kemp's ridley sea turtles, it is likely that fishery interactions in the northern Gulf of Mexico may continue to be an issue of concern for the species, and one that may potentially slow the rate of recovery for Kemp's ridley sea turtles.

While oil spill impacts are discussed generally for all species in Section 4.1.1.1, specific impacts of the DWH oil spill event on Kemp's ridley sea turtles are considered here. Kemp's ridleys experienced the greatest negative impact stemming from the DWH oil spill event of any sea turtle species. Impacts to Kemp's ridley sea turtles occurred to offshore small juveniles, as well as large juveniles and adults. Loss of hatchling production resulting from injury to adult turtles was also estimated for this species. Injuries to adult turtles of other species, such as loggerheads, certainly would have resulted in unrealized nests and hatchlings to those species as well. Yet, the calculation of unrealized nests and hatchlings was limited to Kemp's ridleys for several reasons. All Kemp's ridleys in the Gulf belong to the same population (NMFS et al. 2011), so total population abundance could be calculated based on numbers of hatchlings because all individuals that enter the population could reasonably be expected to inhabit the northern Gulf of Mexico throughout their lives (DWH Trustees 2016).

A total of 217,000 small juvenile Kemp's ridleys (51.5% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. That means approximately half of all small juvenile Kemp's ridleys from the total population estimate of 430,000 oceanic small juveniles were exposed to oil. Furthermore, a large number of small juveniles were removed from the population, as up to 90,300 small juveniles Kemp's ridleys are estimated to have died as a direct result of the exposure. Therefore, as much as 20% of the small oceanic juveniles of this species were killed during that year. Impacts to large juveniles (>3 years old) and adults were also high. An estimated 21,990 such individuals were exposed to oil (about 22% of the total estimated population for those age classes); of those, 3,110 mortalities were estimated (or 3% of the population for those age classes). The loss of near-reproductive and reproductive-stage females would have contributed to some extent to the decline in total nesting abundance observed between 2011 and 2014. The estimated number of unrealized Kemp's ridley nests is between 1,300 and 2,000, which translates to between approximately 65,000 and 95,000 unrealized hatchlings (DWH Trustees 2016). This is a minimum estimate; however, because the sublethal effects of the DWH oil spill event on turtles, their prey, and their habitats might have delayed or reduced reproduction in subsequent years, which may have contributed substantially to additional nesting deficits observed following the DWH oil spill event. These sublethal effects could have slowed growth and maturation rates, increased remigration intervals, and decreased clutch frequency (number of nests per female per nesting season). The nature of the DWH oil spill event effect on reduced Kemp's ridley nesting abundance and associated hatchling production after 2010 requires further evaluation. It is clear that the DWH oil spill event resulted in large losses to the Kemp's ridley population across various age classes, and likely had an important population-level effect on the species. Still, we do not have a clear understanding of those impacts on the population trajectory for the species into the future.

4.1.1.4 Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. NMFS and USFWS published a final rule which designated 9 DPSs for loggerhead sea turtles (76 FR 58868, September 22, 2011, and effective October 24, 2011). This rule listed the following DPSs: (1) Northwest Atlantic Ocean (threatened); (2) Northeast Atlantic Ocean (endangered); (3) South Atlantic Ocean (threatened); (4) Mediterranean Sea (endangered); (5) North Pacific Ocean (endangered); (6) South Pacific Ocean (endangered); (7) North Indian Ocean (endangered); (8) Southeast Indo-Pacific Ocean (endangered); and (9) Southwest Indian Ocean (threatened). The Northwest Atlantic DPS is the only one that occurs within the action area, and therefore it is the only one considered in this Opinion.

Species Description and Distribution

Loggerheads are large sea turtles. Adults in the southeast United States average about 3 ft (92 cm) long, measured as SCL, and weigh approximately 255 lb (116 kg) (Ehrhart and Yoder 1978). Adult and subadult loggerhead sea turtles typically have a light yellow plastron and a reddish brown carapace covered by non-overlapping scutes that meet along seam lines. They typically have 11 or 12 pairs of marginal scutes, 5 pairs of costals, 5 vertebrals, and a nuchal (precentral) scute that is in contact with the first pair of costal scutes (Dodd Jr. 1988).

The loggerhead sea turtle inhabits continental shelf and estuarine environments throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd Jr. 1988). Habitat uses within these areas vary by life stage. Juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd Jr. 1988). Subadult and adult loggerheads are primarily found in coastal waters and eat benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

The majority of loggerhead nesting occurs at the western rims of the Atlantic and Indian Oceans concentrated in the north and south temperate zones and subtropics (NRC 1990a). For the Northwest Atlantic DPS, most nesting occurs along the coast of the United States, from southern

Virginia to Alabama. Additional nesting beaches for this DPS are found along the northern and western Gulf of Mexico, eastern Yucatán Peninsula, at Cay Sal Bank in the eastern Bahamas (Addison 1997; Addison and Morford 1996), off the southwestern coast of Cuba (Moncada Gavilan 2001), and along the coasts of Central America, Colombia, Venezuela, and the eastern Caribbean Islands.

Non-nesting, adult female loggerheads are reported throughout the U.S. Atlantic, Gulf of Mexico, and Caribbean Sea. Little is known about the distribution of adult males who are seasonally abundant near nesting beaches. Aerial surveys suggest that loggerheads as a whole are distributed in U.S. waters as follows: 54% off the southeast U.S. coast, 29% off the northeast U.S. coast, 12% in the eastern Gulf of Mexico, and 5% in the western Gulf of Mexico (TEWG 1998).

Within the Northwest Atlantic DPS, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf Coast of Florida. Previous Section 7 analyses have recognized at least 5 western Atlantic subpopulations, divided geographically as follows: (1) a Northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29ºN; (2) a South Florida nesting subpopulation, occurring from 29°N on the east coast of the state to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez M. 1990; TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001).

The recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula. It also concluded that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the recovery plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are as follows: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia); (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida); (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida); (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas); and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008b). The recovery plan concluded that all recovery units are essential to the recovery of the species. Although the recovery plan was written prior to the listing of the NWA DPS, the recovery units for what was then termed the Northwest Atlantic population apply to the NWA DPS.

Life History Information

The Northwest Atlantic Loggerhead Recovery Team defined the following 8 life stages for the loggerhead life cycle, which include the ecosystems those stages generally use: (1) egg (terrestrial zone); (2) hatchling stage (terrestrial zone); (3) hatchling swim frenzy and transitional stage (neritic zone; the nearshore marine environment from the surface to the sea floor where water depths do not exceed 200 meters); (4) juvenile stage (oceanic zone); (5) juvenile stage (neritic zone); (6) adult stage (oceanic zone); (7) adult stage (neritic zone); and (8) nesting female (terrestrial zone) (NMFS and USFWS 2008b). Loggerheads are long-lived animals. They reach sexual maturity between 20-38 years of age, although age of maturity varies widely among populations (Frazer and Ehrhart 1985; NMFS 2001). The annual mating season occurs from late March to early June, and female turtles lay eggs throughout the summer months. Females deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984), but an individual female only nests every 3.7 years on average (Tucker 2010). Each nest contains an average of 100-126 eggs (Dodd Jr. 1988) which incubate for 42-75 days before hatching (NMFS and USFWS 2008b). Loggerhead hatchlings are 1.5-2-in-long and weigh about 0.7 oz (20 g).

As post-hatchlings, loggerheads hatched on U.S. beaches enter the "oceanic juvenile" life stage, migrating offshore and becoming associated with *Sargassum* habitats, driftlines, and other convergence zones (Carr 1986; Conant et al. 2009; Witherington 2002). Oceanic juveniles grow at rates of 1-2 in (2.9-5.4 cm) per year (Bjorndal et al. 2003; Snover 2002) over a period as long as 7-12 years (Bolten et al. 1998) before moving to more coastal habitats. Studies have suggested that not all loggerhead sea turtles follow the model of circumnavigating the North Atlantic Gyre as pelagic juveniles, followed by permanent settlement into benthic environments (Bolten and Witherington 2003; Laurent et al. 1998). These studies suggest some turtles may either remain in the oceanic habitat in the North Atlantic longer than hypothesized, or they move back and forth between oceanic and coastal habitats interchangeably (Witzell 2002). Stranding records indicate that when immature loggerheads reach 15-24 in (40-60 cm) SCL, they begin to reside in coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002).

After departing the oceanic zone, neritic juvenile loggerheads in the Northwest Atlantic inhabit continental shelf waters from Cape Cod Bay, Massachusetts, south through Florida, the Bahamas, Cuba, and the Gulf of Mexico. Estuarine waters of the United States, including areas such as Long Island Sound, Chesapeake Bay, Pamlico and Core Sounds, Mosquito and Indian River Lagoons, Biscayne Bay, Florida Bay, as well as numerous embayments fringing the Gulf of Mexico, comprise important inshore habitat. Along the Atlantic and Gulf of Mexico shoreline, essentially all shelf waters are inhabited by loggerheads (Conant et al. 2009).

Like juveniles, non-nesting adult loggerheads also use the neritic zone. However, these adult loggerheads do not use the relatively enclosed shallow-water estuarine habitats with limited ocean access as frequently as juveniles. Areas such as Pamlico Sound, North Carolina, and Indian River Lagoon, Florida, are regularly used by juveniles but not by adult loggerheads. Adult loggerheads do tend to use estuarine areas with more open ocean access, such as the Chesapeake Bay in the mid-Atlantic United States. Shallow-water habitats with large expanses of open ocean access, such as Florida Bay, provide year-round resident foraging areas for significant numbers of male and female adult loggerheads (Conant et al. 2009).

Offshore, adults primarily inhabit continental shelf waters, from New York south through Florida, the Bahamas, Cuba, and the Gulf of Mexico. Seasonal use of mid-Atlantic shelf waters, especially offshore New Jersey, Delaware, and Virginia during summer months, and offshore shelf waters, such as Onslow Bay (off the North Carolina coast), during winter months has also been documented (Hawkes et al. 2007), GADNR, unpublished data; SCDNR, unpublished data). Satellite telemetry has identified the shelf waters along the west Florida coast, the Bahamas, Cuba, and the Yucatán Peninsula as important resident areas for adult female loggerheads that nest in Florida (Foley et al. 2008; Girard et al. 2009; Hart et al. 2012). The southern edge of the Grand Bahama Bank is important habitat for loggerheads nesting on the Cay Sal Bank in the Bahamas, but nesting females are also resident in the bights of Eleuthera, Long Island, and Ragged Islands. They also reside in Florida Bay in the United States, and along the north coast of Cuba (A. Bolten and K. Bjorndal, University of Florida, unpublished data). Moncada et al. (2010) report the recapture of 5 adult female loggerheads in Cuban waters originally flipper-tagged in Quintana Roo, Mexico, which indicates that Cuban shelf waters likely also provide foraging habitat for adult females that nest in Mexico.

Status and Population Dynamics

A number of stock assessments and similar reviews (Conant et al. 2009; Heppell et al. 2003; NMFS-SEFSC 2009; NMFS 2001; NMFS and USFWS 2008b; TEWG 1998; TEWG 2000; TEWG 2009) have examined the stock status of loggerheads in the Atlantic Ocean, but none have been able to develop a reliable estimate of absolute population size.

Numbers of nests and nesting females can vary widely from year to year. Nesting beach surveys, though, can provide a reliable assessment of trends in the adult female population, due to the strong nest site fidelity of female loggerhead sea turtles, as long as such studies are sufficiently long and survey effort and methods are standardized (e.g., (NMFS and USFWS 2008b)). NMFS and USFWS (2008b) concluded that the lack of change in 2 important demographic parameters of loggerheads, remigration interval and clutch frequency, indicate that time series on numbers of nests can provide reliable information on trends in the female population.

Peninsular Florida Recovery Unit

The Peninsular Florida Recovery Unit is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed an average of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (NMFS and USFWS 2008b). The statewide estimated total for 2020 was 105,164 nests (FWRI nesting database).

In addition to the total nest count estimates, the FWRI uses an index nesting beach survey method. The index survey uses standardized data-collection criteria to measure seasonal nesting and allow accurate comparisons between beaches and between years. FWRI uses the standardized index survey data to analyze the nesting trends (**Figure 10**) (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). Since the beginning of the index program in 1989, 3 distinct trends were identified. From 1989-1998, there was a 24% increase that was followed by a sharp decline over the subsequent 9 years. A large increase in loggerhead nesting has occurred since, as indicated by the 71% increase in nesting over the 10-year period from 2007 and 2016. Nesting in 2016 also represented a new record for loggerheads on the core index beaches. While nest numbers subsequently declined from the 2016 high FWRI noted that the 2007-2021 period represents a period of increase. FWRI examined the trend from the 1998 nesting high through 2016 and found that the decade-long post-1998 decline was replaced with a slight but non-significant increasing trend. Looking at the data from 1989 through 2016, FWRI concluded that there was an overall positive change in the nest counts although it was not statistically significant due to the wide variability between 2012-2016 resulting in widening confidence intervals. Nesting at the core index beaches declined in 2017 to 48,033, and rose again each year through 2020, reaching 53,443 nests before dipping back to 49,100 in 2021. It is important to note that with the wide confidence intervals and uncertainty around the variability in nesting parameters (changes and variability in nests/female, nesting intervals, etc.) it is unclear whether the nesting trend equates to an increase in the population or nesting females over that time frame (Ceriani, et al. 2019; https://esajournals.onlinelibrary.wiley.com/doi/pdf/10.1002/ecs2.2936).

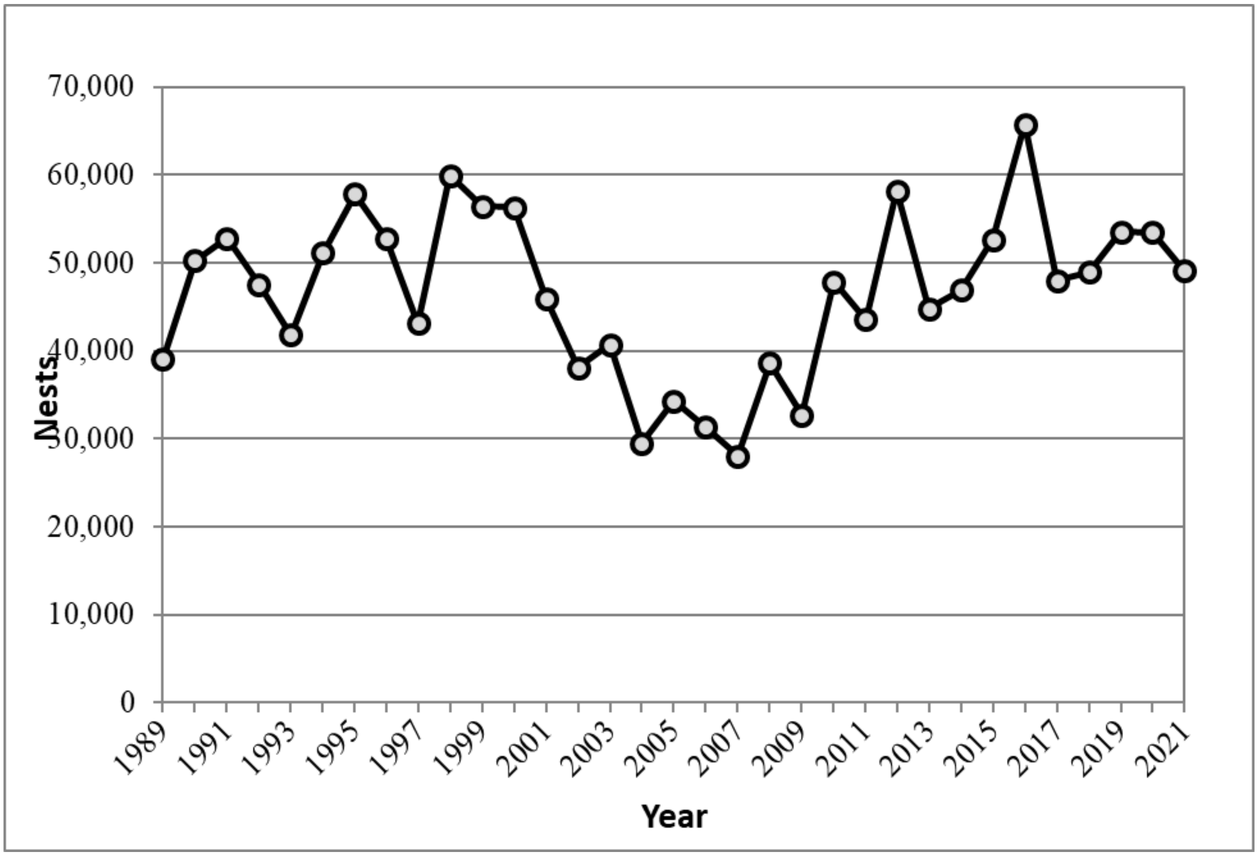

Figure 10. Loggerhead sea turtle nesting at Florida index beaches since 1989

<u>Northern Recovery Unit</u>

Annual nest totals from beaches within the Northern Recovery Unit averaged 5,215 nests from 1989-2008, a period of near-complete surveys of Northern Recovery Unit nesting beaches (GADNR unpublished data, NCWRC unpublished data, SCDNR unpublished data), and represent approximately 1,272 nesting females per year, assuming 4.1 nests per female (Murphy and Hopkins 1984). The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3% annually from 1989-2008. Nest totals from aerial surveys conducted by SCDNR showed a 1.9% annual decline in nesting in South Carolina from 1980-2008. Overall, there are strong statistical data to suggest the Northern Recovery Unit had experienced a long-term decline over that period of time.

Data since that analysis (**Table 3**) are showing improved nesting numbers and a departure from the declining trend. Georgia nesting has rebounded to show the first statistically significant increasing trend since comprehensive nesting surveys began in 1989 (Mark Dodd, GADNR press release, https://georgiawildlife.com/loggerhead-nest-season-begins-where-monitoring-began). South Carolina and North Carolina nesting have also begun to shift away from the past declining trend. Loggerhead nesting in Georgia, South Carolina, and North Carolina all broke records in 2015 and then topped those records again in 2016. Nesting in 2017 and 2018 declined relative to 2016, back to levels seen in 2013 to 2015, but then bounced back in 2019, breaking records for each of the three states and the overall recovery unit. Nesting in 2020 and 2021 declined from the 2019 records, but still remained high, representing the third and fourth highest total numbers for the Northern Recovery Unit since 2008.

Table 3. Total Number of NRU Loggerhead Nests (GADNR, SCDNR, and NCWRC nesting datasets compiled at Seaturtle.org)

Year	Georgia	South Carolina	North Carolina	Totals
2008	1,649	4,500	841	**6,990**
2009	998	2,182	302	**3,472**
2010	1,760	3,141	856	**5,757**
2011	1,992	4,015	950	**6,957**
2012	2,241	4,615	1,074	**7,930**
2013	2,289	5,193	1,260	**8,742**
2014	1,196	2,083	542	**3,821**
2015	2,319	5,104	1,254	**8,677**
2016	3,265	6,443	1,612	**11,320**
2017	2,155	5,232	1,195	**8,582**
2018	1,735	2,762	765	**5,262**
2019	3,945	8,774	2,291	**15,010**
2020	2,786	5,551	1,335	**9,672**
2021	2,493	5,639	1,448	**9,580**

South Carolina also conducts an index beach nesting survey similar to the one described for Florida. Although the survey only includes a subset of nesting, the standardized effort and locations allow for a better representation of the nesting trend over time. Increases in nesting were seen for the period from 2009-2013, with a subsequent steep drop in 2014. Nesting then rebounded in 2015 and 2016, setting new highs each of those years. Nesting in 2017 dropped back down from the 2016 high, but was still the second highest on record. After another drop in 2018, a new record was set for the 2019 season, with a return to 2016 levels in 2020 and 2021 (**Figure 11**).

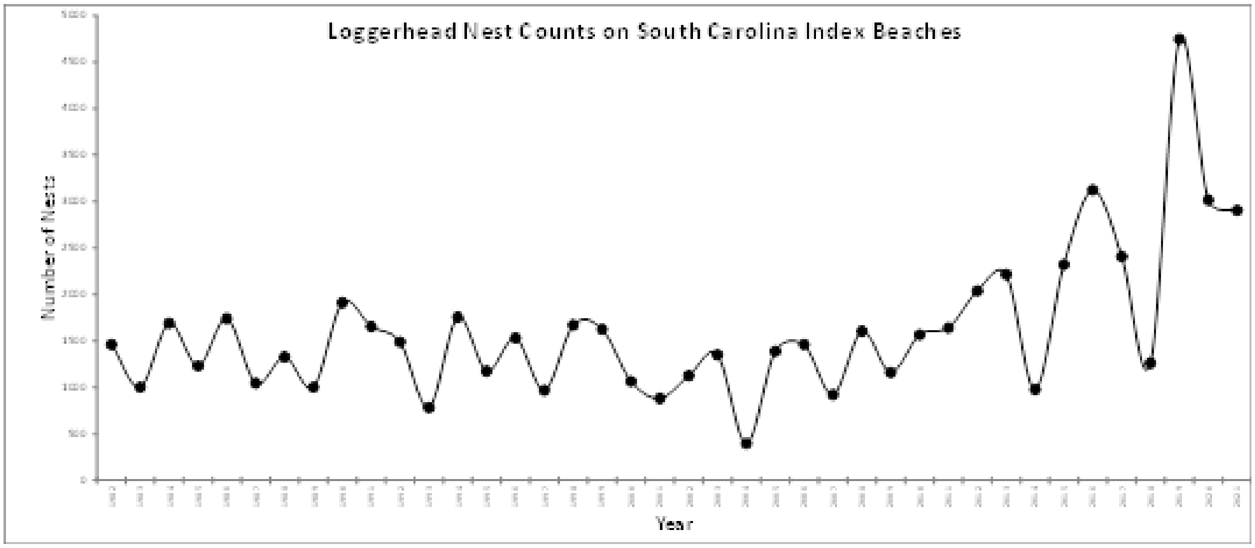

Figure 11. South Carolina index nesting beach counts for loggerhead sea turtles (from the SCDNR website: https://www.dnr.sc.gov/seaturtle/ibs.htm)

Other Northwest Atlantic DPS Recovery Units

The remaining 3 recovery units—Dry Tortugas, Northern Gulf of Mexico, and Greater Caribbean—are much smaller nesting assemblages, but they are still considered essential to the continued existence of the species. Nesting surveys for the Dry Tortugas Recovery Unit are conducted as part of Florida's statewide survey program. Survey effort was relatively stable during the 9-year period from 1995-2004, although the 2002 year was missed. Nest counts ranged from 168-270, with a mean of 246, but there was no detectable trend during this period (NMFS and USFWS 2008b). Nest counts for the Northern Gulf of Mexico Recovery Unit are focused on index beaches rather than all beaches where nesting occurs. Analysis of the 12-year dataset (1997-2008) of index nesting beaches in the area shows a statistically significant declining trend of 4.7% annually. Nesting on the Florida Panhandle index beaches, which represents the majority of Northern Gulf of Mexico Recovery Unit nesting, had shown a large increase in 2008, but then declined again in 2009 and 2010 before rising back to a level similar to the 2003-2007 average in 2011. From 1989-2018 the average number of Northern Gulf of Mexico Recovery Unit nests annually on index beaches was 169 nests, with an average of 1100 counted in the statewide nesting counts (Ceriani et al. 2019). Nesting survey effort has been inconsistent among the Greater Caribbean Recovery Unit nesting beaches, and no trend can be determined for this subpopulation (NMFS and USFWS 2008b). Zurita et al. (2003) found a statistically significant increase in the number of nests on 7 of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. Nonetheless, nesting has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008b).

In-water Trends

Nesting data are the best current indicator of sea turtle population trends, but in-water data also provide some insight. In-water research suggests the abundance of neritic juvenile loggerheads is steady or increasing. Although Ehrhart et al. (2007) found no significant regression-line trend in a long-term dataset, researchers have observed notable increases in CPUE (Arendt et al. 2009; Ehrhart et al. 2007; Epperly et al. 2007). Researchers believe that this increase in CPUE is likely linked to an increase in juvenile abundance, although it is unclear whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence. Bjorndal et al. (2005), cited in NMFS and USFWS (2008b), caution about extrapolating localized in-water trends to the broader population and relating localized trends in neritic sites to population trends at nesting beaches. The apparent overall increase in the abundance of neritic loggerheads in the southeastern United States may be due to increased abundance of the largest oceanic/neritic juveniles (historically referred to as small benthic juveniles), which could indicate a relatively large number of individuals around the same age may mature in the near future (TEWG 2009). In-water studies throughout the eastern United States, however, indicate a substantial decrease in the abundance of the smallest oceanic/neritic juvenile loggerheads, a pattern corroborated by stranding data (TEWG 2009).

Population Estimate

The NMFS Southeast Fisheries Science Center developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS-SEFSC 2009). The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Resulting trajectories of model runs for each individual recovery unit, and the western North Atlantic population as a whole, were found to be very similar. The model run estimates from the adult female population size for the western North Atlantic (from the 2004-2008 time frame), suggest the adult female population size is approximately 20,000-40,000 individuals, with a low likelihood of females' numbering up to 70,000 (NMFS-SEFSC 2009). A less robust estimate for total benthic females in the western North Atlantic was also obtained, yielding approximately 30,000-300,000 individuals, up to less than 1 million (NMFS-SEFSC 2009). A preliminary regional abundance survey of loggerheads within the northwestern Atlantic continental shelf for positively identified loggerhead in all strata estimated about 588,000 loggerheads (interquartile range of 382,000-817,000). When correcting for unidentified turtles in proportion to the ratio of identified turtles, the estimate increased to about 801,000 loggerheads (interquartile range of 521,000-1,111,000) (NMFS-NEFSC 2011).

Threats (Specific to Loggerhead Sea Turtles)

The threats faced by loggerhead sea turtles are well summarized in the general discussion of threats in Section 4.1.1.1. Yet the impact of fishery interactions is a point of further emphasis for this species. The joint NMFS and USFWS Loggerhead Biological Review Team determined that the greatest threats to the Northwest Atlantic DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009).

Regarding the impacts of pollution, loggerheads may be particularly affected by organochlorine contaminants; they have the highest organochlorine concentrations (Storelli et al. 2008) and metal loads (D'Ilio et al. 2011) in sampled tissues among the sea turtle species. It is thought that dietary preferences were likely to be the main differentiating factor among sea turtle species. Storelli et al. (2008) analyzed tissues from stranded loggerhead sea turtles and found that mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991).

While oil spill impacts are discussed generally for all species in Section 4.1.1.1, specific impacts of the DWH oil spill event on loggerhead sea turtles are considered here. Impacts to loggerhead sea turtles occurred to offshore small juveniles as well as large juveniles and adults. A total of 30,800 small juvenile loggerheads (7.3% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. Of those exposed, 10,700 small juveniles are estimated to have died as a result of the exposure. In contrast to small juveniles, loggerheads represented a large proportion of the adults and large juveniles exposed to and killed by the oil. There were 30,000 exposures (almost 52% of all exposures for those age/size classes) and 3,600 estimated mortalities. A total of 265 nests (27,618 eggs) were also translocated during response efforts, with 14,216 hatchlings released, the fate of which is unknown (DWH Trustees 2015b). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil or dispersants or both, and loss of foraging resources which could lead to compromised growth and reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

Unlike Kemp's ridleys, the majority of nesting for the Northwest Atlantic DPS occurs on the Atlantic Coast and, thus, loggerheads were impacted to a relatively lesser degree. However, it is likely that impacts to the Northern Gulf of Mexico Recovery Unit of the Northwest Atlantic DPS would be proportionally much greater than the impacts occurring to other recovery units. Impacts to nesting and oiling effects on a large proportion of the Northern Gulf of Mexico Recovery Unit, especially mating and nesting adults likely had an impact on the Northern Gulf of Mexico Recovery Unit. Based on the response injury evaluations for Florida Panhandle and Alabama nesting beaches (which fall under the Northern Gulf of Mexico Recovery Unit), the DWH Trustees (2016) estimated that approximately 20,000 loggerhead hatchlings were lost due to DWH oil spill response activities on nesting beaches. Although the long-term effects remain unknown, the DWH oil spill event impacts to the Northern Gulf of Mexico Recovery Unit may result in some nesting declines in the future due to a large reduction of oceanic age classes during the DWH oil spill event. Although adverse impacts occurred to loggerheads, the proportion of the population that is expected to have been exposed to and directly impacted by the DWH oil spill event is relatively low. Thus we do not believe a population-level impact occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

Specific information regarding potential climate change impacts on loggerheads is also available. Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80% female offspring for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100% female offspring. Such highly skewed sex ratios could undermine the reproductive capacity of the species. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most nests, leading to egg mortality (Hawkes et al. 2007). Warmer sea surface temperatures have also been correlated with an earlier onset of loggerhead nesting in the spring (Hawkes et al. 2007; Weishampel et al. 2004), short inter-nesting intervals (Hays et al. 2002), and shorter nesting seasons (Pike et al. 2006).

4.1.2 Fishes

4.1.2.1 Smalltooth Sawfish

The U.S. DPS of smalltooth sawfish was listed as endangered under the ESA effective May 1, 2003 (68 FR 15674; April 1, 2003).

Species Description and Distribution

Smalltooth sawfish mate in the spring and early summer (Grubbs unpublished data; Poulakis unpublished data). Fertilization is internal and females give birth to live young. Evidence suggests a gestation period of approximately 12 months and females produce litters of 7-14 young (Feldheim et al. 2017) (Gelsleichter unpublished data). Females have a biennial reproductive cycle (Feldheim et al. 2017) and parturition (act of giving birth) occurs nearly year round though peaking in spring and early summer (March – July) (Poulakis et al. 2011) (Carlson unpublished data). Smalltooth sawfish are approximately 26-31 in (64-80 cm) at birth (Bethea et al. 2012; Poulakis et al. 2011) and may grow to a maximum length of approximately 16 ft (500 cm) (Grubbs unpublished data, (Brame et al. 2019). Simpfendorfer et al. (2008) report rapid juvenile growth for smalltooth sawfish for the first 2 years after birth, with stretched total length increasing by an average of 25-33 in (65-85 cm) in the first year and an average of 19-27 in (48-68 cm) in the second year. Uncertainty remains in estimating post-juvenile growth rates and age at maturity; yet, recent advances indicate maturity at 7-11 years (Carlson and Simpfendorfer 2015) at lengths of approximately 340 cm for males and 350-370 cm for females (Gelsleichter unpublished data).

There are distinct differences in habitat use based on life history stage as the species shifts use through ontogeny. Juvenile smalltooth sawfish less than 220 cm, inhabit the shallow euryhaline waters (i.e., variable salinity) of estuaries and can be found in sheltered bays, dredged canals, along banks and sandbars, and in rivers (NMFS 2000). These juveniles are often closely associated with muddy or sandy substrates, and shorelines containing red mangroves, *Rhizophora mangle* (Hollensead et al. 2016; Hollensead et al. 2018; Poulakis et al. 2011; Poulakis et al. 2013; Simpfendorfer 2001; Simpfendorfer 2003; Simpfendorfer et al. 2010). Simpfendorfer et al. (2010) indicated the smallest juveniles (young-of-the-year juveniles measuring < 100 cm in length) generally used the shallowest water (depths less than 0.5 m (1.64 ft)), had small home ranges (4,264-4,557 m^2), and exhibited high levels of site fidelity. Although small juveniles exhibit high levels of site fidelity for specific nursery habitats for periods of time lasting up to 3 months (Wiley and Simpfendorfer 2007), they do undergo small movements coinciding with changing tidal stages. These movements often involve moving from shallow sandbars at low tide to within red mangrove prop roots at higher tides (Simpfendorfer et al. 2010)—behavior likely to reduce the risk of predation (Simpfendorfer 2006). As juveniles increase in size, they begin to expand their home ranges (Simpfendorfer et al. 2010;

Simpfendorfer et al. 2011), eventually moving to more offshore habitats where they likely feed on larger prey as they continue to mature.

Researchers have identified several areas within the Charlotte Harbor Estuary that are disproportionately more important to juvenile smalltooth sawfish, based on intra- or inter-annual (within or between year) capture rates during random sampling events within the estuary (Poulakis et al. 2011; Poulakis 2012). These high-use areas were termed “hotspots” and also correspond with areas where public encounters are most frequently reported. Use of these “hotspots” can vary within and among years based on the amount and timing of freshwater inflow. Juvenile smalltooth sawfish use hotspots further upriver during high salinity conditions (drought) and areas closer to the mouth of the Caloosahatchee River during times of high freshwater inflow (Poulakis et al. 2011). At this time, researchers are unsure what specific biotic or abiotic factors influence this habitat use, but they believe a variety of conditions in addition to salinity, such as temperature, dissolved oxygen, water depth, shoreline vegetation, and food availability, may influence habitat selection (Poulakis et al. 2011).

The juvenile “hotspots” may be of further significance following the findings of female philopatry (Feldheim et al. 2017). More specifically, Feldheim et al. (2017) found that female sawfish return to the same parturition (birthing) sites over multiple years (parturition site fidelity). NMFS expects that these parturition sites align closely with the juvenile “hotspots” given the high fidelity shown by the smallest size/age classes of sawfish to specific nursery areas. Therefore, disturbance of these nursery areas could have wide-ranging effects on the sawfish population if it were to disrupt future parturition.

While adult smalltooth sawfish may also use the estuarine habitats used by juveniles, they are commonly observed in deeper waters along the coasts. Poulakis and Seitz (2004) noted that nearly half of the encounters with adult-sized smalltooth sawfish in Florida Bay and the Florida Keys occurred in depths from 200-400 ft (70-122 m) of water. Similarly, Simpfendorfer and Wiley (2005) reported encounters in deeper waters off the Florida Keys, and observations from both commercial longline fishing vessels and fishery-independent sampling in the Florida Straits report large smalltooth sawfish in depths up to 130 ft (~40 m) (ISED 2014). Yet, current field studies show adult smalltooth sawfish also use shallow estuarine habitats within Florida Bay and the Everglades (Grubbs unpublished data). Further, NMFS expects that females return to shallow estuaries during parturition (when adult females return to shallow estuaries to give birth).

Status and Population Dynamics

Based on the contraction of the species’ geographic range, we expect that the population to be a fraction of its historical size. However, few long-term abundance data exist for the smalltooth sawfish, making it very difficult to estimate the current population size. Despite the lack of scientific data, recent encounters with young-of-the-year, older juveniles, and sexually mature smalltooth sawfish indicate that the U.S. population is currently reproducing (Feldheim et al. 2017; Seitz and Poulakis 2002; Simpfendorfer 2003). The abundance of juveniles publically encountered by anglers and boaters, including very small individuals, suggests that the population remains viable (Simpfendorfer and Wiley 2004), and data analyzed from Everglades National Park as part of an established fisheries-dependent monitoring program (angler interviews) indicated a slightly increasing trend in juvenile abundance within the Park over the past decade (Carlson and Osborne 2012; Carlson et al. 2007). Similarly, preliminary results of juvenile smalltooth sawfish sampling programs in both ENP and Charlotte Harbor indicate the juvenile population is at least stable and possibly increasing (Poulakis unpublished data, Carlson unpublished data).

Using a demographic approach and life history data for smalltooth sawfish and similar species from the literature, Simpfendorfer (2000) estimated intrinsic rates of natural population increase for the species at 0.08-0.13 per year and population doubling times from 5.4-8.5 years. These low intrinsic rates (i.e., the rate at which a population increases in size if there are no density-dependent forces regulating the population) of population increase, suggest that the species is particularly vulnerable to excessive mortality and rapid population declines, after which recovery may take decades. Carlson and Simpfendorfer (2015) constructed an age-structured Leslie matrix model for the U.S. population of smalltooth sawfish, using updated life history information, to determine the species' ability to recover under scenarios of variable life history inputs and the effects of bycatch mortality and catastrophes. As expected, population growth was highest (λ=1.237 per year) when age-at-maturity was 7 yr and decreased to 1.150 per year when age-at-maturity was 11 yr. Despite a high level of variability throughout the model runs, in the absence of fishing mortality or catastrophic climate effects, the population grew at a relatively rapid rate approaching carrying capacity in 40 years when the initial population was set at 2250 females or 50 years with an initial population of 600 females. Carlson and Simpfendorfer (2015) concluded that smalltooth sawfish in U.S. waters appear to have the ability to recover within the foreseeable future based on a model relying upon optimistic estimates of population size, lower age-at-maturity and the lower level of fisheries-related mortality. Another analysis was less optimistic based on lower estimates of breeding females in the Caloosahatchee River nursery (Chapman unpublished data). Assuming similar numbers of females among the 5 known nurseries, that study would suggest an initial breeding population of only 140-390 females, essentially half of the initial population considered by Carlson and Simpfendorfer (2015). A smaller initial breeding population would extend the time to reach carrying capacity.

Threats

Past literature indicates smalltooth sawfish were once abundant along both coasts of Florida and quite common along the shores of Texas and the northern Gulf of Mexico (NMFS 2010 and citations therein). Based on recent comparisons with these historical reports, the U.S. DPS of smalltooth sawfish has declined over the past century (Simpfendorfer 2001; Simpfendorfer 2002). The decline in smalltooth sawfish abundance has been attributed to several factors including bycatch mortality in fisheries, habitat loss, and life history limitations of the species (NMFS 2010).

<u>Bycatch Mortality</u>

Bycatch mortality is cited as the primary cause for the decline in smalltooth sawfish in the United States (NMFS 2010). While there has never been a large-scale directed fishery, smalltooth sawfish easily become entangled in fishing gears (gill nets, otter trawls, trammel nets, and seines) directed at other commercial species, often resulting in serious injury or death

(NMFS 2009). This has historically been reported in Florida (Snelson and Williams 1981), Louisiana (Simpfendorfer 2002), and Texas (Baughman 1943). For instance, one fisherman interviewed by Evermann and Bean (1897) reported taking an estimated 300 smalltooth sawfish in just one netting season in the Indian River Lagoon, Florida. In another example, smalltooth sawfish landings data gathered by Louisiana shrimp trawlers from 1945-1978, which contained both landings data and crude information on effort (number of vessels, vessel tonnage, number of gear units), indicated declines in smalltooth sawfish landings from a high of 34,900 lbs in 1949 to less than 1,500 lbs in most years after 1967. The Florida net ban passed in 1995 has led to a reduction in the number of smalltooth sawfish incidentally captured, "…by prohibiting the use of gill and other entangling nets in all Florida waters, and prohibiting the use of other nets larger than 500 ft^2 in mesh area in nearshore and inshore Florida waters" (FLA. CONST. art. X, § 16; "nearshore and inshore Florida waters" means all Florida waters inside a line 3-mi-seaward of the coastline along the Gulf of Mexico and inside a line 1-mi-seaward of the coastline along the Atlantic Ocean). However, the threat of bycatch currently remains in commercial fisheries (e.g., South Atlantic shrimp fishery, Gulf of Mexico shrimp fishery, federal shark fisheries of the South Atlantic, and the Gulf of Mexico reef fish fishery), though anecdotal information collected by NMFS port agents suggest smalltooth sawfish captures are now rare.

In addition to incidental bycatch in commercial fisheries, smalltooth sawfish have historically been and continue to be captured by recreational anglers. Encounter data (ISED 2014) and past research (Caldwell 1990) document that rostra are sometimes removed from smalltooth sawfish caught by recreational anglers, thereby reducing their chances of survival. While the current threat of mortality associated with recreational fisheries is expected to be low given that possession of the species in Florida has been prohibited since 1992, bycatch in recreational fisheries remains a potential threat to the species.

Habitat Loss

Modification and loss of smalltooth sawfish habitat, especially nursery habitat, is another contributing factor in the decline of the species. Activities such as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff contribute to these losses (SAFMC 1998). Large areas of coastal habitat were modified or lost between the mid-1970s and mid-1980s within the United States (Dahl and Johnson 1991). Since then, rates of loss have decreased, but habitat loss continues. From 1998-2004, approximately 64,560 ac of coastal wetlands were lost along the Atlantic and Gulf coasts of the United States, of which approximately 2,450 acres were intertidal wetlands consisting of mangroves or other estuarine shrubs (Steadman and Dahl 2008). Further, Orlando et al. (1994) analyzed 18 major southeastern estuaries and recorded over 703 mi of navigation channels and 9,844 mi of shoreline with modifications. In Florida, coastal development often involves the removal of mangroves and the armoring of shorelines through seawall construction. Changes to the natural freshwater flows into estuarine and marine waters through construction of canals and other water control devices have had other impacts: altered the temperature, salinity, and nutrient regimes; reduced both wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Gilmore 1995; Reddering 1988; Whitfield and Bruton 1989). While these modifications of habitat are not the primary reason for the decline of smalltooth sawfish abundance, it is likely a contributing factor and almost certainly hampers the recovery of the species. Juvenile sawfish and their nursery habitats are particularly likely to be affected by these kinds of habitat losses or alternations, due to their affinity for shallow, estuarine systems. Prohaska et al. (2018) showed that juvenile smalltooth sawfish within the anthropogenically altered Charlotte Harbor estuary have higher metabolic stress compared to those collected from more pristine nurseries in the Everglades. Although many forms of habitat modification are currently regulated, some permitted direct and indirect damage to habitat from increased urbanization still occurs and is expected to continue to threaten survival and recovery of the species in the future.

Life History Limitations

The smalltooth sawfish is also limited by its life history characteristics as a relatively slow-growing, late-maturing, and long-lived species. Animals using this life history strategy are usually successful in maintaining small, persistent population sizes in constant environments, but are particularly vulnerable to increases in mortality or rapid environmental change (NMFS 2000). The combined characteristics of this life history strategy result in a very low intrinsic rate of population increase (Musick 1999) that make it slow to recover from any significant population decline (Simpfendorfer 2000).

Stochastic Events

Although stochastic events such as aperiodic extreme weather and harmful algal blooms are expected to affect smalltooth, we are currently unsure of their impact. A strong and prolonged cold weather event in January 2010 resulted in the mortality of at least 15 juvenile and 1 adult sawfish (Poulakis et al. 2011; Scharer et al. 2012), and led to far fewer catches in directed research throughout the remainder of the year (Bethea et al. 2011). Another less severe cold front in 2011 did not result in any known mortality, but did alter the typical habitat use patterns of juvenile sawfish within the Caloosahatchee River. Since surveys began, 3 hurricanes have made direct landfall within the core range of U.S. sawfish. While these storms denuded mangroves along the shoreline and created hypoxic water conditions, we are unaware of any direct effects to sawfish. Just prior to the passage of Hurricane Irma in 2017, acoustically tagged sawfish moved away from their normal shallow nurseries and then returned within a few days (Poulakis unpublished data; Carlson unpublished data). Harmful algal blooms have occurred within the core range of smalltooth sawfish and affected a variety of fauna including sea turtles, fish, and marine mammals, but to date no sawfish mortalities have been reported.

Current Threats

The 3 major factors that led to the current status of the U.S. DPS of smalltooth sawfish – bycatch mortality, habitat loss, and life history limitations – continue to be the greatest threats today. All the same, other threats such as the illegal commercial trade of smalltooth sawfish or their body parts, predation, and marine pollution and debris may also affect the population and recovery of smalltooth sawfish on smaller scales (NMFS 2010). We anticipate that all of these threats will continue to affect the rate of recovery for the U.S. DPS of smalltooth sawfish.

In addition to the anthropogenic effects mentioned previously, changes to the global climate are likely to be a threat to smalltooth sawfish and the habitats they use. The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal and its impacts to coastal resources may be significant (IPCC 2007b; IPCC 2013). Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, changes in the amount and timing of precipitation, and changes in air and water temperatures (EPA 2012; NOAA 2012). The impacts to smalltooth sawfish cannot, for the most part, currently be predicted with any degree of certainty, but we can project some effects to the coastal habitats where they reside. Red mangroves and shallow, euryhaline waters will be directly impacted by climate change through sea level rise, which is expected to increase 0.45 to 0.75 m by 2100 (IPCC 2013). Sea level rise will impact mangrove resources, as sediment surface elevations for mangroves will not keep pace with conservative projected rates of elevation in sea level (Gilman et al. 2008). Sea level increases will also affect the amount of shallow water available for juvenile smalltooth sawfish nursery habitat, especially in areas where there is shoreline armoring (e.g., seawalls). Further, the changes in precipitation coupled with sea level rise may also alter salinities of coastal habitats, reducing the amount of available smalltooth sawfish nursery habitat.

4.1.2.2 Gulf Sturgeon

Gulf sturgeon (*Acipenser oxyrinchus desotoi)* were listed as threatened effective October 30, 1991 (56 CFR 49653, September 30, 1991), after their stocks were greatly reduced or extirpated throughout much of their historic range by overfishing, dam construction, and habitat degradation. NMFS and the USFWS jointly manage Gulf sturgeon. In riverine habitats, USFWS is responsible for all consultations regarding Gulf sturgeon and critical habitat. In estuarine habitats, responsibility is divided based on the action agency involved. USFWS consults with the Department of Transportation, the Environmental Protection Agency, the U.S. Coast Guard, and the Federal Emergency Management Agency; NMFS consults with the Department of Defense, U.S. Army Corps of Engineers, the Bureau of Ocean Energy Management, and any other federal agencies not specifically mentioned at 50 CFR 226.214. In marine areas, NMFS is responsible for all consultations regarding Gulf sturgeon and critical habitat. In 2009, NMFS and USFWS conducted a 5-year review and found Gulf sturgeon continued to meet the definition of a threatened species (USFWS and NMFS 2009).

Species Description and Distribution

The Gulf sturgeon is a subspecies of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Gulf sturgeon are nearly cylindrical fish with an extended snout, vertical mouth, 5 rows of scutes (bony plates surrounding the body), 4 chin barbels (slender, whisker-like feelers extending from the head used for touch and taste), and a heterocercal (upper lobe is longer than lower) caudal fin (tail fin). Adults range from 1.75-2.75 m and weigh up to 175 kg; females grow larger than males. Gulf sturgeon spawn in freshwater and then migrate to feed and grow in estuarine/marine (brackish/salt) waters. Large subadults and adults feed primarily on lancelets, brachiopods, amphipods and other crustaceans, polychaetes, and gastropods. Small Gulf sturgeon feed on benthic infauna such as amphipods, grass shrimp, isopods, oligochaetes, polychaetes, and chironomid and ceratopogonid larvae, found in the intertidal zone. Subadults of more than 5 kg and adults in the freshwater middle river reaches essentially fast during the summer and fall (Mason Jr. and Clugston 1993).

Historically, Gulf sturgeon occurred from the Mississippi River east to Tampa Bay. Sporadic occurrences were recorded as far west as the Rio Grande River in Texas and Mexico, and as far east and south as Florida Bay (Reynolds 1993; Wooley and Crateau 1985). The subspecies' present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi respectively, east to the Suwannee River in Florida.

Life History

Gulf sturgeon are long-lived, with some individuals reaching at least 42 years in age (Huff 1975). Age at sexual maturity ranges from 8-17 years for females and 7-21 years for males (Huff 1975). Chapman and Carr (1995) estimated that mature female Gulf sturgeon that weigh between 64 and 112 lb (29-51 kg) produce an average of 400,000 eggs. Spawning intervals range from 1-5 years for males, while females require longer intervals ranging from 3-5 years (Fox et al. 2000; Huff 1975).

Gulf sturgeon move from the Gulf of Mexico into coastal rivers in early spring (i.e., March through May). Fox et al (2000) found water temperatures at time of river entry differed significantly by reproductive stage and sex. Individuals entered the river system when water temperatures ranged anywhere between 11.2°C and 27.1°C. Spawning occurs in the upper reaches of rivers in the spring when water temperature is around 15°C to 20°C. While Sulak and Clugston (1999) suggest that sturgeon spawning activity is related to moon phase, other researchers have found little evidence of spawning associated with lunar cycles (Fox et al. 2000; Slack et al. 1999). Fertilization is external; females deposit their eggs on the river bottom and males fertilize them. Gulf sturgeon eggs are demersal, adhesive, and vary in color from gray to brown to black (Huff 1975; Vladykov and Greely 1963a). Parauka et al. (1991) reported that hatching time for artificially spawned Gulf sturgeon ranged from 85.5 hours at 18.4°C to 54.4 hours at about 23°C. Published research on the life history of younger Gulf sturgeon is limited. After hatching, YOY individuals generally disperse downstream of spawning sites, though some may travel upstream as well (Clugston et al. 1995; Sulak and Clugston 1999), and move into estuarine feeding areas for the winter months.

Tagging studies confirm that Gulf sturgeon exhibit a high degree of river fidelity (Carr 1983). Of 4,100 fish tagged, 21% (860 of 4,100 fish) were later recaptured in the river of their initial collection, 8 fish (0.2%) moved between river systems, and the remaining fish (78.8%) have not yet been recaptured (USFWS and GSMFC 1995). There is no information documenting the presence of spawning adults in non-natal rivers. However, there is some evidence of movements by both male and female Gulf sturgeon (n = 22) from natal rivers into non-natal rivers (Carr et al. 1996; Craft et al. 2001; Fox et al. 2002; Ross et al. 2001; Wooley and Crateau 1985).

Gene flow is low in Gulf sturgeon stocks, with each stock exchanging less than one mature female per generation (Waldman and Wirgin 1998). Genetic studies confirm that Gulf sturgeon exhibit river-specific fidelity. Stabile et al. (1996) analyzed tissue taken from Gulf sturgeon in 8 drainages along the Gulf of Mexico for genetic diversity and noted significant differences among Gulf sturgeon stocks, which suggests region-specific affinities and likely river-specific fidelity. Five regional or river-specific stocks (from west to east) have been identified: (1) Lake Pontchartrain and Pearl River; (2) Pascagoula River; (3) Escambia and Yellow Rivers; (4) Choctawhatchee River; and (5) Apalachicola, Ochlockonee, and Suwannee Rivers (Stabile et al. 1996).

After spawning, Gulf sturgeon move downstream to areas referred to as “summer resting” or “holding” areas. Adults and subadults are not distributed uniformly throughout the river, but instead show a preference for these discrete holding areas usually located in the lower and middle river reaches (Hightower et al. 2002). While it was suggested these holding areas were sought for cooler water temperatures (Carr et al. 1996; Chapman and Carr 1995), Hightower et al. (Hightower et al. 2002) found that water temperatures in holding areas where Gulf sturgeon were repeatedly found in the Choctawhatchee River were similar to temperatures where sturgeon were only occasionally found elsewhere in the river.

In the fall, movement from the rivers into the estuaries and associated bays begins in September (at water temperatures around 23°C) and continues through November (Foster and Clugston 1997; Huff 1975; Wooley and Crateau 1985). Because the adult and large subadult sturgeon have spent at least 6 months fasting or foraging sparingly on detritus (Mason Jr. and Clugston) in the rivers, it is presumed they immediately begin foraging. Telemetry data indicate Gulf sturgeon are found in high concentrations near the mouths of their natal rivers with individual fish traveling relatively quickly between foraging areas where they spend an extended period of time (Edwards et al. 2007; Edwards et al. 2003).

Most subadult and adult Gulf sturgeon spend the cool winter months (October/November through March/ April) in the bays, estuaries, and the nearshore Gulf of Mexico (Clugston et al. 1995; Fox et al. 2002; Odenkirk 1989). Tagged fish have been located in well-oxygenated shallow water (less than 7 m) areas that support burrowing macro invertebrates (Craft et al. 2001; Fox and Hightower 1998; Fox et al. 2002; Parauka et al. 2001; Rogillio et al. 2007; Ross et al. 2001; Ross et al. 2009). These areas may include shallow shoals 5-7 ft (1.5-2.1 m), deep holes near passes (Craft et al. 2001), unvegetated sand habitats such as sandbars, and intertidal and subtidal energy zones (Abele and Kim 1986; Menzel 1971; Ross et al. 2009). Subadult and adult Gulf sturgeon overwintering in Choctawhatchee Bay (Florida) were generally found to occupy the sandy shoreline habitat at depths of 4-6 ft (2-3 m) (Fox et al. 2002; Parauka et al. 2001). These shifting, predominantly sandy, areas support a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, ghost shrimp, small crabs, various polychaete worms, and lancelets (Abele and Kim 1986; Menzel 1971; Williams et al. 1989). Preference for sandy habitat is supported by studies in other areas that have correlated Gulf sturgeon presence to sandy substrate (Fox et al. 2002).

Gulf sturgeon are described as opportunistic and indiscriminate benthivores that change their diets and foraging areas during different life stages. Their guts generally contain benthic marine invertebrates including amphiopods, lancelets, polychaetes, gastropods, shrimp, isopods, molluscs, and crustaceans (Carr et al. 1996; Fox et al. 2002; Huff 1975; Mason Jr. and Clugston 1993). Generally, Gulf sturgeon prey are burrowing species that feed on detritus or suspended particles or both, and inhabit sandy substrate. In the river, YOY sturgeon eat aquatic invertebrates and detritus (Mason Jr. and Clugston 1993; Sulak and Clugston 1999) and juveniles forage throughout the river on aquatic insects (e.g., mayflies and caddisflies), worms (oligochaete), and bivalves (Huff 1975; Mason Jr. and Clugston 1993). Adults forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth (Gu et al. 2001). Both adult and subadult Gulf sturgeon are known to lose up to 30% of their total body weight while in fresh water, and subsequently compensate the loss during winter feeding in marine areas (Carr 1983; Clugston et al. 1995; Heise et al. 1999; Morrow et al. 1998; Ross et al. 2000; Sulak and Clugston 1999; Wooley and Crateau 1985).

Status and Population Dynamics

Abundance of Gulf sturgeon is measured at the riverine scale. Currently, 7 rivers are known to support reproducing populations of Gulf sturgeon: Pearl; Pascagoula; Escambia; Yellow; Choctawhatchee; Apalachicola; and Suwannee. Gulf sturgeon abundance estimates by river and year for the 7 known reproducing populations are presented in **Table 4**. The number of individuals within each riverine population is variable across their range, but generally over the last decade (USFWS and NMFS 2009), populations in the eastern part of the range (Suwannee, Apalachicola, Choctawhatchee) appear to be relatively stable in number or have a slightly increasing population trend. In the western portion of the range, populations in the Pearl and Pascagoula rivers, have never been nearly as abundant as those to the east, and their current status, post-hurricanes Katrina and Rita, is unknown as comprehensive surveys have not occurred.

Table 4. Gulf Sturgeon Abundance Estimates by River and Year, with Confidence Intervals (CI) for the 7 Known Reproducing Populations (Data from Sulak et al. 2016)

River	Year of data collection	Abundance Estimate	Lower Bound 95% CI	Upper Bound 95% CI	Source
Suwannee	2012-2013	9,743	3,437	29,653	USGS unpublished M. Randall
Apalachicola	2014	785	631	1,037	USFWS unpublished A. Kaeser
Choctawhatchee	2007	2,800	not reported	not reported	USFWS 2009
Yellow	2010-2011	1,036	724	1348	USFWS unpublished A. Kaeser
Escambia	2006	451	338	656	USFWS 2008
Pascagoula	2000	216	124	429	Ross et al. 2001
Pearl	2001	430	323	605	Rogillio et al. 2001

Both acute and episodic events are known to impact individual populations of Gulf sturgeon that in turn, affect overall population numbers. For example, on August 9, 2011, an overflow of "black liquor" (an extremely alkaline waste byproduct of the paper industry) was accidentally released by a paper mill into the Pearl River near Bogalusa, Louisiana, that may have affected the status and abundance of the Pearl River population. While paper mills regularly use acid to balance the black liquor's pH before releasing the material, as permitted by the Louisiana Department of Environmental Quality, this material released was not treated. The extreme alkalinity of the untreated black liquor caused it to quickly bond with oxygen (aerobic) to dissociate in water. This reduced the amount of oxygen available within the water column, creating a hypoxic environment (DO < 1 mg/L) lethal to aquatic life. These hypoxic conditions moved downstream of the release site killing fish and mussels in the Pearl River over several days. Within a week after the spill, the DO concentrations returned to normal in all areas of the Pearl River tested by LDWF. The investigation of fish mortality began on August 13, 2011, several days after the spill occurred. Twenty-eight Gulf sturgeon carcasses (38-168 cm TL) were collected in the Pearl River after the spill (Sanzenbach 2011a; Sanzenbach 2011b) and anecdotal information suggests many other Gulf sturgeon carcasses were not collected. The smaller fish collected represent YOY and indicate spawning is likely occurring in the Pearl River. The spill occurred during the time when Gulf sturgeon were still occupying the freshwater habitat. Because the materials moved downriver after the spill, the entire Pearl River population of Gulf sturgeon was likely impacted.

Threats

The 1991 listing rule (56 FR 49653) for Gulf sturgeon cited the following impacts and threats: (1) Dams on the Pearl, Alabama, and Apalachicola Rivers; also on the North Bay arm of St. Andrew Bay; (2) Channel improvement and maintenance activities: dredging and de-snagging; (3) Water quality degradation; and (4) Contaminants.

In 2009, NMFS and USFWS conducted a 5-year review of the Gulf sturgeon and identified several new threats to the Gulf sturgeon (USFWS and NMFS 2009). The following is a comprehensive list of threats to Gulf sturgeon, additional details can be found in the 5-year status review (USFWS and NMFS 2009):

1) Pollution from industrial, agricultural, and municipal activities is believed responsible for a suite of physical, behavioral, and physiological impacts to sturgeon worldwide. Specific impacts of pollution and contamination on sturgeon have been identified to include muscle atrophy; abnormality of gonad, sperm, and egg development; morphogenesis of organs, tumors; and disruption of hormone production.

2) Chemicals and metals such as chlordane, dichlorodiphenyldichloroethylene, dichlorodiphenyltrichloroethane, dieldrin, polychlorinated biphenyls, cadmium, mercury, and selenium settle to the river bottom and are later incorporated into the food web as they are consumed by benthic feeders, such as sturgeon or macroinvertebrates.

3) Bycatch from fisheries may continue although all directed fisheries of Gulf sturgeon have been closed since 1990 (USFWS and GSMFC 1995). Although confirmed reports are rare, it is a common opinion among Gulf sturgeon researchers that bycatch mortality continues.

4) Dredging activities can pose significant impacts to aquatic ecosystems by: (1) direct removal/burial of organisms; (2) turbidity/siltation effects; (3) contaminant resuspension; (4) noise/disturbance; (5) alterations to hydrodynamic regime and physical habitat; and (6) loss of riparian habitat. Dredging operations may also destroy benthic feeding areas, disrupt spawning migrations, and resuspend fine sediments causing siltation over required substrate in spawning habitat. Because Gulf sturgeon are benthic omnivores, the modification of the benthos affects the quality, quantity, and availability of prey.

5) Collisions between jumping Gulf sturgeon and fast-moving boats on the Suwannee River and elsewhere are a relatively recent and new source of sturgeon mortality and pose a serious public safety issue as well. The Florida Fish and Wildlife Commission documented 3 collisions in the Suwannee River in 2008, and 1 incident in 2009.

6) Dams represent a significant impact to Gulf sturgeon by blocking passage to historical spawning habitats, which reduces the amount of available spawning habitat or entirely impede access to it. The ongoing operations of these dams also affect downstream habitat.

7) Global climate change may affect Gulf sturgeon by leading to accelerated changes in habitats utilized by Gulf sturgeon through saltwater intrusion, changes in water temperature, and extreme weather periods that could increase both droughts and floods.

8) Hurricanes have resulted in mortality of Gulf sturgeon in both Escambia Bay after Hurricane Ivan in 2004 (USFWS 2005) and Hurricane Katrina in 2005.

9) Red tide is the common name for a harmful algal bloom (HAB) of marine algae (*Karenia brevis*) that produces a brevetoxin that is absorbed directly across the gill membranes of fish or through ingestion of algal cells. Fish mortalities associated with *Karenia brevis* events are very common and widespread. Blooms of red tides have been increasing in frequency in the Gulf of Mexico since the 1990s and have likely killed Gulf sturgeon at both the juvenile and adult life stages.

10) Aquaculture: Although the State of Florida has Best Management Practices to reduce the risk of hybridization and escapement, the threat of introduction of captive fishes into the wild continues.

Summary of the Status of Gulf Sturgeon

In summary, the Gulf sturgeon population is estimated to number approximately 15,000 individuals. The number of individuals within each riverine population is variable across their range, but populations in the eastern part of the range (Suwannee, Apalachicola, Choctawhatchee) appear to be relatively stable in number or have a slightly increasing population trend (Sulak et al 2016).[2] Recovery of depleted populations is an inherently slow process for a late-maturing species such as Gulf sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life span also allows multiple opportunities to contribute to future generations, this is hampered within the species' range by habitat alteration, pollution, and bycatch.

A wide range of threats continues to dictate the status of Gulf sturgeon and its recovery. Modification of habitat through dams, the operation of dams, and dredging particularly impact Gulf sturgeon. The presence of dams reduces the amount of available spawning habitat or entirely impedes access to it, while ongoing operation of these dams affects downstream water quality parameters such as depth, temperature, velocity, and DO. Similarly, dredging projects modify Gulf sturgeon spawning and nursery habitat through direct removal of habitat features or reduced water quality due to nutrient-loading, anoxia, and contaminated sediments. Water quality can be further influenced by inter-basin water transfers and climate change which may exacerbate existing water quality issues. Further, access to habitat and water quality continues to be a problem even with NMFS's authority under the Federal Power Act to prescribe fish passage and existing controls on some pollution sources. The inadequacy of regulatory mechanisms to control habitat alterations is contributing to the status of Gulf sturgeon.

Bycatch is also a current threat to the species that is contributing to its status. Although confirmed reports are rare, it is a common opinion among Gulf sturgeon researchers that bycatch mortality continues. While many of the threats to Gulf sturgeon have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries, bycatch is not currently being addressed. Therefore, the loss of Gulf sturgeon as bycatch likely continues.

4.1.2.3 Atlantic Sturgeon

Five separate DPSs of Atlantic sturgeon were listed under the ESA by NMFS effective April 6, 2012 (77 FR 5880 and 5914, February 6, 2012). The New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs were listed as endangered. The Gulf of Maine DPS was listed as threatened.

Species Description and Distribution

Atlantic sturgeon are long-lived, late-maturing, estuarine-dependent, anadromous fish distributed along the eastern coast of North America (Waldman and Wirgin 1998). Historically, sightings have been reported from Hamilton Inlet, Labrador, Canada, south to the St. Johns River, Florida (Murawski et al. 1977; Smith and Clugston 1997). Atlantic sturgeon may live up to 60 years, reach lengths up to 14 ft, and weigh over 800 lbs (ASSRT 2007; Collette and Klein-MacPhee 2002). They are distinguished by armor-like plates (called scutes) and a long

[2] Sulak, K.J., Parauka, F., Slack, W.T., Ruth, R.T., Randall, M.T., Luke, K., Mettee, M.F., and Price, M.E. (2016) Status of scientific knowledge, recovery progress, and future research directions for the Gulf sturgeon, Acipenser oxyrinchus Vladykov, 1955. J Appl Ichthyol. 32 (Suppl. 1) 87-161. https://doi.org/10.1111/jai.13245

protruding snout that has four barbels (slender, whisker-like feelers extending from the lower jaw used for touch and taste). Adult Atlantic sturgeon spend the majority of their lives in nearshore marine waters, returning to the rivers where they were born (natal rivers) to spawn (Wirgin et al. 2002). Young sturgeon may spend the first few years of life in their natal river estuary before moving out to sea (Wirgin et al. 2002). Atlantic sturgeon are omnivorous benthic (bottom) feeders and incidentally ingest mud along with their prey. Diets of adult and subadult Atlantic sturgeon include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (ASSRT 2007; Bigelow and Schroeder 1953; Guilbard et al. 2007; Savoy 2007). Juvenile Atlantic sturgeon feed on aquatic insects, insect larvae, and other invertebrates (ASSRT 2007; Bigelow and Schroeder 1953; Guilbard et al. 2007).

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 basin (ACE Basin) southward along the South Carolina, Georgia, and Florida coastal areas to the Saint Johns River, Florida. The marine range of Atlantic sturgeon from the South Atlantic DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (**Figure 12**).

The action area includes estuarine and marine coastal waters along the Florida east coast. The location of the action means juveniles, subadult, and adults could be effected by the action. While adult Atlantic sturgeon from all DPSs mix extensively in marine waters, generally adults return to their natal rivers to spawn. Genetic studies show that fewer than two adults per generation spawn in rivers other than their natal river (King et al. 2001; Waldman et al. 2002; Wirgin et al. 2000). Young sturgeon spend the first few years of life in their natal river estuary before moving out to sea. Therefore, we expect only Atlantic sturgeon from the South Atlantic DPS to be affected by the action.

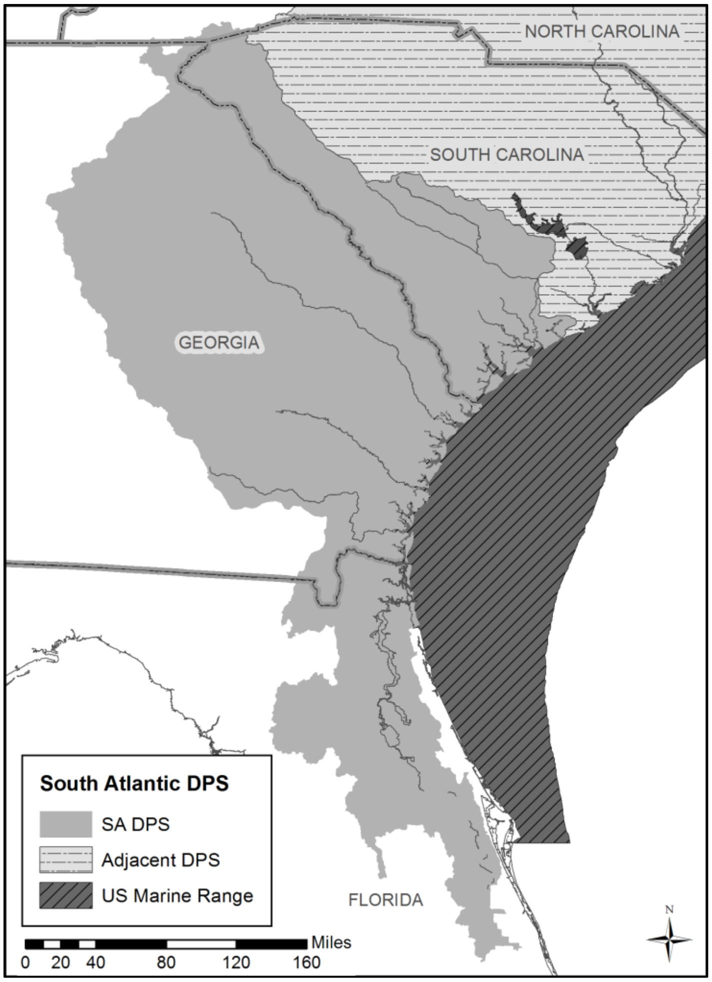

Figure 12. The South Atlantic DPS, including the adjacent portion of the marine range.

Life History Information

Atlantic sturgeon are generally referred to as having four size/developmental categories: eggs/larvae; YOY; juveniles and subadults; and adults. Hatching occurs approximately 94-140 hours after egg deposition. Immediately after hatching larvae enter the yolk sac larval stage and assume a demersal existence (Smith et al. 1980). The yolk sac provides nutrients to the animals until it is completely absorbed 8-12 days after hatching (Kynard and Horgan 2002). Animals in this stage are fewer than 4 weeks old, with total lengths (TL) less than 30 millimeters (mm) (Van Eenennaam et al. 1996a). Animals in this phase are in freshwater and are located far upstream very near the spawning beds. As the larvae develop they commence downstream migration towards the estuaries. During the first half of their downstream migration, movement is limited to night. During the day, larvae use gravel, rocks, sticks, and other three-dimensional structure as refugia (Kynard and Horgan 2002). During the latter half of migration when larvae are more fully developed, movement occurs both day and night. Salinities of 5-10 ppt are known to cause mortality at this young stage (Bain 1997; Cech and Doroshov 2005; Kynard and Horgan 2002).

As larvae grow and absorb the yolk sac, they enter the YOY phase. YOY are greater than 4 weeks old but less than 1 year, and generally occur in the natal river. These animals are generally located in freshwater downstream of the spawning beds, though they can be found in the estuaries.

Following the YOY life phase, sturgeon develop into juveniles and subadults. There is little morphometric difference, aside from overall size, between juveniles and subadults; they are primarily distinguished by their occurrence within estuarine or marine waters. Juveniles are generally only found in estuarine habitats, while subadults may be found in estuarine and marine waters. As a group, juveniles and subadults range in size from approximately 300-1500 mm TL. The term "juveniles" refers to animals 1 year of age or older that reside in the natal estuary. Estuarine habitats are important for juveniles, serving as nursery areas by providing abundant foraging opportunities, as well as thermal and salinity refuges, for facilitating rapid growth. During their first 2 years, juvenile Atlantic sturgeon remain in the estuaries of their natal rivers, which may include both fresh and brackish channel habitats below the head of tide (Hatin et al. 2007). Upon reaching age 2, juveniles become increasingly salt tolerant and some individuals will begin their outmigration to nearshore marine waters (Bain 1997; Dovel and Berggren 1983; Hatin et al. 2007). Some juveniles will take up residency in non-natal rivers that lack active spawning sites (Bain 1997). By age 5, most juveniles have completed their transition to saltwater becoming "subadults," "late-stage juveniles," or "marine migratory juveniles"; however, these animals are frequently encountered in estuaries of non-natal rivers (Bahr and Peterson 2016).

Out migration of larger juveniles may be influenced by the density of younger, less-developed juveniles. Because early juveniles are intolerant of salinity, they are likely unable to use foraging habitats in coastal waters if riverine food resources become limited. However, older, more-developed juveniles are able to use these coastal habitat, though they may prefer the relatively predator-free environments of brackish water estuaries as long as food resources are not limited (Schueller and Peterson 2010).

Adults are sexually mature individuals of 1500+ mm TL and 5 years of age or older. They may be found in freshwater riverine habitats on the spawning grounds or making migrations to and from the spawning grounds. They also use estuarine waters seasonally, principally in the spring through fall and will range widely in marine waters during the winter. After emigration from the natal estuary, subadults and adults travel within the marine environment, typically in waters shallower than 50 m in depth, using coastal bays, sounds, and ocean waters often occurring over sand and gravel substrate (Collins and Smith 1997; Dovel and Berggren 1983; Dunton et al. 2010; Erickson et al. 2011; Greene et al. 2009; Laney et al. 2007; Murawski et al. 1977; Savoy and Pacileo 2003; Smith 1985; Stein et al. 2004; Vladykov and Greely 1963a; Welsh et al. 2002; Wirgin and King 2011).

Atlantic sturgeon populations show clinal variation, with a general trend of faster growth and earlier age at maturity in more southern systems. Atlantic sturgeon mature between the ages of 5 and 19 years in South Carolina (Smith et al. 1982), between 11 and 21 years in the Hudson River (Young et al. 1988), and between 22 and 34 years in the St. Lawrence River (Scott and Crossman 1973). Female Atlantic sturgeon likely do not spawn every year. Multiple studies have shown that spawning intervals range from 1 to 5 years for males (Caron et al. 2002; Collins et al. 2000b; Smith 1985) and 2 to 5 years for females (Stevenson and Secor 1999; Van Eenennaam et al. 1996b; Vladykov and Greely 1963b). Fecundity (number of eggs) of Atlantic sturgeon has been correlated with age and body size, with egg production ranging from 400,000 to 8,000,000 eggs per female per year (Dadswell 2006; Smith et al. 1982; Van Eenennaam and Doroshov 1998). The average age at which 50 percent of maximum lifetime egg production is achieved is estimated to be 29 years, approximately 3 to 10 times longer than for other bony fish species examined (Boreman 1997).

Spawning adult Atlantic sturgeon generally migrate upriver in spring to early summer, which occurs in February-March in southern systems, April-May in mid-Atlantic systems, and May-July in Canadian systems (Bain 1997; Caron et al. 2002; Murawski et al. 1977; Smith 1985; Smith and Clugston 1997). Likely fall spawning runs have been identified in the Edisto River, South Carolina (Farrae et al. 2017) and the Altamaha River, Georgia (Ingram and Peterson 2016). Telemetry data collected in 2013 and 2015 also show acoustically tagged fish making spawning runs in late summer (August – September) in the Savannah River (SCDNR, unpublished data). A fall spawning run has also been confirmed in the Roanoke River, North Carolina (Smith et al. 2015), and in the Carolina DPS; however, they report a spring spawning run is also likely occurring. This suggests that a fall spawn is occurring in a number of southern rivers (Collins et al. 2000b; McCord et al. 2007; Moser et al. 1998; Rogers and Weber 1995; Weber and Jennings 1996). Spawning is believed to occur in flowing water between the salt front of estuaries and the fall line of large rivers, when and where optimal flows are 46-76 centimeters (cm) per second and depths are 3-27 meters (m) (Bain et al. 2000; Borodin 1925; Crance 1987; Leland 1968; Scott and Crossman 1973). Males commence upstream migration to the spawning sites when waters reach around 6°C (Dovel and Berggren 1983; Smith 1985; Smith et al. 1982) with females following a few weeks later when water temperatures are closer to 12° or 13°C (Collins et al. 2000a; Dovel and Berggren 1983; Smith 1985). Atlantic sturgeon have highly adhesive eggs that must be laid on hard bottom in order to stick. Thus, spawning occurs over hard substrate, such as cobble, gravel, or boulders (Gilbert 1989; Smith and Clugston 1997).

Status and Population Dynamics

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 Georgia prior to 1890.

The South Atlantic DPS historically supported 8 spawning subpopulations. At the time of listing only 6 spawning subpopulations were believed to have existed: the Combahee River; Edisto River; Savannah River; Ogeechee River; Altamaha River (including the Oconee and Ocmulgee tributaries); and Satilla River. We determined those rivers/river systems supported spawning if YOY were observed or mature adults were present in freshwater portions of a system. 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 5 DPSs. Peterson et al. (2008) estimated the number of spawning adults in the Altamaha River was 324 (95% CI: 143-667) in 2004 and 386 (95% CI: 216-787) in 2005. The Altamaha and Combahee/Edisto River spawning subpopulations are likely less than 6% of their historical abundance. For the remaining spawning rivers, fewer than 300 adults are estimated to be spawning annually (total of both sexes) (75 FR 61904; October 6, 2010). 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. The abundance of the remaining 3 spawning subpopulations in the South Atlantic DPS is likely less than 1% of their historical abundance (ASSRT 2007).

The two remaining historical spawning subpopulations in the Broad-Coosawatchie River and St. Marys River were believed to be extinct. However, new information provided from the capture of juvenile Atlantic sturgeon suggests the spawning subpopulation in the St. Marys River is not extinct and continues to exist, albeit at very low levels. Regardless of river, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development.

In 2017, the Atlantic States Marine Fisheries Commission (ASMFC) completed an Atlantic Sturgeon Benchmark Stock Assessment (ASMFC 2017). The purpose of the assessment was to evaluate the status of Atlantic sturgeon along the U.S. Atlantic coast (ASMFC 2017). The assessment considered the status of each DPS individually, as well as all 5 DPSs collectively as a single unit. The assessment determined the South Atlantic DPS abundance is "depleted" relative to historical levels. The assessment concluded there was not enough information available to assess the abundance of the DPS since the implementation of the 1998 fishing moratorium. However, it did conclude there was 40% probability the South Atlantic DPS is still subjected to mortality levels higher than determined acceptable in the 2017 assessment.

The assessment also estimated effective population sizes (N_e) when possible. Effective population size is generally considered to be the number of individuals that contribute offspring to the next generation. More specifically, based on genetic differences between animals in a given year, or over a given period of time, researchers can estimate the number of adults needed to produce that level of genetic diversity. For the South Atlantic DPS, the assessment reported N_e for the Edisto, Savannah, Ogeechee, and Altamaha rivers (**Table 5**). Additional estimates of N_e have been conducted since the completion of the assessment, including for additional river systems; **Table 5** reports those estimates. White et al. (2021) cautions that because the populations they considered were sampled at varying temporal scales and intensities and represented a mixture of single and mixed-cohort samples, the N_e estimates they report should be interpreted with reservation as they technically represent a value between true N_e and the effective number of breeders. They also state that while their estimates are valuable for comparing the general magnitude of difference among populations, they should not be used to make inferences about long-term population viability (White et al. 2021).

Table 5. Estimates of Effective Population Size by Rivers

River	Effective Population Size (N_e) (95% CI)	Sample Size	Collection Years	Reference
Edisto	55.4 (36.8-90.6)	109	1996-2005	ASMFC (2017)
	Fall Run – 48.0 (44.7-51.5)	1,154	1996-2004	Farrae et al. (2017)
	Fall Run (82 (60.3-122.1)	373	1996, 1998, 2001-2003, 2005	White et al. (2021)

River	Effective Population Size (N_e) (95% CI)	Sample Size	Collection Years	Reference
	Spring Run – 13.3 (12.1-14.6)	198	1998, 2003	Farrae et al. (2017)
	Spring Run – 16.4 (12.8-20.6)	123	1998, 2003	White et al. (2021)
	60.0 (51.9-69.0)	145	1996, 1998, 2005	Waldman et al. (2018)
Savannah	126.5 (88.1-205)	98	2000-2013	ASMFC (2017)
	123 (103.1-149.4)	161	2013, 2014, 2017	Waldman et al. (2018)
	154.5 (99.6-287.7)	134	2000, 2007, 2208, 2013, 2017, 2018	White et al. (2021)
Ogeechee	32.2 (26.9-38.8)	115	2003-2015	ASMFC (2017)
	26 23.9–28.2	200	2007-2009, 2014-2017	Waldman et al. (2018)
	23.9 (22.2-25.7)	197	2007-2009, 2014-2017	Fox et al. (2019)
	Spring Run – 31.1 (24.3-40.2)	92	2003, 2007, 2009, 2014, 2015, 2016	White et al. (2021)
	Fall Run – 56.5 (36.3-103.6)	55	2003, 2004, 2008, 2009, 2015, 2016	White et al. (2021)
Altamaha	111.9 (67.5-216.3)	186	2005-2015	ASMFC (2017)
	149 (128.7–174.3)	245	2005, 2011, 2014, 2016-2017	Waldman et al. (2018)
	142.1 (124.2-164.0)	268	2005, 2011, 2014-2017	Fox et al. (2019)
	141.7 (73.4-399)	189	2005, 2010, 2011, 2018	White et al. (2021)
Satilla	21 (18.7–23.2)	68	2015-2016	Waldman et al. (2018)
	11.4 (9.1-13.9)	74	2010, 2014, 2016	White et al. (2021)
St. Marys	1 (1.3–2.0)	14	2014-2015	Waldman et al. (2018)

Generally, a minimum N_e of 100 individuals is considered the threshold required to limit the loss in total fitness from in-breeding depression to <10%; while an N_e greater than 1,000 is the recommended minimum to maintain evolutionary potential (ASMFC 2017; Frankham et al. 2014). N_e is useful for defining abundance levels where populations are at risk of loss of genetic fitness (ASMFC 2017). While not inclusive of all the spawning rivers in the South Atlantic DPS, the estimates reported in **Table 5** suggest there is a risk for inbreeding depression (N_e < 100) in 4 of those rivers (Edisto, Ogeechee, Satilla, and St. Marys rivers) and loss of evolutionary potential (N_e < 1000) in all six. This information suggests there at least some inbreeding depression within the DPS and loss of evolutionary potential throughout all of it. However, White et al. (2021), stated that while historic comparisons are currently not available, all 18 populations surveyed showed reasonably high levels of contemporary genetic diversity and low inbreeding despite relatively recent and severe demographic bottleneck events.

The concept of a viable population able to adapt to changing environmental conditions is critical to Atlantic sturgeon. Low population numbers of every river population in the South Atlantic DPS put them in danger of extinction; none of the river populations are large or stable enough to provide with any level of certainty for continued existence of the South Atlantic DPS. Although the largest impact that caused the precipitous decline of the species has been restricted (directed fishing), the population sizes within the South Atlantic DPS have remained relatively constant at greatly reduced levels (approximately 6% of historical population sizes in the Altamaha River, and 1% of historical population sizes in the remainder of the DPS) for 100 years. Small numbers of individuals resulting from drastic reductions in populations, such as occurred with Atlantic sturgeon due to the commercial fishery, can remove the buffer against natural demographic and environmental variability provided by large populations (Berry 1971; Shaffer 1981; Soulé 1980). Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon, and they continue to face a variety of other threats that contribute to their risk of extinction. Their late age at maturity provides more opportunities for individual Atlantic sturgeon to be removed from the population before reproducing. While a long life span also allows multiple opportunities to contribute to future generations, it also increases the timeframe over which exposure to the multitude of threats facing the South Atlantic DPS can occur.

The viability of the South Atlantic DPS depends on having multiple self-sustaining riverine spawning populations and maintaining suitable habitat to support the various life functions (spawning, feeding, growth) of Atlantic sturgeon populations. Because a DPS is a group of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS will result in (1) a long-term gap in the range of the DPS that is unlikely to be recolonized, (2) loss of reproducing individuals, (3) loss of genetic biodiversity, (4) potential loss of unique haplotypes, (5) potential loss of adaptive traits, (6) reduction in total number, and (7) potential for loss of population source of recruits. The loss of a population will negatively impact the persistence and viability of the DPS as a whole, as fewer than two individuals per generation spawn outside their natal rivers (King et al. 2001; Waldman et al. 2002; Wirgin et al. 2000). The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn.

Threats

Atlantic sturgeon were once numerous along the East Coast until fisheries for their meat and caviar reduced the populations by over 90% in the late 1800s. Fishing for Atlantic sturgeon became illegal in state waters in 1998 and in remaining U.S. waters in 1999. Dams, dredging, poor water quality, and accidental catch (bycatch) by fishermen continue to threaten Atlantic sturgeon. The South Atlantic DPS was listed as endangered under the ESA because of a combination of habitat restriction and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

Dams

Dams for hydropower generation, flood control, and navigation adversely affect Atlantic sturgeon habitat by impeding access to spawning, developmental, and foraging habitat, modifying (diverting) free-flowing rivers to reservoirs, physically damaging fish on upstream and downstream migrations, and altering water quality in the remaining downstream portions of spawning and nursery habitat.

Fish passage devices have shown limited benefit to Atlantic sturgeon as a means of minimizing impacts of dams because these devices have been historically designed for salmon and other water-column fish rather than large, bottom-dwelling species like sturgeon. However, NMFS continues to evaluate ways to effectively pass sturgeon above and below man-made barriers. For example, large nature-like fishways (e.g., rock ramps) hold promise as a mechanism for successful passage. On the Savannah River, the New Savannah Bluff Lock and Dam (NSBL&D) at the City of Augusta, denies Atlantic sturgeon access to 7% of its historically available habitat (ASSRT 1998). However, the Augusta Shoals, the only rocky shoal habitat on the Savannah River and the former primary spawning habitat for Atlantic sturgeon in the river (Duncan et al. 2003; Marcy et al. 2005; USFWS 2003; Wrona et al. 2007), is located above NSBL&D, and is currently inaccessible to Atlantic sturgeon. So, while Atlantic sturgeon have access to the majority of historical habitat in terms of unimpeded river miles, only a small amount of spawning habitat exists downstream of the NSBL&D and the vast majority of the rocky freshwater spawning habitat they need is inaccessible as a result of the NSBL&D.

Dredging

Riverine, nearshore, and offshore areas are often dredged to support commercial shipping and recreational boating, construction of infrastructure, and marine mining. Environmental impacts of dredging include the direct removal/burial of organisms; turbidity/siltation effects; contaminant resuspension; noise/disturbance; alterations to hydrodynamic regime and physical habitat; and actual loss of riparian habitat (Chytalo 1996; Winger et al. 2000). According to Smith and Clugston (1997), dredging and filling impact important habitat features of Atlantic sturgeon as they disturb benthic fauna, eliminate deep holes, and alter rock substrates. Dredging in nursery grounds modifies the quality of the habitat and is further curtailing the extent of available habitat in the Cape Fear, Cooper, and Savannah rivers, where sturgeon habitat has already been modified and curtailed by the presence of dams. Maintenance dredging is currently modifying Atlantic sturgeon nursery habitat in the Savannah River and modeling indicates that the deepening of the navigation channel will result in reduced dissolved oxygen (DO) and upriver movement of the salt wedge, restricting spawning habitat. Dredging is also modifying nursery and foraging habitat in the Saint Johns River.

Dredging directly effects sturgeon by entraining them in dredge drag arms and impeller pumps. Mechanical dredges have also been documented to kill sturgeon. Dickerson (2013) summarized observed takes of 38 sturgeon from dredging activities conducted by USACE and observed from 1990-2013: 3 Gulf, 11 shortnose, and 23 Atlantic, and 1 unidentified due to decomposition. Of the three types of dredges included (hopper, clamshell, and pipeline) in the report, most sturgeon were captured by hopper dredge, though some takes were also noted in clamshell and pipeline dredges. Notably, reports include only those trips when an observer was on board to document capture. Additional data provided by USACE indicate another 16 Atlantic sturgeon were killed by dredging from 2016-2018. To offset the adverse effects associated with dredging, relocation trawling is sometimes used. The USACE has used this technique during dredging at Brunswick Harbor, Savannah Harbor, Kings Bay, and in the Savannah River channel. Trawling in these area captured 215 and relocated 215 Atlantic sturgeon from 2016-2018.

Seasonal restrictions on dredging operations have been imposed in some rivers for some species; from example, a March 16–May 31 prohibition to protect striped bass in the Savannah River. This spring closure likely benefits sturgeon as well. Seasonal restrictions are also placed on hopper dredging conducted offshore of Savannah Harbor in the shipping channel to protect sea turtles. To reduce the impacts of dredging on anadromous fish species, most of the Atlantic states impose work restrictions during sensitive time periods (spawning, migration, feeding) when anadromous fish are present.

Water Quality

Atlantic sturgeon rely on a variety of water quality parameters to successfully carry out their life functions. Low DO and the presence of contaminants modify the quality of Atlantic sturgeon habitat and in some cases, restrict the extent of suitable habitat for life functions. Secor (1995) noted a correlation between low abundances of sturgeon during this century and decreasing water quality caused by increased nutrient loading and increased spatial and temporal frequency of hypoxic (low oxygen) conditions. Of particular concern is the high occurrence of low DO coupled with high temperatures in the river systems throughout the range of the South Atlantic DPS in the Southeast. Sturgeon are more highly sensitive to low DO than other fish species (Niklitschek and Secor 2009a; Niklitschek and Secor 2009b) and low DO in combination with high temperature is particularly problematic for Atlantic sturgeon. Studies have shown that juvenile Atlantic sturgeon experience lethal and sublethal (metabolic, growth, feeding) effects as DO drops and temperatures rise (Niklitschek and Secor 2005; Niklitschek and Secor 2009a; Niklitschek and Secor 2009b; Secor and Gunderson 1998). Low DO is modifying sturgeon habitat in the Savannah River due to dredging, and nonpoint source inputs are causing low DO in the Ogeechee River and in the Saint Marys River, which completely eliminates juvenile nursery habitat in summer. Low DO has also been observed in the Saint Johns River in the summer.

Atlantic sturgeon may be particularly susceptible to impacts from environmental contamination because they are long-lived, benthic feeders. Sturgeon feeding in estuarine habitats near urbanized areas may be exposed to numerous suites of contaminants within the substrate. Contaminants, including toxic metals, polychlorinated aromatic hydrocarbons (PAHs), organophosphate and organochlorine pesticides, polychlorinated biphenyls (PCBs), and other chlorinated hydrocarbon compounds can have substantial deleterious effects on aquatic life. These elements and compounds can cause acute lesions, growth retardation, and reproductive impairment in fishes (ASSRT 2007; Cooper 1989; Sindermann 1994).

Heavy metals and organochlorine compounds accumulate in sturgeon tissue, but their long-term effects are not known (Ruelle and Henry 1992; Ruelle and Keenlyne 1993). Elevated levels of contaminants, including chlorinated hydrocarbons, in several other fish species are associated with reproductive impairment (Cameron et al. 1992; Drevnick and Sandheinrich 2003; Hammerschmidt et al. 2002; Longwell et al. 1992), reduced egg viability (Billsson et al. 1998; Giesy et al. 1986; Mac and Edsall 1991; Matta et al. 1997; Von Westernhagen et al. 1981), reduced survival of larval fish (Berlin et al. 1981; Giesy et al. 1986), delayed maturity (Jorgensen (Jorgensen et al. 2004) and posterior malformations (Billsson et al. 1998). Pesticide exposure in fish may affect antipredator and homing behavior, reproductive function, physiological development, and swimming speed and distance (Beauvais et al. 2000; Moore and Waring 2001; Scholz et al. 2000; Waring and Moore 2004). It should be noted that the effect of multiple contaminants or mixtures of compounds at sub-lethal levels on fish has not been adequately studied. Atlantic sturgeon use marine, estuarine, and freshwater habitats and are in direct contact through water, diet, or dermal exposure with multiple contaminants throughout their range (ASSRT 2007). Trace metals, trace elements, or inorganic contaminants (mercury, cadmium, selenium, lead, etc.) are another suite of contaminants occurring in fish. Post (1987) states that toxic metals may cause death or sub-lethal effects to fish in a variety of ways and that chronic toxicity of some metals may lead to the loss of reproductive capabilities, body malformation, inability to avoid predation, and susceptibility to infectious organisms.

Waterborne contaminants may also affect the aquatic environment. Issues such as raised fecal coliform and estradiol concentrations affect all wildlife that utilize riverine habitat. The impact of many of these waterborne contaminants on sturgeon is unknown, but they are known to affect other species of fish in rivers and streams. These compounds may enter the aquatic environment via wastewater treatment plants, agricultural facilities, as well as runoff from farms (Culp et al. 2000; Folmar et al. 1996; Wallin et al. 2002; Wildhaber et al. 2000) and settle to the bottom, therefore affecting benthic foragers to a greater extent than pelagic (Geldreich and Clarke 1966). For example, estrogenic compounds are known to affect the male to female sex ratio of fish in streams and rivers via decreased gonadal development, physical feminization, and sex reversal (Folmar et al. 1996). Although the effects of these contaminants are unknown in shortnose and Atlantic sturgeon, Omoto et al. (2002) found that varying the oral doses of estradiol-17β or 17α methyltestosterone given to captive hybrid "bester" sturgeon (*Huso huso* female × *Acipenser ruthenus* male) could induce abnormal ovarian development or a lack of masculinization. These compounds, along with high or low DO concentrations, can result in sub-lethal effects that may have negative consequences on small populations.

Water Quantity

Water allocation issues are a growing threat in the Southeast and exacerbate existing water quality problems. Taking water from one basin and transferring it to another fundamentally and irreversibly alters natural water flows in both the originating and receiving basins, which can affect DO levels, temperature, and the ability of the basin of origin to assimilate pollutants (GWC 2006). Large water withdrawals negatively affect water quality within the river systems in the range of the South Atlantic DPS. Known water withdrawals of over 240 million gallons per day are permitted from the Savannah River for power generation and municipal uses. However, permits for users withdrawing fewer than 100,000 gallons per day are not required, 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

Large-scale factors impacting riverine water quality and quantity that likely exacerbate habitat threats to Atlantic sturgeon of the South Atlantic DPS include drought, and intra- and inter-state water allocation. Changes in the climate are very likely be associated with more extreme precipitation and faster evaporation of water, leading to greater frequency of both very wet and very dry conditions. For example, while annual precipitation in the Southeast has increased by 0.19 inches per decade since 1950 (NCDC 2019), the southeastern United States has experienced several years of drought since 2007. During this time, Georgia and South Carolina experienced drought conditions that ranged from moderate to extreme. Between March 2007 and December 2008, 50-100% of the State of Georgia and the State of South Carolina experienced some level of drought ranging in intensity from “abnormally dry” to “exceptional,” based on the drought intensity categories used by the U.S. Drought Monitor (NDMC 2018). That drought was surpassed just a few years later. From September 2010-March 2013, both states experienced “abnormally dry” to “exceptional” drought conditions across 50-100% of their area https://droughtmonitor.unl.edu/DmData/Timeseries.aspx (NDMC 2018). Another, shorter, period of drought struck Georgia in 2016-2017, when 50-100% of the state experienced drought ranging in intensity from “abnormally dry” to “exceptional (NDMC 2021). The State of South Carolina also experienced some degree of drought during that period, but it was not as extensive. While Georgia has periodically undergone periods of drought—there have been 6 periods of drought lasting from 2-7 years since 1903 (Barber and Stamey 2000)—drought frequency appears to be increasing (Ruhl 2003). Abnormally low stream flows can restrict sturgeon access to important habitats and exacerbate water quality issues such as increased water temperature, nutrient levels, and contaminants, as well reduced DO.

Long-term observations also confirm changes in temperature are occurring at a rapid rate, directly affecting PBF 4. From 1895-2018, the average annual temperature in the Southeast rose 0.1°F per decade. From 1950-2018, the increase tripled to 0.3°F per decade (NCDC 2019). Aside from observation, climate modeling also projects future increases in temperatures in the Southeast. **Table 6** summarizes the increases projected for the Southeast by the mid-century (2036–2065) and late-century (2071–2100). These are projections from the Representative Concentration Pathway (RCP) model scenarios RCP8.5 and RCP4.5, used by the Intergovernmental Panel on Climate Change (IPCC), relative to average from 1976–2005 (Hayhoe et al. 2017).[3]

[3] RCPs make predictions based on changes, if any, in future greenhouse gas emissions. Specifically, they evaluate radiative forcing, or the amount of energy stored at the Earth’s surface in watts/m^2. As the amount of greenhouse gases increases in the atmosphere more energy is trapped, and the number of watts/m^2 increases. RCP2.6 and RCP8.5 represent the lowest and highest radiative scenarios, of 2.6 watts/m^2 and 8.5 watts/m^2, respectively. RCP4.5 and RCP6.0 assume intermediate levels of radiative forcing.

Table 6. Projected Temperature Increase in the Southeast Under Two Model Projections and Time Series (Hayhoe et al. 2017)

National Climate Assessment Region	RCP4.5 Mid-Century (2036–2065)	RCP8.5 Mid-Century (2036–2065)	RCP4.5 Late-Century (2071–2100)	RCP8.5 Late-Century (2071–2100)
Southeast	3.40°F (1.89°C)	4.30°F (2.39°C)	4.43°F (2.46°C)	7.72°F (4.29°C)

Atlantic sturgeon are already susceptible to reduced water quality resulting from dams, inputs of nutrients, contaminants from industrial activities and nonpoint sources, and interbasin transfers of water. The IPCC projects with high confidence that higher water temperatures and changes in extremes in the Southeast region, including floods and droughts, will affect water quality and exacerbate many forms of water pollution from sediments, nutrients, dissolved organic carbon, pathogens, pesticides, and salt, as well as thermal pollution, with possible negative impacts on ecosystems (IPCC 2007a).

Sea-level rise is another consequence of climate change; it has already had significant impacts on coastal areas and these impacts are likely to increase. Since 1852, when the first topographic maps of the southeastern United States were prepared, high tidal flood elevations have increased approximately 12 inches (30.5 cm). During the 20th century, global sea level has increased 6 to 7.8 inches (15 to 20 cm) (NAST 2000). Sea level rise is also projected to extend areas of salinization of groundwater and estuaries. Some of the most populated areas of this region are low-lying; the threat of saltwater entering into this region's aquifers with projected sea level rise is a concern (USGRG 2004). Saltwater intrusion will likely exacerbate existing water allocation issues, leading to an increase in reliance on interbasin water transfers to meet municipal water needs, further stressing water quality. Similarly, saltwater intrusion is likely to affect local ecosystems. Analysts attribute the forest decline in the Southeast to saltwater intrusion associated with sea level rise. Coastal forest losses will be even more severe if sea level rise accelerates as is expected as a result of global warming. Direct effects to PBF 3 are anticipated as result of these changes.

The effects of future climate change will vary greatly in diverse coastal regions for the United States. Warming is very likely to continue in the United States during the next 25 to 50 years, regardless of reduction in greenhouse gases, due to emissions that have already occurred (NAST 2000). It is very likely that the magnitude and frequency of ecosystem changes will continue to increase in the next 25 to 50 years, and it is possible that they will accelerate. A warmer and drier climate would reduce stream flows and increase water temperatures. Expected consequences would be a decrease in the amount of DO in surface waters and an increase in the concentration of nutrients and toxic chemicals due to reduced flushing rate (Murdoch et al. 2000). Because many rivers are already under a great deal of stress due to excessive water withdrawal or land development, and this stress may be exacerbated by changes in climate, anticipating and planning adaptive strategies may be critical (Hulme 2005). A warmer, wetter climate could ameliorate poor water quality conditions in places where human-caused concentrations of nutrients and pollutants currently degrade water quality (Murdoch et al. 2000).

Increases in water temperature and changes in seasonal patterns of runoff will very likely disturb fish habitat and affect recreational uses of lakes, streams, and wetlands. Surface water resources in the Southeast are intensively managed with dams and channels and almost all are affected by human activities; in some systems water quality is either below recommended levels or nearly so. A global analysis of the potential effects of climate change on river basins indicates that due to changes in discharge and water stress, the area of large river basins in need of reactive or proactive management interventions in response to climate change will be much higher for basins impacted by dams than for basins with free-flowing rivers (Palmer et al. 2008). Human-induced disturbances also influence coastal and marine systems, often reducing the ability of the systems to adapt so that systems that might ordinarily be capable of responding to variability and change are less able to do so. Because stresses on water quality are associated with many activities, the impacts of the existing stresses are likely to be exacerbated by climate change. Within 50 years, river basins that are impacted by dams or by extensive development, like the Savannah or Cooper River, will experience greater changes in discharge and water stress than unimpacted, free-flowing rivers (Palmer et al. 2008).

Dams, dredging, and poor water quality have already modified and restricted the extent of suitable habitat for Atlantic sturgeon spawning and nursery habitat. Changes in water availability (depth and velocities) and water quality (temperature, salinity, DO, contaminants, etc.) in rivers and coastal waters inhabited by Atlantic sturgeon resulting from climate change will further modify and restrict the extent of suitable habitat for the South Atlantic DPS. Effects could be especially harmful since these populations have already been reduced to low numbers, potentially limiting their capacity for adaptation to changing environmental conditions (Belovsky 1987; Salwasser et al. 1984; Soulé 1987; Thomas 1990).

Vessel Strikes

Very little is known about the effects of vessel strikes on individuals from the South Atlantic DPS. However, there is increasing evidence that vessels may pose a significant threat. NMFS does not have a dedicated sturgeon stranding program, so we rely on the public to report sightings. To promote our interest in hearing from the public, we began disseminating signs asking the public to report sightings (alive or dead) in the summer of 2018. Limited resources required us to focus our initial efforts on North Carolina; signs were deployed in Georgia in 2020.[4] Since those signs have been deployed (summer 2018-summer 2019), we received 5 reports of dead Atlantic sturgeon in the Cape Fear River that were likely struck by ships. Prior to the deployment of these signs, there were 2 reports of potential ship strikes in the Cape Fear River from 2011 to 2014. It is unclear if this uptick represents an increasing threat from vessels or just increasing reports. It is also unclear how, or if, an apparent increase in the number of vessel-struck individuals in North Carolina relates to individuals of the South Atlantic DPS. Regardless, the lower estuaries of rivers in the South Atlantic DPS are often marsh habitats that can be very difficult for the public to access. Given the geology of these rivers and potential underreporting, it is possible, if not likely, that a significant number of sturgeon are being struck by vessels in the rivers of the South Atlantic DPS, but remain unknown to us.

[4] South Carolina has their own sturgeon encounter reporting program and share their reports with NMFS.

The types of vessels responsible for these injury is currently unknown. However, Balazik et al. (2012) hypothesize vessel strike mortalities are likely caused by deep-draft ocean cargo ships, with drafts that coincide with the river depths most frequently used by Atlantic sturgeon. The authors reported telemetry data suggesting that while staging (holding in an area from hours to days, with minimal upstream or downstream movements), adult male Atlantic sturgeon spent most (62%) of their time within 1 m of the river bottom (Balazik et al. 2012). Under the assumption that Atlantic sturgeon do not modify their behavior as a result of vessel noise, Balazik et al. (2012) hypothesized adult male Atlantic sturgeon in the James River would rarely encounter small recreational boats or tugboats, with shallow drafts, operating in the upper portions of the water column. Thus, they conclude large cargo vessels were the most likely cause of the vessel strike injuries (Balazik et al. 2012).

Bycatch Mortality

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast, from which they have never rebounded (**Figure 13**). Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the South Atlantic DPS. Atlantic sturgeon are more sensitive to bycatch mortality because they are a long-lived species, have an older age at maturity, have lower maximum reproductive rates, and a large percentage of egg production occurs later in life. Based on these life history traits, Boreman (1997) calculated that Atlantic sturgeon can only withstand the annual loss of up to 5% of their population to bycatch mortality without suffering population declines. Mortality rates of Atlantic sturgeon taken as bycatch in various types of fishing gear range between 0 and 51%, with the greatest mortality occurring in sturgeon caught by sink gillnets. Atlantic sturgeon are particularly vulnerable to being caught in sink gillnets; therefore, fisheries using this type of gear account for a high percentage of Atlantic sturgeon bycatch. 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.

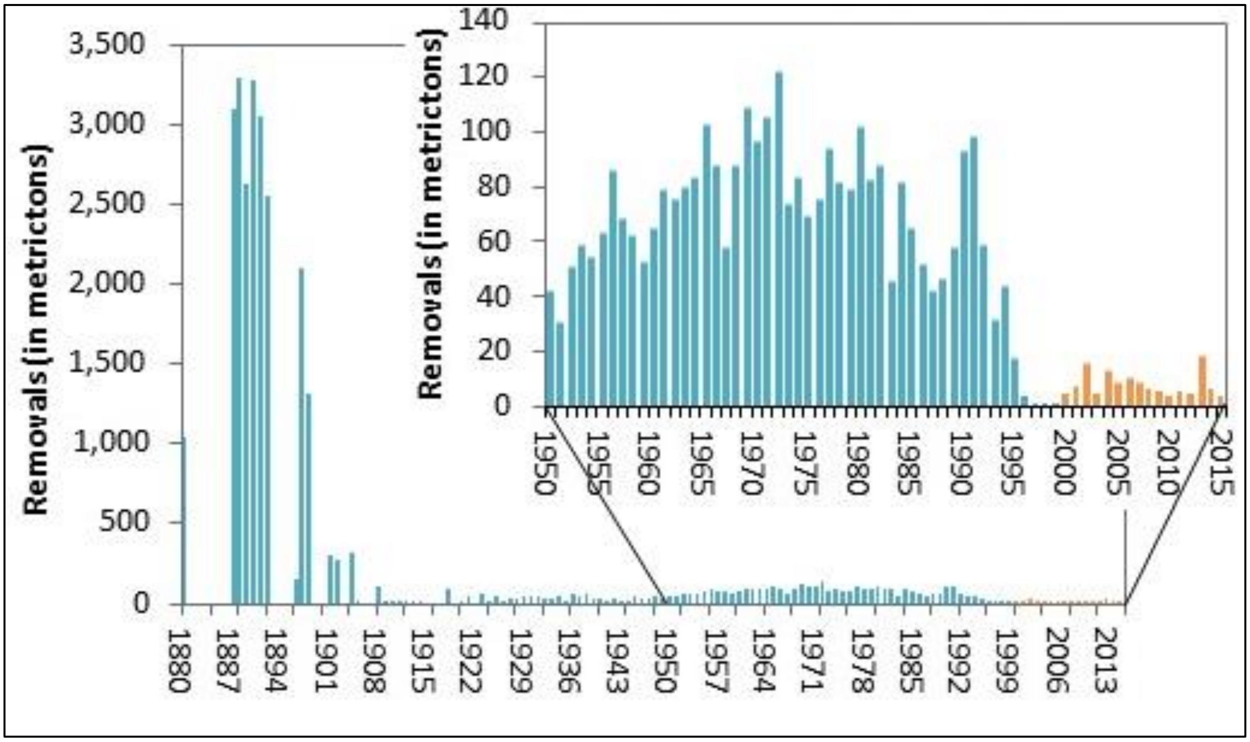

Figure 13. Atlantic Sturgeon Landings Over Time (ASMFC 2017)

<u>Stochastic Events</u>

Stochastic events, such as hurricanes, are common throughout the range of individuals from the South Atlantic DPS. These events are unpredictable and their effect on the survival and recovery of the species in unknown; however, they have the potential to impede the survival and recovery directly if animals die as a result of them, or indirectly if habitat, is damaged as a result of these disturbances. Hurricane impacts are primarily caused by low DO, or hypoxia, in floodwaters caused by the entrainment and decomposition of organic matter transported into rivers from the floodplain, saturated soils, and wastewater and septic inputs (Mallin and Corbett 2006; USFWS and NMFS 2022). For example, in 2018, flooding from Hurricane Florence flushed significant amounts of organic matter into rivers supporting sturgeon in South Carolina and North Carolina. The DO levels in those rivers dropped so low (i.e., 0.2 mg/L) that thousands of fish suffocated, including multiple sturgeon. Harm to benthic invertebrate communities by hurricanes has also been documented (Poirrier et al. 2008) and may lead to indirect effects on individuals from the South Atlantic DPS populations through temporary loss of prey. The severity of impacts to individuals from the South Atlantic DPS may be related to the strength of the hurricane and geographic aspects of its landfall.

5 ENVIRONMENTAL BASELINE

5.1 Overview

This section describes the effects of past and ongoing human and natural factors contributing to the current status of the species, their habitats (including designated critical habitat), and ecosystem within the action area without the additional effects of the proposed action. In the case of ongoing actions, this section includes the effects that may contribute to the projected future status of the species, their habitats, and ecosystem. The environmental baseline describes a species' and critical habitat's health based on information available at the time of this consultation.

By regulation, the environmental baselines for an Opinion 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. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

Focusing on the impacts of the activities in the action area specifically, allows us to assess the prior experience and state (or condition) of the endangered and threatened individuals, and areas of critical habitat that occur in an action area, that will be exposed to effects from the action under consultation. This is important because, in some states or life history stages, or areas of their ranges, listed individuals or critical habitat features will commonly exhibit, or be more susceptible to, adverse responses to stressors than they would be in other states, stages, or areas within their distributions. These localized stress responses or stressed baseline conditions may increase the severity of the adverse effects expected from the proposed action.

5.2 Status of ESA-Listed Species Considered for Further Analysis

As stated in SERO-2019-00012 and Section 2.2 (Action Area) herein, the proposed action will be conducted in the major estuaries and marine environment of Florida state waters. The following sections describe the status of the species we expect to be adversely affected by the proposed action within the action area.

5.2.1 Green Sea Turtle

With the exception of post-hatchlings, green sea turtles live in nearshore tropical and subtropical waters where they feed on marine algae and seagrasses. The action area contains shallow protected waters in Florida state waters where green sea turtles could be transient during the day. NMFS believes that no individual green sea turtle is likely to be a permanent resident of the action area, although some individuals may be present at any given time. These same individuals will migrate into offshore waters of the Gulf of Mexico, Caribbean Sea, and other areas of the North Atlantic Ocean at certain times of the year, and thus may be affected by activities occurring there; therefore, the status of green sea turtle in the action area is considered to be the same as those discussed in Section 4.1.1.2.

5.2.2 Kemp's Ridley Sea Turtle

Kemp's ridley sea turtle habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 ft (37 m) deep, although they can also be found in deeper offshore waters. These areas support the primary prey species of the Kemp's ridley sea turtle, which consist of swimming crabs, but may also include fish, jellyfish, and an array of mollusks. The action area includes Florida marine and estuarine waters where adult and juvenile Kemp's ridley sea turtles may be present, especially for foraging. NMFS believes that no individual Kemp's ridley sea turtle is likely to be a permanent resident of the action area, although some individuals may be present at any given time. These same individuals will migrate into offshore waters of the Gulf of Mexico, Caribbean Sea, and other areas of the North Atlantic Ocean at certain times of the year, and thus may be affected by activities occurring there; therefore, the status of Kemp's ridley sea turtles in the action area are considered to be the same as those discussed in Section 4.1.1.3.

5.2.3 Loggerhead Sea Turtle

Adult loggerhead sea turtles may be found miles out to sea and in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels and mouths of large rivers. Juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface. The action area includes Florida marine and estuarine waters where adult and juvenile loggerhead sea turtles may be present. NMFS believes that no individual loggerhead sea turtle is likely to be a permanent resident of the action area, although some individuals may be present at any given time. These same individuals will migrate into offshore waters of the Gulf of Mexico, Caribbean Sea, and other areas of the North Atlantic Ocean at certain times of the year, and thus may be affected by activities occurring there; therefore, the status of loggerhead sea turtles in the action area are considered to be the same as those discussed in Section 4.1.1.4.

5.2.4 Smalltooth Sawfish

Smalltooth sawfish inhabit the shallow waters of estuaries and can be found in sheltered bays, dredged canals, along banks and sandbars, and in rivers in Florida. Juvenile smalltooth sawfish occur in euryhaline waters (i.e., waters with a wide range of salinities) and are often closely associated with muddy or sandy substrates, and shorelines containing red mangroves. While there is a resident reproducing population of smalltooth sawfish in southwest Florida from Charlotte Harbor through the Dry Tortugas, it is possible that this species may use any of the sampling areas as forage or refuge habitat. One of the Florida FIM Survey locations, Charlotte Harbor, is within smalltooth sawfish critical habitat (CHEU), and it is likely that smalltooth sawfish may be in or near that sampling location year-around. NMFS believes that some juvenile smalltooth sawfish, particularly very small juveniles, are likely to be permanent residents of the action area, particularly in the CHEU, although some individuals of all sizes may be present at any given time. Large juvenile and adult smalltooth sawfish will migrate into offshore waters of the Gulf of Mexico, and thus may be affected by activities occurring there; therefore, the status of smalltooth sawfish in the action area are considered to be the same as those discussed in Sections 4.1.2.1.

5.2.5 Gulf Sturgeon

Gulf sturgeon can be found from the mouth of the Mississippi River to the opening of Tampa Bay, but the core of its range is from Lake Pontchartrain in Louisiana to the Suwannee River in Florida. In the Gulf of Mexico, Gulf sturgeon can inhabit the nearshore marine waters around barrier islands. Gulf sturgeon are opportunistic feeders and forage over large areas. During foraging periods, Gulf sturgeon generally occupy shoreline areas between depths of 6.5-13 ft (2-4 m) and characterized by low-relief sand substrate. Benthic by nature, sturgeon are known to be taken in bottom trawls, though only occasionally and often are released without injury. The sampling locations are located within Gulf sturgeon designated critical habitat (Units 9-12), and it is likely that Gulf sturgeon may be in or near those areas year-around. NMFS believes that juveniles and subadults are likely to be permanent residents of the action area, particularly within designated critical habitat, although some individuals of all sizes may be present at any given time. Adult Gulf sturgeon will migrate into offshore waters of the Gulf of Mexico at certain times of the year, and thus may be affected by activities occurring there; therefore, the status of Gulf sturgeon in the action area are considered to be the same as those discussed in Sections 4.1.2.2.

5.2.6 Atlantic Sturgeon

Atlantic sturgeon spend the majority of their lives in nearshore marine waters, returning to their natal rivers to spawn. Young sturgeon may spend the first few years of life in their natal river estuary before moving out to sea. Atlantic sturgeon are omnivorous benthic feeders and filter quantities of mud along with their food. Adult sturgeon diets include mollusks, gastropods, amphipods, isopods, and fish. Juvenile sturgeon feed on aquatic insects and other invertebrates. One of the sampling locations is located within Atlantic sturgeon designated critical habitat (Unit 7), and it is likely that all stages of Atlantic sturgeon may be in or near that area year-around. NMFS believes that juveniles and subadults are likely to be permanent residents of the action area, particularly within designated critical habitat, although some individuals of all sizes may be present at any given time. Adults will migrate into offshore waters of the North Atlantic Ocean at certain times of the year, and thus may be affected by activities occurring there; therefore, the status of Atlantic sturgeon in the action area are considered to be the same as those discussed in Sections 4.1.2.3.

5.3 Factors Affecting ESA-Listed Species Considered for Further Analysis

5.3.1 Federal Actions

5.3.1.1 ESA Section 10 Permits

Sea turtles, smalltooth sawfish, Gulf sturgeon, and Atlantic sturgeon are the focus of research activities authorized by Section 10 permits under the ESA. The ESA allows the issuance of permits to take listed species for the purposes of scientific research and enhancement (Section 10(a)(1)(A)). In addition, the ESA allows for NMFS to enter into cooperative agreements with states, developed under Section 6 of the ESA, to assist in recovery actions of listed species. Prior to issuance of these authorizations, the proposal must be reviewed for compliance with Section 7 of the ESA.

Per a search of the NOAA Fisheries APPS database (https://apps.nmfs.noaa.gov/) by the consulting biologist on October 20, 2022, there were 17 active Section 10(a)(1)(A) scientific research permits applicable to green, Kemp's ridley, and loggerhead sea turtles within the State of Florida. These permits allow the capture, handling, sampling, and release of these turtle species (all life stages except hatchlings) and range in purpose from reducing bycatch in commercial fisheries to gaining better scientific knowledge.

Per a search of the NOAA Fisheries APPS database by the consulting biologist, there were 4 active Section 10(a)(1)(A) scientific research permits applicable to smalltooth sawfish within the State of Florida. These permits allow the incidental take, capture, handling, sampling, tagging, and release, and the import and export of smalltooth sawfish and generally focus on monitoring and gaining better scientific knowledge.

Per a search of the NOAA Fisheries APPS database by the consulting biologist, there are 0 active Section 10(a)(1)(A) scientific research permits applicable to Gulf sturgeon within the State of Florida.

Per a search of the NOAA Fisheries APPS database by the consulting biologist, there are 3 active Section 10(a)(1)(A) scientific research permits applicable to Atlantic sturgeon within the State of Florida. These permits allow federal and state agency personnel to collect, necropsy, sample, and salvage dead any Atlantic sturgeon found beached, sunken, or floating. U.S. facilities authorized to hold captive bred sturgeon are also authorized to collect, necropsy, and sample under this permit, should a captive Atlantic sturgeon need to be euthanized. Opportunistic research such as this may be useful for scientific and educational purposes.

5.3.1.2 Other Actions under the ESA

Status reviews of the green sea turtle were completed on August 31, 2007, and March 30, 2015. Each review determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at the time.

A draft bi-national recovery plan for Kemp's ridley sea turtle was published on March 6, 2010 (75 FR 12496). A 5-year review was completed in July 2015 and it determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at the time.

A revised recovery plan for the loggerhead sea turtle was completed December 8, 2008 (NMFS and USFWS 2008a). Status reviews of the loggerhead sea turtle were completed on August 11, 2009, and August 31, 2007. Each review determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at the time.

A recovery plan for the smalltooth sawfish was completed in 2009 (NMFS 2009). Status reviews of the smalltooth sawfish were completed in 2010 (NMFS 2010) and 2018.[5] Each review determined that no delisting or reclassification of the species status was warranted at the time.

A recovery plan for Gulf sturgeon was completed in 1995 (USFWS and GSMFC 1995). A Gulf sturgeon 5-year status review was completed in 2009 (USFWS and NMFS 2009). The review determined that no delisting or reclassification of the species status (i.e., threatened or endangered) was warranted at the time.

A recovery plan for Atlantic sturgeon has not yet been developed.

In August of 2007, NMFS issued a regulation pursuant to its authority under the ESA (72 FR 43176, August 3, 2007) to require any fishing vessels subject to the jurisdiction of the United States to take observers at NMFS's request. The purpose of this measure is to learn more about sea turtle interactions with fishing operations, to evaluate existing measures to reduce sea turtle takes, and to determine whether additional measures to address prohibited sea turtle takes may be necessary.

5.3.1.3 Vessel Activity and Operations

Potential sources of adverse effects from federal vessel activity and operations in the action area include operations of the U.S. Navy and U.S. Coast Guard. Through the Section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. Refer to the Biological Opinions for the U.S. Coast Guard (NMFS 1995; NMFS 1996) and the U.S. Navy (NMFS 1996; NMFS 1997a; NMFS 2013) for details on the scope of vessel operations for these agencies and conservation measures implemented as standard operating procedures.

5.3.1.4 Dredging

The construction and maintenance of federal navigation channels and sand mining sites ("borrow areas") conducted by the USACE has been identified as a source of sea turtle mortality. Hopper dredges have been known to entrain and kill sea turtles as the suction dragheads of the advancing dredge. Entrainment events most likely occur when hopper dredge dragheads approach an animal that is oriented on the bottom and either resting or foraging and moving at minimal speed. In most cases, the entrainment scenario occurs when the operating environment presents challenges for the turtle deflector to operate as designed and the operator is not able to keep the draghead(s) fixed on the bottom. Similarly, entrainment can occur when a sea turtle burrows into the substrate or is within a hole/trench/depression that the draghead moves over. Entrained sea turtles rarely survive. Hopper dredging can also affect Gulf sturgeon and Atlantic sturgeon through environmental effects and direct capture. Environmental effects of dredging to sturgeon

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[5] NMFS. 2018. Smalltooth sawfish 5-year review: Summary and Evaluation of United States Distinct Population Segment of Smalltooth Sawfish. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Protected resources Division, St. Petersburg, FL.

include the following: (1) direct removal/burial of organisms; (2) turbidity/siltation effects; (3) contaminant resuspension; (4) noise/disturbance; (5) alterations to hydrodynamic regime and physical habitat; and (6) loss of riparian habitat (Chytalo 1996; Winger et al. 2000).

The USACE has Opinions from NMFS covering the use of hopper dredges for maintenance dredging and beach renourishment activities in the Atlantic and Gulf of Mexico. In the South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States (SARBO) (NMFS 1997b), NMFS determined that dredging along the Atlantic Coast of the southeastern United States (North Carolina through Florida), would adversely affect green sea turtle (North Atlantic DPS and South Atlantic DPS), Kemps' ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), smalltooth sawfish (U.S. DPS), and Atlantic sturgeon (South Atlantic DPS), but it would not jeopardize their continued existence.

NMFS completed a programmatic Opinion on the impacts of USACE's Gulf of Mexico hopper-dredging operations in 2003 for dredging in the USACE's South Atlantic Division (NMFS 1997b). The Gulf of Mexico Regional Biological Opinion on Hopper Dredging of navigational channels and borrow areas determined hopper dredging in the Gulf of Mexico would adversely affect 4 sea turtle species (i.e., green, hawksbill, Kemp's ridley, and loggerhead) and Gulf sturgeon, but it would not jeopardize their continued existence.

5.3.1.5 Minor In-Water Construction Activities

On November 20, 2017, NMFS completed a programmatic Opinion on the impacts of USACE Jacksonville District's continued authorization of 10 minor in-water activities occurring throughout their jurisdiction (i.e., the State of Florida, Puerto Rico, and U.S. Virgin Islands; SER-2015-17616; hereafter, referred to as the JAXBO), placing general project design criteria on each activity to avoid or minimize impacts to ESA-listed species and critical habitat. Those in-water activities included: shoreline stabilization; pile-supported structures and buoys; maintenance, minor, and muck dredging; water-management outfalls; scientific survey devices; boat ramps; aquatic habitat enhancement; transmission and utility lines; marine debris removal; and temporary platforms, fill, and coffer dams. The JAXBO determined that the ongoing authorization of these activities would adversely affect green sea turtle, Kemp's ridley sea turtle, loggerhead sea turtle, smalltooth sawfish, Gulf sturgeon, and Atlantic sturgeon, but these activities would not jeopardize their continued existence. The JAXBO is in the process of reinitiation.

5.3.2 State and Private Actions

5.3.2.1 Maritime Industry

Private and commercial vessels, including fishing vessels, operating in the action area have the potential to interact with sea turtles. The effects of fishing vessels, recreational vessels, or other types of commercial vessels on these species may involve disturbance or injury/mortality due to collisions or entanglement in anchor lines. Commercial traffic and recreational pursuits can also adversely affect sea turtles through propeller and boat strikes. The STSSN includes many records of vessel interaction with sea turtles where there are high levels of vessel traffic. The extent of the problem is difficult to assess because we cannot know whether the majority of sea turtles are struck pre- or post-mortem. It is important to note that minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so it is more likely to become vulnerable to effects such as entanglements or predation. NMFS and the U.S. Coast Guard have completed several formal consultations on individual marine events that may affect sea turtles.

Smalltooth sawfish spend most of their time at or near the bottom, where they are not subject to vessel interactions.

Sturgeon spend most of their time at or near the bottom, where they are not subject to vessel interactions. Collisions between jumping Gulf sturgeon and fast-moving boats on the Suwannee River are a relatively recent event and pose a new source of sturgeon mortality, and a serious public safety issue as well. Vessel interactions have been identified as potential threats to Atlantic sturgeon, but only in rivers, and only for animals from the New York Bight and Chesapeake Bay DPSs.

5.3.2.2 Coastal Development

Beachfront development, lighting, and beach erosion control all are ongoing activities along the Florida coastline. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nighttime human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, more and more coastal counties are adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

5.3.2.3 State Fisheries

Recreational fishing as regulated by the State of Florida can affect protected species or their habitats within the action area. Pressure from recreational fishing in and adjacent to the action area is likely to continue. Observations of state recreational fisheries have shown that loggerhead sea turtles are known to bite baited hooks and frequently ingest the hooks. Hooked sea turtles have been reported by the public fishing from boats, piers, and beach, banks, and jetties and from commercial anglers fishing for reef fish and for sharks with both single rigs and bottom longlines (NMFS 2001). Additionally, lost fishing gear such as line cut after snagging on rocks, or discarded hooks and line, can also pose an entanglement threat to sea turtles in the area. A detailed summary of the known impacts of hook-and-line incidental captures to Kemp's ridley and loggerhead sea turtles can be found in the TEWG reports (1998; 2000). Information on sturgeon caught via recreational hook-and-line is sparse; however, hook-and-line gear is considered likely to adversely affect Gulf and Atlantic sturgeons. Recreational fishing is currently a major activity that directly interacts with smalltooth sawfish throughout most of Florida, particularly southwest Florida. Smalltooth sawfish occur as bycatch in the recreational hook-and-line fishery, mostly by shark, red drum, snook, and tarpon fishers (Wiley and Simpfendorfer 2010). Recreational fishing piers occur within the action area. We have consulted on the building and rebuilding of some of recreational fishing piers that involve a federal action agency and exempted the take of ESA-listed species due to incidental recreational hook-and-line capture.

Each Opinion determined the take of ESA-listed sea turtles and fish, including green, Kemp's ridley and loggerhead, smalltooth sawfish, and sturgeon, from recreational fishing would adversely these species, but it would not jeopardize their continued existence.

5.3.3 Marine Debris, Pollution, and Environmental Contamination

Marine debris may affect green sea turtles, Kemp's ridley sea turtles, loggerhead sea turtles, smalltooth sawfish, Gulf sturgeon, and Atlantic sturgeon in the action area. The effects from marine debris are difficult to measure. Where possible, conservation actions are being implemented to monitor or study the effects to ESA-listed species from marine debris.

Sources of pollutants and environmental contamination along the coastal areas include atmospheric loading of PCBs, stormwater runoff from coastal towns and cities into rivers and canals emptying into bays and the ocean, and groundwater and other discharges (Vargo et al. 1986). In addition, marina and dock construction, dredging, aquaculture, oil and gas exploration and extraction, and boat traffic can degrade marine habitats used by sea turtles and sturgeon (Colburn et al. 1996). Nutrient loading from land-based sources such as coastal community discharges is known to stimulate plankton blooms in closed or semi-closed estuarine systems (Bowen and Valiela 2001; Rabalais et al. 2002). The effects on larger embayments are unknown. Although pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo et al. 1986), the impacts of many other anthropogenic toxins have not been investigated. The development of marinas and docks in inshore waters can negatively impact nearshore habitats. An increase in the number of docks built increases boat and vessel traffic. Fueling facilities at marinas can sometimes discharge oil, gas, and sewage into sensitive estuarine and coastal habitats. Although these contaminant concentrations do not likely affect the more pelagic waters, green sea turtles, Kemp's ridley sea turtles, loggerhead sea turtles, smalltooth sawfish, Gulf sturgeon, and Atlantic sturgeon travel between nearshore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycles.

5.3.4 Stochastic Events

Stochastic (i.e., random) events, such as hurricanes, occur in Florida and can affect the action area. These events are unpredictable and their effect on the recovery of ESA-listed sea turtles, smalltooth sawfish, and Gulf and Atlantic sturgeon is unknown; yet, they have the potential to directly impede recovery if animals die as a result or indirectly if important habitats are damaged. Other stochastic events, such as a cold snap, can injure or kill these species.

5.3.5 Climate Change

The threats of climate change to green sea turtles, Kemp's ridley sea turtles, loggerhead sea turtles, smalltooth sawfish, Gulf sturgeon, and Atlantic sturgeon are discussed in their corresponding sections in the Rangewide Status of the Species (Section 4).

5.3.6 Conservation and Recovery Actions

NMFS has implemented a number of regulations aimed at reducing potential for incidental mortality of sea turtles from commercial fisheries in the action area. These include TED requirements for the southeastern shrimp fisheries. Sea turtles and Atlantic sturgeon benefit from the use TEDs. TEDs and bycatch reduction device requirements may reduce sea turtle and Atlantic sturgeon bycatch in Southeast trawl fisheries (ASSRT 2007). NMFS has required the use of TEDs in Southeast U.S. shrimp trawls since 1989 and in summer flounder trawls in the mid-Atlantic area (south of Cape Charles, Virginia) since 1992 to reduce the potential for incidental mortality of sea turtles in commercial trawl fisheries. These regulations have been refined over the years to ensure that TED effectiveness is maximized through more widespread use, and proper placement, installation, floatation, and configuration (e.g., width of bar spacing). We published a final rule on December 20, 2019 (84 FR 70048), which requires all skimmer trawl vessels 40 feet and greater in length to use TEDs designed to exclude small sea turtles in their nets effective April 1, 2021.

The listing of smalltooth sawfish under CITES Appendix I in 2007 has afforded the species an additional layer of protection; however, laws protecting sawfish need to be enforced. Public outreach and education are essential to protecting the species from mortality associated with recreational and commercial fisheries. Sawfish handling and release guidelines have been developed by the Smalltooth Sawfish Recovery and Implementation Team. Anglers and boaters are also encouraged to share all sawfish encounters with the FWC FWRI via email (sawfish@myfwc.com) or phone (1-844-4SAWFISH/472-9347).

In 1998, the ASMFC instituted a coast-wide moratorium on the harvest of Atlantic sturgeon, which is to remain in effect until there are at least 20 protected age classes in each spawning stock (anticipated to take up to 40 or more years). NMFS followed the ASMFC moratorium with a similar moratorium on the harvest of Atlantic sturgeon in federal waters. Amendment 1 to ASMFC's Atlantic sturgeon FMP also includes measures for preservation of existing habitat, habitat restoration and improvement, monitoring of bycatch and stock recovery, and breeding/stocking protocols.

NMFS and the USFWS co-manage Gulf sturgeon. NMFS supports conservation efforts and consults on activities that could affect this species. USFWS works on mark and recapture research and telemetry tagging to evaluate Gulf sturgeon movements to gain better abundance estimates, oversees captive breeding programs, and provides outreach to educate the public about this species. In 2009, NMFS and USFWS organized a workshop to identify survey protocols and monitoring procedures to fulfill the data needs of future assessments. The primary objective of the workshop was to create a standardized survey and monitoring project to obtain reliable estimates of natural mortality and abundance, as well as life history, behavioral, and habitat use, throughout the Gulf sturgeon’s range. The project began in 2010 and continues today.

6 EFFECTS OF THE ACTION

6.1 Overview

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 (40 CFR 402.02).

In this section of our amended Opinion, we assess the effects of the modified proposed action on listed species and that are likely to be adversely affected. The analysis in this section forms the foundation for our Jeopardy Analysis (Section 8). The quantitative and qualitative analyses in this section are based upon the best available commercial and scientific data on species biology and the effects of the action. Data are limited, so we are often forced to make assumptions to overcome the limits in our knowledge. Sometimes, the best available information may include a range of values for a particular aspect under consideration, or different analytical approaches may be applied to the same data set. In those cases, the uncertainty is resolved in favor of the species. NMFS generally selects the value that would lead to conclusions of higher, rather than lower, risk to endangered or threatened species. This approach provides the “benefit of the doubt” to threatened and endangered species.

6.2 Effects of the Action on ESA-Listed Species Considered for Further Analysis

6.2.1 Routes of Effect that are Not Likely to Adversely Affect ESA-Listed Species

6.2.1.1 Seines

21.3-m Center-Bag Seine

Sea Turtles

The 21.3-m seine may affect Kemp’s ridley and loggerhead sea turtles via incidental capture; however, we believe any effect to these species is extremely unlikely to occur. There has never been a documented interaction between these sea turtle species and Florida FIM Survey 21.3-m center bag seining operations. Because the Florida FIM Survey effectively has 100% observer coverage and because no documented capture of these species with this gear type has occurred during the survey, it is likely that no captures have occurred and that any future capture of this species using this gear type is unlikely to occur. Thus, we believe that the potential for capture in the 21.3-m center bad seine is not likely to adversely affect sea turtles.

Sea turtles may be affected by their temporary inability to access the in-water or nearshore portion of the 21.3-m seining sites due to their avoidance of seining activities and related noise. While the action area is not a known nesting area for sea turtles in Florida, juvenile sea turtles are known to use the interior waters of Florida bays and inlets for developmental and foraging habitat. During deployment of this gear, a relatively small fraction of the total area of available habitat may be obstructed for a relatively short amount of time. Because of the availability of other suitable habitat in the area and the temporary nature of the survey activities, we anticipate the effect of temporary loss of habitat access to sea turtles will be so small as to be unmeasurable and, therefore, insignificant. Thus, we believe the temporary loss of habitat due to 21.3-m center bag seining is not likely to adversely affect sea turtles.

Sturgeon

The 21.3-m seine may affect Gulf sturgeon and Atlantic sturgeon via incidental capture; however, we believe any effect to these species is extremely unlikely to occur. During foraging periods, Gulf sturgeon generally occupy nearshore areas between 6.5-13 ft deep characterized by low-relief sand substrate (Fox et al. 2002). As stated in SERO-2019-00012, the 21.3-m center-bag seine is used to sample in water shallower than Gulf sturgeon are typically known to occur (i.e., less than 6 ft). Further, there has never been a documented interaction between a Gulf sturgeon or Atlantic sturgeon and Florida FIM Survey 21.3-m center bag seining operations. Because the Florida FIM Survey effectively has 100% observer coverage and because no documented capture of these species with this gear type has occurred during the survey, it is likely that no captures have occurred and that any future capture of this species using this gear type is extremely unlikely to occur. Thus, we believe that the potential for capture in the 21.3-m center bag seine is not likely to adversely affect sturgeon.

Smalltooth Sawfish

The action area in Charlotte Harbor contains habitat that serves nursery area functions, including foraging and refuge, for smalltooth sawfish. Smalltooth sawfish may be affected by their inability to access the in-water or nearshore portion of the 21.3-m seining sites in Charlotte Harbor due to their avoidance of seining activities and related noise. As stated above, during deployment of this gear, a relatively small fraction of the total area of available habitat may be obstructed for a relatively short amount of time. Because of the availability of other suitable habitat in the area and the temporary nature of the survey activities, we believe the effect of temporary loss of habitat access to smalltooth sawfish within Charlotte Harbor will be so small as to be unmeasurable and, therefore, insignificant. Thus, we believe the temporary loss of habitat due to 21.3-m center bag seining is not likely to adversely affect smalltooth sawfish.

183-m Center-Bag Seine

Sea Turtles

Sea turtles may be affected by their temporary inability to access the in-water or nearshore portion of the 183-m seining sites due to their avoidance of seining activities and related noise. While the action area is not a known nesting area for sea turtles in Florida, juvenile sea turtles are known to use the interior waters of Florida bays and inlets for developmental and foraging habitat. During deployment of this gear, a relatively small fraction of the total area of available habitat may be obstructed for a relatively short amount of time. Because of the availability of other suitable habitat in the area and the temporary nature of the survey activities, we anticipate any habitat avoidance effects to these species will be so small as to be unmeasurable and, therefore, insignificant. Thus, we believe that the temporary loss of habitat associated with 183-m center bag seining is not likely to adversely affect sea turtles.

Sturgeon

The 183-m seine may affect Atlantic sturgeon via incidental capture; however, we believe any effect to this species is extremely unlikely to occur. There has never been a documented interaction between an Atlantic sturgeon and Florida FIM Survey 183-m center bag seining operations. Because the Florida FIM Survey effectively has 100% observer coverage and because no documented captures of this species with this gear type has occurred during the survey, it is likely that no captures have occurred and that any future capture of this species using this gear type is extremely unlikely to occur. Thus, we believe that the potential for capture in the 183-m center bag seine is not likely to adversely affect sturgeon.

Gulf and Atlantic sturgeon may be affected by their temporary inability to access the in-water or nearshore portion of the 183-m seining sites due to their avoidance of seining activities and related noise. Gulf sturgeon are known to use the interior waters of northwestern Florida from the panhandle to Tampa Bay for spawning and foraging. Atlantic sturgeon are known to occur in the interior waters of northeastern Florida (i.e., St. Marys and St. Johns rivers). During deployment of this gear, a relatively small fraction of the total area of available habitat may be obstructed for a relatively short amount of time. Because of the availability of other suitable habitat in the area and the temporary nature of the survey activities, we anticipate any habitat avoidance effects to these species will be so small as to be unmeasurable and, therefore, insignificant. Thus, we believe the temporary loss of habitat due to 183-m center bag seining is not likely to adversely affect sturgeon.

Smalltooth Sawfish

The action area in Charlotte Harbor contains habitat that serves nursery area functions, including foraging and refuge, for smalltooth sawfish. Smalltooth sawfish may be affected by their inability to access the in-water or nearshore portion of the 183-m seining sites in Charlotte Harbor due to their avoidance of seining activities and related noise. As stated above, during deployment of this gear, a relatively small fraction of the total area of available habitat may be obstructed for a relatively short amount of time. Because of the availability of other suitable habitat in the area and the temporary nature of the survey activities, we believe the effect of temporary loss of habitat access to smalltooth sawfish within Charlotte Harbor will be so small as to be unmeasurable and, therefore, insignificant. Thus, we believe the temporary loss of habitat due to 183-m center bag seining is not likely to adversely affect smalltooth sawfish.

6.2.1.2 Otter Trawl

Smalltooth Sawfish

The otter trawl may affect smalltooth sawfish via incidental capture; however, we believe any effect to this species is extremely unlikely to occur. There has never been a documented interaction between a smalltooth sawfish and Florida FIM Survey otter trawl operations. Because the Florida FIM Survey effectively has 100% observer coverage and because no document capture of this species with this gear type has occurred during the survey, it is likely that no captures have occurred and that any future capture of this species using this gear type is extremely unlikely to occur. Thus, we believe that the potential for capture in the otter trawl is not likely to adversely affect smalltooth sawfish.

6.2.1.3 Vessel Operations

Sea Turtles

Sea turtles near the surface of the water could be affected by vessel strike due to moving vessels. Vessel strikes can cause injury to sea turtles via concussive impact. Depending on the type of vessel, the running gear (including the propeller and skeg of an outboard motor) may also cause cutting/slashing injuries. We believe that it is extremely unlikely that Florida FIM Survey-related vessels will strike a sea turtle. First, there has never been a documented interaction between a Florida FIM Survey vessel and a sea turtle. Second, while actively sampling, vessels move very slowly (i.e., 1-2 kt) or remain idle. While vessels transiting to and from port or between survey stations could travel at greater speeds, the captain, designated lookout, and crew keep look for objects, including sea turtles, at all times in the path of a vessel. If a sea turtle is detected, the vessel's course can be immediately altered or speed reduced (or both) to avoid incidental collisions. Thus, we believe the potential for vessel strike during survey activities is not likely to adversely affect sea turtles.

Sturgeon

Collisions between jumping Gulf sturgeon and fast-moving recreational boats on the Suwannee River are a relatively recent and pose a new source of sturgeon mortality. While it is possible for Gulf sturgeon to jump anywhere in the river, sturgeon in the Suwannee River are more commonly observed jumping where they gather in "holding" areas upriver of NMFS's jurisdiction (i.e., upriver of river kilometer zero). Major holding areas in the Suwannee River occur above Jack's Sandbar; below Manatee Springs; between Fanning Springs and Usher Landing; below Old Town Trestle; below the confluence of the Santa Fe and Suwannee rivers; near Rock Bluff; and below Anderson Springs (https://myfwc.com/conservation/you-conserve/wildlife/sturgeon/). The Florida FIM Survey does not sample in these major holding areas. Vessel interactions have been identified as potential threats to Atlantic sturgeon, but only in rivers, and only for animals from the New York Bight and Chesapeake Bay DPSs. The Florida FIM Survey only operates in the riverine portion of the range of the SA DPS of Atlantic sturgeon.

Sturgeon could be affected by vessel strike due to moving vessels; however, we believe that it is extremely unlikely that Florida FIM Survey-related vessels will strike a sturgeon. First, there has never been a documented interaction between a Florida FIM Survey vessel and a Gulf sturgeon or Atlantic sturgeon. Second, sturgeon spend most of their time at or near the bottom of the water, where they are not subject to vessel interactions. In addition, navigational markers throughout Florida alert boaters to shallow areas to prevent groundings. Because Florida FIM

Survey vessels will rely on these markers to avoid shallow areas for safety reasons and will travel at "Idle / No Wake" speeds at all times while operating in water depths where the draft of the vessel provides less than a 4-ft clearance from the bottom, there is little risk that Florida FIM Survey vessels will strike a sturgeon. Thus, the potential for vessel strike during survey activities is not likely to adversely affect sturgeon.

Smalltooth Sawfish

Smalltooth sawfish could be affected by vessel strike due to moving vessels; however, we believe that it is extremely unlikely that Florida FIM Survey-related vessels will strike a smalltooth sawfish. First, there has never been a documented interaction between a Florida FIM Survey vessel and a smalltooth sawfish. Second, smalltooth sawfish spend most of their time at or near the bottom of the water, and would rarely be at risk from collisions with vessels at the surface. In addition, navigational markers throughout Florida alert boaters to shallow areas to prevent groundings. Because Florida FIM Survey vessels will rely on these markers to avoid shallow areas for safety reasons and will travel at "Idle / No Wake" speeds at all times while operating in water depths where the draft of the vessel provides less than a 4-ft clearance from the bottom, there is little risk that Florida FIM Survey vessels will strike a smalltooth sawfish. Thus, the potential for vessel strike during survey activities is not likely to adversely affect smalltooth sawfish.

6.2.2 Routes of Effect that are Likely to Adversely Affect ESA-Listed Species

6.2.2.1 Seines

21.3-m Center-Bag Seine

Incidental captures of green sea turtles and smalltooth sawfish have occurred in the Florida FIM Survey 21.3-m center bag seine gear. All of these seine captures resulted in a live release with no suspected post-release mortality. As stated below, all previous captures of ESA-listed species in the 183-m center bag seines resulted in a live release with no suspected post-release mortality. We have no other information on the effects to sea turtles or smalltooth sawfish from capture in 21.3-m center bag sein gear. The Florida FIM Survey is conducted by professional fishery biologists, trained fishery technicians, and follows a highly structured scientific protocol. Additionally, the Florida FIM Survey adheres strictly to the NOAA Fisheries safe handling and release protocols (Appendix B and C). For these reasons, we believe it is reasonable to expect that these species may be incidentally captured and released alive during future 21.3-m center bag seining operations.

183-m Center-Bag Seine

Incidental captures of green sea turtles, Kemp's ridley sea turtles, loggerhead sea turtles, Gulf sturgeon, and smalltooth sawfish have occurred in the Florida FIM Survey 183-m center bag seine gear. All of these seine captures resulted in a live release with no suspected post-release mortality. As stated above, all previous captures of ESA-listed species in the 21.3-m center bag seines resulted in a live release with no suspected post-release mortality. We have no other information on the effects to sea turtles, sturgeon, or smalltooth sawfish from capture in 183-m center bag sein gear. As stated above, the Florida FIM Survey is conducted by professionals and adheres strictly to the NOAA Fisheries safe handling and release protocols (Appendix B and C). For these reasons, we believe it is reasonable to expect that these species may be incidentally captured and released alive during future 183-m center bag seining operations.

6.2.2.2 Otter Trawl

Incidental captures of green sea turtles, Kemp's ridley sea turtles, loggerhead sea turtles, Gulf sturgeon, and Atlantic sturgeon have occurred in the Florida FIM Survey otter trawl gear. All trawl captures resulted in a live release with no suspected post-release mortality. In the following sections, we describe the types of interactions and resulting effects we anticipate may occur to sea turtles and sturgeon from interacting with the Florida FIM Survey otter trawl gear.

Sea Turtles

Generally, when sea turtles dive under water, their bodies create energy for their cells in a process that uses oxygen from their lungs. Sea turtles that are stressed from being forcibly submerged due to capture in an otter trawl, eventually use up all their oxygen stores. Since they must continue to create energy with or without oxygen, when their oxygen stores are used up, they begin to create energy via a process that does not require oxygen (i.e., anaerobic glycolysis). However, this process can significantly increase the level of a certain type of lactic acid in a sea turtle's blood (Lutcavage and Lutz 1997b); if the level gets too high it can cause death.

Numerous factors affect the survival rate of forcibly submerged sea turtles. It is likely that the speed at which physiological changes occur and how long they last are related to the intensity of struggling and how long the animal is underwater (Lutcavage and Lutz 1997a). The size, activity level, and condition of the sea turtle; the ambient water temperature; and if multiple forced submergences have recently occurred all affect how badly an animal may be injured by forced submergence. Disease factors and hormonal status may also influence survival during forced submergence. Larger sea turtles are capable of longer voluntary dives than small sea turtles, so young sea turtles may be more vulnerable to the stress from forced submergence. The normal process for creating cellular energy happens more quickly during the warmer months. Since this process takes place more quickly, oxygen stores are also used more quickly, and anaerobic glycolysis may begin sooner. Subsequently, the negative effects from forced submergence may occur more quickly during warm months. With each forced submergence event, the level of lactic acid in the blood increases and can require a long (up to 20 hours) time to recover to normal levels. Sea turtles are probably more susceptible to dying from high levels of lactic acid if they experience multiple forced submergence events in a short period of time. Recurring submergence does not allow sea turtles to get rid of high levels of lactic acid (Lutcavage and Lutz 1997a). Stabenau and Vietti (2003) illustrated that sea turtles given time to stabilize their pH level after being forcibly submerged have a higher survival rate. How quickly this happens depends on the overall health, age, size, etc. of the sea turtle, time of last breath, time of submergence, environmental conditions (e.g., sea surface temperature, wave action), and the nature of any sustained injuries at the time of submergence (NRC 1990b).

Tow times have been identified as a significant factor in trawl-related mortalities of sea turtles caused by forced submergence (NRC 1990b). Henwood and Stuntz (1987b) concluded that tow times less than 60 minutes had mortality rates of less than 1%. Based on these findings, exemptions to TED requirements were created for vessels that would normally be required to use TEDs so long as they limited their tow times. Tow-time requirements for vessels exempted from TED use are limited to 55 minutes from April through October and to 75 minutes from November through March (50 CFR 223.206(d)(3)). The regulatory tow time limits include a 15-minute allowance for setting and retrieving gear, since the NRC analysis of tow times looked at bottom time only.

While the Florida FIM Survey trawls does not use a TED, tow times (doors in-doors out) are limited to 10 minutes during bay sampling and 5 minutes during river sampling. As stated above, the Florida FIM Survey is conducted by professionals and adheres strictly to the NOAA Fisheries safe handling and release protocols (Appendix B and C). Therefore, we believe it is reasonable to expect that any sea turtles that may be incidentally captured will be released alive during future trawling operations.

Sturgeon

Gulf and Atlantic sturgeon may experience stress, abrasions, and scute damage from capture in trawl gear. Blunt force trauma may also occur if the animal contacts the frame of the trawl net. Little is known about post-release mortality of sturgeons taken in trawl gear; however, relocation trawling ahead of USACE- and BOEM-permitted hopper dredging is becoming more commonplace and is required in the 2020 SARBO to reduce the risk of lethal entrainment in dredging equipment. The PDCs of the 2020 SARBO state that relocation trawling tow times will not exceed 42 minutes (doors in – doors out) and that tow speeds will not exceed 3.5 kts.

The Florida FIM Survey limits tow times (doors in – doors out) to 10 minutes during bay sampling and 5 minutes during river sampling; tow speeds are set at approximately 1.2 kts. As stated above, the Florida FIM Survey is conducted by professionals and adheres strictly to the NOAA Fisheries safe handling and release protocols (Appendix B and C). Therefore, we believe it is reasonable to expect that any sturgeon that may be incidentally captured will be released alive during future trawling operations. Further, all protected species are handled quickly and carefully when encountered as outlined in the NOAA Fisheries safe handling and release protocols.

6.2.2.3 Documented Past Captures of ESA-Listed Species during the Florida FIM Survey by Gear Type

While the Florida FIM Survey has been operating in some capacity since 1985, the survey design and methodology were standardized in 2007. Therefore, only capture data from 2007-2021 are presented in the tables below.

21.3-m Center-bag Seine

Table 7 is a list of incidental captures in the 21.3-m center-bag seines for the years 2007-2021 in all survey locations. Green sea turtle (n=9) and smalltooth sawfish (n=3) have been captured during Florida FIM Survey 21.3-m center bag sein operations. All captures resulted in a live release with no suspected post-release mortality.

Table 7. Number of Captures of ESA-listed Species in the 21.3-m Center Bay Seine during all Florida FIM Survey Operations, 2007-2021.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Species									
Green sea turtle	0	0	0	0	0	0	3	0	0
Kemp's ridely sea turtle	0	0	0	0	0	0	0	0	0
Loggerhead sea turtle	0	0	0	0	0	0	0	0	0
Smalltooth sawfish	1	1	0	0	1	0	0	0	0
Gulf sturgeon	0	0	0	0	0	0	0	0	0
Atlantic sturgeon	0	0	0	0	0	0	0	0	0

Year	2016	2017	2018	2019 (Year-1)	2020 (Year-2)	2021 (Year-3)	Total Captures
Species							
Green sea turtle	2	0	0	1	2	1	9
Kemp's ridely sea turtle	0	0	0	0	0	0	0
Loggerhead sea turtle	0	0	0	0	0	0	0
Smalltooth sawfish	0	0	0	0	0	0	3
Gulf sturgeon	0	0	0	0	0	0	0
Atlantic sturgeon	0	0	0	0	0	0	0

183-m Center-bag Seine

Table 8 is a list of incidental captures in the 183-m seines for the years 2007-2021 in all survey locations. Green sea turtle (n=272), Kemp's ridley sea turtle (n=17), loggerhead sea turtles (n=7), smalltooth sawfish (n=16), and Gulf sturgeon (n=4) have been captured during Florida FIM Survey 183-m center bag sein operations. All captures resulted in a live release with no suspected post-release mortality.

Table 8. Number of Captures of ESA-listed Species in the 183-m Center Bag Seine during all Florida FIM Survey Operations, 2007-2021.

Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Species									
Green sea turtle	9	19	10	20	21	12	17	11	19
Kemp's ridley sea turtle	0	1	0	1	0	2	1	0	3
Loggerhead sea turtle	0	1	1	1	1	1	0	0	0
Smalltooth sawfish	0	1	0	0	0	1	0	0	3
Gulf sturgeon	0	0	0	0	0	0	0	1	0
Atlantic sturgeon	0	0	0	0	0	0	0	0	0

Year	**2016**	**2017**	**2018**	**2019 (Year-1)**	**2020 (Year-2)**	**2021 (Year-3)**	**Total Captures**
Species							
Green sea turtle	27	29	17	18	14	29	272
Kemp's ridley sea turtle	2	3	2	2	0	0	17
Loggerhead sea turtle	0	2	0	0	0	0	7
Smalltooth sawfish	5	2	1	0	1	2	16
Gulf sturgeon	1	1	0	0	1	0	4
Atlantic sturgeon	0	0	0	0	0	0	0

Otter Trawl

Table 9 is a list of incidental captures in the otter trawls for the years 2007-2021 in all survey locations. Green sea turtle (n=25), Kemp's ridley sea turtle (n=15), loggerhead sea turtles (n=2), Gulf sturgeon (n=22), and Atlantic sturgeon (n=1) have been captured during Florida FIM Survey otter trawl operations. All captures resulted in a live release with no suspected post-release mortality.

Table 9. Number of Captures of ESA-listed Species in the Otter Trawl during all Florida FIM Survey Operations, 2007-2021.

Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Species									
Green sea turtle	0	3	2	2	0	2	3	1	2
Kemp's ridley sea turtle	1	1	0	0	1	3	4	0	1
Loggerhead sea turtle	0	0	0	0	0	0	0	0	0
Smalltooth sawfish	0	0	0	0	0	0	0	0	0
Gulf sturgeon	0	3	1	4	0	0	3	4	3
Atlantic sturgeon	0	0	0	0	0	0	0	1	0

Year	**2016**	**2017**	**2018**	**2019 (Year-1)**	**2020 (Year-2)**	**2021 (Year-3)**	**Total Captures**
Species							
Green sea turtle	2	1	1	0	3	3	25
Kemp's ridley sea turtle	1	2	0	0	0	1	15
Loggerhead sea turtle	0	2	0	0	0	0	2
Smalltooth sawfish	0	0	0	0	0	0	0
Gulf sturgeon	3	1	0	0	0	0	22
Atlantic sturgeon	0	0	0	0	0	0	1

6.3 Anticipated Future Incidental Captures of ESA-Listed Species during Florida FIM Survey Operations by Gear Type

As previously stated, SERO-2019-00012 was reinitiated for 2 reasons: 1) the amount or extent of incidental take anticipated in the original Opinion was exceeded for green sea turtles and smalltooth sawfish; and 2) the modification to the action, which includes additional survey locations located within areas that contain critical habitat that were not previously considered in the original Opinion. Section 3.2 above considers the potential effects on designated critical habitat that were not previously considered. In this section, NMFS re-analyzes the effects of the seine and otter trawl survey operations on ESA-listed species, in light of the fact that the non-lethal captures of green sea turtles and smalltooth sawfish exceeded our previous estimates.

The number of incidental captures in any given year can be influenced by sea temperatures, species abundances, fluctuating salinity levels in estuarine habitats where the Florida FIM Survey operations may be occurring, and other factors that cannot be predicted. For these reasons, we believe basing our future capture estimate on 1-year time period is largely impractical. Based upon our experience monitoring fisheries, we believe a 3-year time period is appropriate for meaningful monitoring. The triennial takes are set as 3-year running sums (i.e., 2023-2025, 2024-2026, 2025-2027 and so on) and not static 3-year periods (i.e., 2023-2025, 2026-2028, 2029-2031, and so on). This approach reduces the likelihood of reinitiation of ESA consultation process because of inherent variability in captures, while allowing for an accurate assessment of how the proposed action is performing versus our expectations.

6.3.1 21.3-m Center-bag Seine

Table 10 calculates the captures of green sea turtle and smalltooth sawfish in the 21.3-m seines for any consecutive 3-year period based on the past captures in **Table 7** above. Because it is not possible to take only part of an individual, the numbers of captures are rounded up to the nearest whole number. This results in an increase in the total number of captures.

Table 10. Anticipated Future Captures of ESA-Listed Species in Florida FIM Survey 21.3-m Seining Operations during Any Consecutive 3-Year Period

Species	Past Captures (2007-2021)	Average Captures per Year	Future Captures Every 3 Years
Green sea turtle	9	0.6 (9 ÷ 15)	1.8, rounded up to 2 (0.6 × 3)
Smalltooth sawfish	3	0.20 (3 ÷ 15)	0.60, rounded up to 1 (0.20 × 3)

6.3.2 183-m Center-bag Seine

Table 11 calculates the captures of green, Kemp's ridley, and loggerhead sea turtles, and Gulf and Atlantic sturgeon in the 183-m seines for any consecutive 3-year period based on the past captures in **Table 8** above. Because it is not possible to take only part of an individual, the numbers of captures are rounded up to the nearest whole number. This results in an increase in the total number of captures.

Table 11. Anticipated Future Captures of ESA-Listed Species in the Florida FIM Survey 183-m Seine Operations during Any Consecutive 3-Year Period

Species	Past Captures (2007-2021)	Average Captures per Year	Future Captures Every 3 Years
Green sea turtle	272	18.13 (272 ÷ 15)	54.39, rounded up to 55 (18.13 × 3)
Kemp's ridley sea turtle	17	1.13 (17 ÷ 15)	3.4, rounded up to 4 (1.13 × 3)
Loggerhead sea turtle	7	0.47 (7 ÷ 15)	1.41, rounded up to 2 (0.47 × 3)
Smalltooth sawfish	16	1.07 (16 ÷ 15)	3.21, round up to 4 (1.07 × 3)
Gulf sturgeon	4	0.27 (4 ÷ 15)	0.81, rounded up to 1 (0.27 × 3)

6.3.3 Otter Trawl

Table 12 calculates the captures of green, Kemp's ridley, and loggerhead sea turtles, and Gulf and Atlantic sturgeon in the otter trawl for any consecutive 3-year period based on the past captures in **Table 9** above. Because it is not possible to take only part of an individual, the numbers of captures are rounded up to the nearest whole number. This results in an increase in the total number of captures.

Table 12. Anticipated Future Captures of ESA-Listed Species in the Florida FIM Survey Otter Trawl Operations during Any Consecutive 3-Year Period

Species	Past Captures (2007-2021)	Captures per Year	Future Captures Every 3 Years
Green sea turtle	25	1.67 (25 ÷ 15)	5.01, rounded up to 6 (1.67 × 3)
Kemp's ridley sea turtle	15	1.00 (15 ÷ 15)	3.00 (1.00 × 3)
Loggerhead sea turtle	2	0.13 (2 ÷ 15)	0.39, rounded up to 1 (0.13 × 3)
Gulf sturgeon	22	1.47 (22 ÷ 15)	4.41, rounded up to 5 (1.47 × 3)
Atlantic sturgeon	1	0.07 (1 ÷ 15)	0.21, rounded up to 1 (0.07 × 3)

6.3.4 Total Anticipated Future Captures of ESA-listed Species in the Florida FIM Survey

We believe the summary in **Table 13** below is an accurate representation of future anticipated captures of ESA-listed species in the Florida FIM Survey during any consecutive 3-year period. As stated above, there have been no lethal interactions with any ESA-listed species during the Florida FIM Survey. Therefore, we conclude that all future anticipated captures of ESA-listed species during the Florida FIM Survey will be non-lethal. The capture of green sea turtles by each DPS is discussed in the Jeopardy Analysis (Section 8) and presented in the Incidental Take Statement (Section 11; **Table 14**).

Table 13. Total Anticipated Future Captures of ESA-Listed Species in the Florida FIM Survey during any Consecutive 3-Year Period

Species	21.3-m Seine (Table 10)	183-m Seine (Table 11)	Otter Trawl (Table 12)	Total Future Captures
Green sea turtle	2	55	6	63
Kemp's ridley sea turtle	0	4	3	7
Loggerhead sea turtle	0	2	1	3
Smalltooth sawfish	1	4	0	5
Gulf sturgeon	0	1	5	6
Atlantic sturgeon	0	0	1	1

7 CUMULATIVE EFFECTS

ESA Section 7 regulations require NMFS to consider cumulative effects in formulating its Opinions (50 CFR 402.14). Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion (50 CFR 402.02). NMFS is not aware of any future projects that may contribute to cumulative effects. Within the action area, major future changes are not anticipated in addition to the ongoing activities and processes described in the environmental baseline. The present human uses of the action area are expected to continue, though some may occur at increased levels, frequency, or intensity in the near future.

8 JEOPARDY ANALYSIS

To "jeopardize the continued existence of…" means to "engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Thus, in making this determination for each species, we must look at whether the proposed action directly or indirectly reduces the reproduction, numbers, or distribution of a listed species. Then if there is a reduction in 1 or more of these elements, we evaluate whether it would be expected to cause an appreciable reduction in the likelihood of both the survival and the recovery of the species.

The NMFS and USFWS's ESA Section 7 Handbook (USFWS and NMFS 1998) defines survival and recovery, as they apply to the ESA's jeopardy standard. Survival means "the species' persistence…beyond the conditions leading to its endangerment, with sufficient resilience to allow recovery from endangerment." The Handbook further explains that 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 sufficiently large 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. Per the Handbook and the ESA regulations at 50 CFR 402.02, recovery means "improvement in the status of a 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." Recovery is the process by which species' ecosystems are restored or threats to the species are removed or both so that self-sustaining and self-regulating populations of listed species can be supported as persistent members of native biotic communities.

The analyses conducted in the previous sections of this Opinion serve to provide a basis to determine whether the proposed action would be likely to jeopardize the continued existence of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), smalltooth sawfish (U.S. DPS), Gulf sturgeon, and Atlantic sturgeon (South Atlantic DPS). In the Effects of the Action (Section 6.0), we outlined how the proposed action can adversely affect these species. Now we turn to an assessment of the species response to these impacts, in terms of overall population effects, and whether those effects of the proposed actions, when considered in the context of the Status of the Species (Section 4.0), the Environmental Baseline (Section 5.0), and the Cumulative Effects (Section 7.0), will jeopardize the continued existence of the affected species. For any species listed globally, our jeopardy determination must evaluate whether the proposed action will appreciably reduce the likelihood of survival and recovery at the species' global range. For any species listed as DPSs, a jeopardy determination must evaluate whether the proposed action will appreciably reduce the likelihood of survival and recovery of that DPS.

8.1 Green sea turtle (North Atlantic and South Atlantic DPSs)

Within U.S. waters, individuals from both the North Atlantic and South Atlantic DPSs of green sea turtle can be found on foraging grounds. While there are currently no in-depth studies available to determine the percent of individuals from the North Atlantic and South Atlantic DPSs in any given location, an analysis of cold-stunned green turtles in the northern Gulf of Mexico found approximately 4% of individuals came from nesting stocks in the South Atlantic DPS (specifically Suriname, Aves Island, Brazil, Ascension Island, and Guinea Bissau) (Foley et al. 2007). On the Atlantic coast of Florida, a study on the foraging grounds off Hutchinson Island found that approximately 5% of the turtles sampled came from the Aves Island/Suriname nesting assemblage, which is part of the South Atlantic DPS (Bass and Witzell 2000). This information suggests that the vast majority of the anticipated captures in both Gulf of Mexico and Atlantic Ocean are likely to come from the North Atlantic DPS. However, it is possible that animals from the South Atlantic DPS could be captured during the proposed action. For these reasons, we will act conservatively and conduct 2 jeopardy analyses, 1 for each DPS. The North Atlantic DPS analysis will assume that 95% of animals captured during the proposed action are from the North Atlantic DPS (based on Bass and Witzell (2000)). Our analysis for the South Atlantic DPS will assume that 5% of the green sea turtles affected by the proposed action are from the South Atlantic DPS. While the Florida FIM Survey operates on both the Gulf of Mexico and Atlantic Ocean coasts of the Florida, we feel using the percentage compositions from the Atlantic coast of Florida is most conservative to both DPSs.

Applying the above percentages to our estimated non-lethal take of 63 green sea turtles during any consecutive 3-year period, we estimate the following:

- Up to 60 green sea turtles will come from the North Atlantic DPS (63 × 0.95 = 59.85, rounded up to 60), all of which will be non-lethal.
- Up to 4 green sea turtle will come from the SA DPS (63 × 0.05 = 3.15, rounded up to 4), all of which will be non-lethal.

We note that rounding when splitting the take into the two DPSs results in a slightly higher combined total than the consecutive 3-year estimate presented in **Table 13** (i.e., 64 instead of 63). While we use the higher numbers for purposes of analyzing the likelihood of jeopardy to the DPSs (Section 8.1.1 and 8.1.2 below), we do not expect or authorize more than 63 green sea turtle takes during any consecutive 3-year period the Florida FIM Survey is in operation.

8.1.1 North Atlantic DPS of Green Sea Turtle

The Florida FIM Survey may result in the non-lethal take of up to 60 green sea turtles from the North Atlantic DPS over any consecutive 3-year period. The potential non-lethal capture of green sea turtles from the North Atlantic DPS is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The individuals suffering non-lethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of green sea tturtles are anticipated. The captures may occur anywhere in the action area, which encompasses only a portion of green sea turtles' overall range/distribution within the North Atlantic DPS. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of North Atlantic DPS green sea turtles would be anticipated. Therefore, the non-lethal take of green sea turtles from the North Atlantic DPS associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the North Atlantic DPS of green sea turtle in the wild.

8.1.2 South Atlantic DPS of Green Sea Turtle

The Florida FIM Survey may result in the non-lethal take of up to 4 green sea turtles from the South Atlantic DPS over any consecutive 3-year period. The potential non-lethal capture of green sea turtles from the South Atlantic DPS is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The individuals suffering non-lethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. The captures may occur anywhere in the action area, which encompasses only a portion of green sea turtles' overall range/distribution within the South Atlantic DPS. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of South Atlantic DPS green sea turtles would be anticipated. Therefore, the non-lethal take of green sea turtles from the South Atlantic DPS associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the South Atlantic DPS of green sea turtle in the wild.

8.2 Kemp's Ridley Sea Turtle

The Florida FIM Survey is anticipated to result in the non-lethal take of up to 7 Kemp's ridley sea turtles during any consecutive 3-year period. The potential non-lethal capture of Kemp's ridley sea turtles is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The individuals suffering non-lethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of Kemp's ridley sea turtles are anticipated. The captures may occur anywhere in the action area, which encompasses only a portion of this species overall range/distribution. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of Kemp's ridley sea turtles would be anticipated. Therefore, the non-lethal captures of Kemp's ridley sea turtles associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of Kemp's ridley sea turtle in the wild.

8.3 Loggerhead Sea Turtle (Northwest Atlantic DPS)

The Florida FIM Survey may result in the non-lethal take of up to 3 loggerhead sea turtle from the Northwest Atlantic DPS during any consecutive 3-year period. The potential non-lethal captures of a loggerhead sea turtles from the Northwest Atlantic DPS is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The individuals suffering non-lethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of loggerhead sea turtles are anticipated. The captures may occur anywhere in the action area, which encompasses only a portion of loggerhead sea turtles' overall range/distribution within the Northwest Atlantic DPS. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of Northwest Atlantic DPS of loggerhead sea turtle would be anticipated. Therefore, the non-lethal take of loggerhead sea turtles associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the Northwest Atlantic DPS of the loggerhead sea turtle in the wild.

8.4 Smalltooth Sawfish (U.S. DPS)

The Florida FIM Survey may result in the non-lethal take of up to 5 smalltooth sawfish from the U.S. DPS during any consecutive 3-year period. The potential non-lethal captures of smalltooth sawfish from the U.S. DPS is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The individuals suffering non-lethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of smalltooth sawfish are anticipated. The captures may occur anywhere in the action area, which encompasses only a portion of the overall range/distribution of smalltooth sawfish within the U.S. DPS. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of U.S. DPS of smalltooth sawfish would be anticipated. Therefore, the non-lethal take of smalltooth sawfish associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the U.S. DPS of the smalltooth sawfish in the wild.

8.5 Gulf Sturgeon

The Florida FIM Survey may result in the non-lethal take of up to 6 Gulf sturgeon during any consecutive 3-year period. The potential non-lethal captures of Gulf sturgeon is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The individuals suffering non-lethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of Gulf sturgeon are anticipated. The captures may occur anywhere along the Gulf of Mexico coast on Florida, which encompasses only a portion of overall range/distribution of Gulf sturgeon within the Gulf of Mexico. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of Gulf sturgeon would be anticipated. Therefore, the non-lethal take of Gulf sturgeon associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the Gulf sturgeon in the wild.

8.6 Atlantic Sturgeon (South Atlantic DPS)

The Florida FIM Survey may result in the non-lethal take of up to 1 Atlantic sturgeon from the South Atlantic DPS during any consecutive 3-year period. The potential non-lethal captures of Atlantic sturgeon from the South Atlantic DPS is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The individuals suffering non-lethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of Atlantic sturgeon are anticipated. The captures may occur anywhere along the Atlantic coast of Florida, which encompasses only a portion of overall range/distribution of Atlantic sturgeon within the South Atlantic DPS. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of South Atlantic

DPS of Atlantic sturgeon would be anticipated. Therefore, the non-lethal take of Atlantic sturgeon associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the South Atlantic DPS of the Atlantic sturgeon in the wild.

9 CONCLUSION

We reviewed the Status of the Species (Section 4), the Environmental Baseline (Section 5), the Effects of the Action (Section 6), and the Cumulative Effects (Section 7) using the best available data. The Florida FIM Survey will result in the non-lethal take of up to 63 green sea turtles, 7 Kemp's ridley sea turtles, 3 loggerhead sea turtles, 5 smalltooth sawfish, 6 Gulf sturgeon, and 1 Atlantic surgeon during any during any consecutive 3-year period. Given the nature of the proposed action and the information provided above, we conclude that the action, as proposed, is not likely to jeopardize the continued existence of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), smalltooth sawfish (U.S. DPS), Gulf sturgeon, and Atlantic sturgeon (South Atlantic DPS).

10 INCIDENTAL TAKE STATEMENT

10.1 Overview

Section 9 of the ESA and protective regulations issued pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption.

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct (ESA Section 2(19)). *Incidental take* is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that would otherwise be considered prohibited under Section 9 or Section 4(d), but which is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the Reasonable and Prudent Measure and the Terms and Conditions of the Incidental Take Statement of the Opinion.

As soon as the USFWS becomes aware of any take of an ESA-listed species under NMFS's purview that occurs during the proposed action, the USFWS shall report it to NMFS SERO PRD via the NMFS SERO Endangered Species Take Report Form (https://forms.gle/85fP2da4Ds9jEL829). This form shall be completed for each individual known reported capture, entanglement, stranding, or other take incident. Information provided via this form shall include the title (Florida FIM Survey), the issuance date, and ECO tracking number (SERO-2022-01768), for this Opinion; the species name; the date and time of the incident; the general location and activity resulting in capture; condition of the species (i.e., alive, dead, sent to rehabilitation); size of the individual, behavior, identifying features (i.e., presence of tags, scars, or distinguishing marks), and any photos that may have been taken. At that time, consultation may need to be reinitiated.

The USFWS has a continuing duty to ensure compliance with the reasonable and prudent measures and terms and conditions included in this incidental take statement. If the USFWS (1) fails to assume and implement the terms and conditions or (2) fails to require the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the USFWS must report the progress of the action and its impact on the species to NMFS as specified in the Incidental Take Statement (50 CFR §402.14(i)(3)).

10.2 Amount of Extent of Anticipated Incidental Take

Based on the above information and analyses, NMFS believes that the proposed action is likely to adversely affect green sea turtles (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtles, loggerhead sea turtles (Northwest Atlantic DPS), smalltooth sawfish (U.S. DPS), Gulf sturgeon, and Atlantic sturgeon (South Atlantic DPS). These effects will result from seine and otter trawl operations associated with the Florida FIM Survey. NMFS anticipates the following non-lethal incidental take may occur as a result of the proposed action over any consecutive 3-year period (i.e., 2023-2025, 2024-2026, 2025-2027 and so on) (**Table 14**). As stated above, we do not expect, and do not authorize, more than 63 total green sea turtle takes during any consecutive 3-year period, of which up to 4 may be from the SA DPS.

Table 14. Anticipated Incidental Non-Lethal Take for any Consecutive 3-Year Period during the Florida FIM Survey

Species	Take
Green sea turtle (North Atlantic and South Atlantic DPSs)	63
Kemp's ridley sea turtle	7
Loggerhead sea turtle (Northwest Atlantic DPS)	3
Smalltooth sawfish (U.S. DPS)	5
Gulf sturgeon	6
Atlantic sturgeon (South Atlantic DPS)	1

10.3 Effect of Take

NMFS has determined that the anticipated take specified in Section 10.2 is not likely to jeopardize the continued existence of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), smalltooth sawfish (U.S. DPS), Gulf sturgeon, and Atlantic sturgeon (South Atlantic DPS) if the Florida FIM Survey is conducted as proposed.

10.4 Reasonable and Prudent Measures

Section 7(b)(4) of the ESA requires NMFS to issue to any federal agency whose proposed action is found to comply with Section 7(a)(2) of the ESA, but may incidentally take individuals of listed species, a statement specifying the impact of that taking. It also states the Reasonable and Prudent Measures necessary to minimize the impacts from the proposed action, and Terms and Conditions to implement those measures, must be provided and followed to minimize those impacts. "Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take." (50 CFR 402.02). Per Section 7(o)(2), any incidental taking that complies with the specified terms and conditions is not considered to be a prohibited taking of the species concerned.

The Reasonable and Prudent Measures and terms and conditions are required to document the incidental take by the proposed action and to minimize the impact of that take on ESA-listed species (50 CFR 402.14 (i)(1)(ii) and (iv)). These measures and terms and conditions must be implemented by the USFWS for the protection of Section 7(o)(2) to apply. The USFWS has a continuing duty to ensure compliance with the reasonable and prudent measures and terms and conditions included in this Incidental Take Statement. If it fails to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms, or fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. To monitor the impact of the incidental take, the USFWS must report the progress of the action and its impact on the species to SERO PRD as specified in the Incidental Take Statement [50 CFR 402.14(i)(3)].

NMFS has determined that the following Reasonable and Prudent Measures are necessary and appropriate to minimize impacts of the incidental take of ESA-listed species related to the proposed action. The following Reasonable and Prudent Measures and associated terms and conditions are established to implement these measures, and to document incidental takes. Only incidental takes that occur while these measures are in full implementation are authorized. These restrictions remain valid until reinitiation and conclusion of any subsequent Section 7 consultation.

We have determined that the following Reasonable and Prudent Measures are necessary or appropriate to minimize the impacts of future sea turtle, smalltooth sawfish, and sturgeon take or to limit adverse effects to these species to predictable levels, and to monitor levels of incidental take.

1. Sea turtles, smalltooth sawfish, and sturgeon released after interactions with seine or otter trawl gear may experience some degree of physiological injury (lacerations, abrasions, etc.). The ultimate severity of these events depends upon the actual interaction and the handling of an animal. Therefore, the experience, ability, and willingness of the Florida FIM Survey participants to remove all gear prior to release are crucial to the survival of these species. NMFS requires that captured sea turtles, smalltooth sawfish, and sturgeon be handled in a way that minimizes adverse effects from incidental take and reduces mortality.

2. The jeopardy analyses for sea turtles, smalltooth sawfish, and sturgeon are based on the assumption that the frequency and magnitude of adverse effects that occurred in the past will continue into the future. If those prove to be underestimates, we risk having misjudged the potential adverse effects to these species. Thus, it is imperative that NMFS monitor and track the level of take occurring during Florida FIM Survey. Therefore, USFWS must ensure that monitoring and reporting of all ESA-listed species takes (1) detect captures and mortalities resulting from the Florida FIM Survey; (2) assess the actual level of incidental take in comparison with the anticipated incidental take

documented in this Opinion; and (3) detect when the level of anticipated take is exceeded.

10.5 Terms and Conditions

In order to be exempt from the prohibitions established by Section 9 of the ESA, the USFWS must comply (or must ensure that any applicant complies) with the following Terms and Conditions.

The following Terms and Conditions implement Reasonable and Prudent Measure #1:

- Trawl tow-time (doors in-doors out) shall not exceed 5 minutes during river sampling or 10 minutes during bay sampling. The trawl speed shall be set to tow approximately 0.1 nm in 5 minutes during river sampling and 0.2 nm in 10 minutes during bay sampling (approximately 1.2 kts). These tow-times and trawl speeds must be strictly adhered to by all biologists participating in the Florida FIM Survey unless it is unsafe to do so (e.g., emergency situation due to weather or health of the crew).

- Florida FIM Survey researchers must take the actions described in Appendix B (Sea Turtle, Smalltooth Sawfish, and Sturgeon Safe Handling and Release) and Appendix C (NOAA's Careful Release Protocols for Sea Turtle Release with Minimal Injury) to safely handle and release incidentally caught ESA-listed species. All Florida FIM Survey biologists must receive annual training on these safe handling guidelines.

The following Terms and Conditions implement Reasonable and Prudent Measure #2:

- For any each individual known reported capture, entanglement, stranding, or other take incident of an ESA-listed species, the Florida FIM Survey must record the information as specified on the Protected Species Incidental Take Form (Appendix D). This form should also be used to notify NMFS Southeast Regional Office Protected Resources Division of any incidental take within 24 hours or a soon as reasonably possible via the online NMFS SERO Endangered Species Take Report Form (https://forms.gle/85fP2da4Ds9jEL829) and should also be submitted in accordance with the annual report, described below.

- The online NMFS SERO Endangered Species Take Report Form (https://forms.gle/85fP2da4Ds9jEL829) shall be completed for each individual known reported capture, entanglement, stranding, or other take incident of an ESA-listed species. Information provided via the online form shall include the title (Florida FIM Survey), the issuance date, and tracking number (SERO-2022-01768), for this Opinion; the species name; the date and time of the incident; the general location and activity resulting in capture; condition of the species (i.e., alive, dead, sent to rehabilitation); size of the individual, behavior, and identifying features (i.e., presence of tags, scars, or distinguishing marks). All photos that may have been taken and the Protected Species Incidental Take Form (Appendix D) shall up uploaded via the online form. At that time, consultation may need to be reinitiated.

- The Florida FIM Survey must use the Take Tracking Sheet (Appendix E) to keep a running tally of incidental take during any calendar year of Florida FIM Survey sampling. This spreadsheet should be submitted in accordance with the annual report, described below.

- The Florida FIM Survey must submit an annual report detailing the amount of effort (i.e., number of seine sets and trawl tows) and the number and location (i.e., latitude, longitude) of protected species incidentally taken. The annual report must be submitted within 90 working days of the completion of that calendar year's activities to NMFS Southeast Regional Office Protected Resources Division at: takereport.nmfsser@noaa.gov. Please also copy the Consultation Biologist, Dana Bethea, at: Dana.Bethea@noaa.gov. The email shall reference the project name (Florida FIM Survey) and tracking number (SERO-2022-01768) in the subject line.

11 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authority to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation Recommendations identified in Opinions can assist action agencies in implementing their responsibilities under Section 7(a)(1). Conservation recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans, or to develop information. The following conservation recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the federal action agency:

The following Conservation Recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the USFWS:

Sea Turtles:

- The USFWS should support in-water abundance estimates of sea turtles to achieve more accurate status assessments for these species and to better assess the impacts of incidental take during the Florida FIM Survey.
- The USFWS should conduct or fund research that investigates ways to reduce and minimize mortality of sea turtles in commercial fisheries and dredging activities.
- The USFWS should conduct or fund outreach designed to increase the public's knowledge and awareness of ESA-listed sea turtle species.

Smalltooth sawfish:

- The USFWS should support in-water abundance estimates of smalltooth sawfish to achieve a more accurate status assessment for this species and to better assess the impacts of incidental take during the Florida FIM Survey.
- The USFWS should conduct or fund research that investigates ways to reduce and minimize mortality of smalltooth sawfish in commercial fisheries.

- The USFWS should conduct or fund outreach designed to increase the public's knowledge and awareness of the smalltooth sawfish.

Sturgeons:

- The USFWS should fund or conduct research to identify migration patterns of ESA-listed sturgeon. Telemetry studies to track fish and ascertain the use of spawning and foraging habitat would improve knowledge of life history. Data describing the upstream sturgeon spawning areas to characterize habitat and assess availability would assist in determining spawning habitat preference and availability.
- The USFWS should fund or conduct research that evaluates the relationship between flow, water temperature, and sturgeon migration. Additional information on this relationship would provide a better indicator of conditions that cue and successfully initiate sturgeon spawning movement.
- The USFWS should collect data describing Gulf and Atlantic sturgeon location and movement in the Atlantic Ocean, by depth and substrate to assist in future assessments of interactions between fishing gear (i.e., commercial, recreational, or research) sturgeon migratory and feeding behavior.
- The USFWS should collect information on incidental catch rates and condition of sturgeon captured in fisheries independent research gear to assist in future assessments of gear impacts to sturgeon.
- The USFWS should conduct or fund research that investigates ways to reduce and minimize mortality of ESA-listed sturgeon in commercial fisheries and dredging activities.
- The USFWS should conduct or fund outreach designed to increase the public's knowledge and awareness of ESA-listed sturgeons.

12 REINITIATION OF CONSULTATION

This concludes formal consultation on the proposed action. As provided in 50 CFR 402.16, reinitiation of formal consultation is required and shall be requested by the USFWS or by NMFS, where discretionary federal action agency involvement or control over the action has been retained, or is authorized by law, and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the USFWS must immediately request reinitiation of formal consultation and project activities may only resume if the USFWS establishes that such continuation will not violate Sections 7(a)(2) and 7(d) of the ESA.

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