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NATIONAL MARINE FISHERIES SERVICE
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Mr. Donald W. Kinard
Chief, Regulatory Division
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Ref.: U.S. Army Corps of Engineers Jacksonville District's Programmatic Biological Opinion (JAXBO)

Dear Mr. Kinard:

Enclosed is the National Marine Fisheries Service's (NMFS's) Programmatic Biological Opinion (Opinion) based on our review of the impacts associated with the U.S. Army Corps of Engineers (USACE's) Jacksonville District's authorization of 10 categories of minor in-water activities within Florida and the U.S. Caribbean (Puerto Rico and the U.S. Virgin Islands).

The Opinion analyzes the effects from 10 categories of minor in-water activities occurring in Florida and the U.S. Caribbean on sea turtles (loggerhead, leatherback, Kemp's ridley, hawksbill, and green); smalltooth sawfish; Nassau grouper; scalloped hammerhead shark, Johnson's seagrass; sturgeon (Gulf, shortnose, and Atlantic); corals (elkhorn, staghorn, boulder star, mountainous star, lobed star, rough cactus, and pillar); whales (North Atlantic right whale, sei, blue, fin, and sperm); and designated critical habitat for Johnson's seagrass; smalltooth sawfish; sturgeon (Gulf and Atlantic); sea turtles (green, hawksbill, leatherback, loggerhead); North Atlantic right whale; and elkhorn and staghorn corals in accordance with Section 7 of the Endangered Species Act. We also analyzed effects on the proposed Bryde's whale. We based our analysis on project-specific information provided by USACE, consultants, and NMFS's review of published literature. The Opinion concludes that the suite of activities evaluated within the Opinion is likely to adversely affect, but is not likely to jeopardize, the continued existence of Johnson's seagrass and is likely to adversely affect, but is not likely to destroy or adversely modify, critical habitat for smalltooth sawfish and Johnson's seagrass.

We look forward to further cooperation with you on other USACE projects to ensure the conservation and recovery of our threatened and endangered marine species. If you have any questions regarding this consultation, please contact Nicole Bonine, Consultation Biologist, at (727) 824-5336, or by email at Nicole.Bonine@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure
File: 1514-22.F.4

Endangered Species Act - Section 7 Consultation
Biological Opinion

Agency:	United States Army Corps of Engineers, Jacksonville District
Applicant:	United States Army Corps of Engineers, Jacksonville District
Activity:	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
Consulting Agency:	National Marine Fisheries Service Southeast Regional Office Protected Resources Division (SER-2015-17616)
Date Issued:	Nov. 20, 2017
Approved By:	Roy E. Crabtree, Ph.D. Regional Administrator

Table of Contents

1 Consultation History 18
2 Description of the Proposed Action and Potential Routes of Effect to Species and Critical Habitat 20
2.1 Project Action Area 23
2.1.1 Species Specific Restriction and Exclusion Zones within the Action Area 24
2.1.2 USACE Effect Determinations for Listed Species and Critical Habitat 35
2.1.3 Listed Species and Critical Habitat Occurring within the Action Area 38
2.2 Activities Analyzed, Project Design Criteria, and Potential Routes of Effect 44
2.2.1 Activity 1 (A1): Shoreline Stabilization 96
2.2.2 Activity 2 (A2): Pile-Supported Structures and Anchored Buoys 109
2.2.3 Activity 3 (A3): Maintenance, Minor, and Muck Dredging 134
2.2.4 Activity 4 (A4): Water-Management Outfall Structures and Associated Endwalls 152
2.2.5 Activity 5 (A5): Scientific Survey Devices 164
2.2.6 Activity 6 (A6): Boat Ramps 171
2.2.7 Activity 7 (A7): Aquatic Habitat Enhancement, Establishment, and Restoration Activities 181
2.2.8 Activity 8 (A8): Transmission and Utility Lines 203
2.2.9 Activity 9 (A9): Marine Debris Removal 216
2.2.10 Activity 10 (A10): Temporary Platforms, Fill, and Cofferdams 220
2.2.11 Summary and Cumulative Effect of Proposed Action to Listed Species and Critical Habitat 233
2.3 Project-Specific Review 236
2.4 Programmatic Review 240
3 Status of Listed Species and Critical Habitat Likely to be Adversely Affected 242
3.1 Status of Species Likely to be Adversely Affected 242
3.1.1 Johnson’s Seagrass 242
3.2 Status of Critical Habitat Likely to be Adversely Affected 252
3.2.1 Johnson’s Seagrass Critical Habitat 252
3.2.2 Smalltooth Sawfish Critical Habitat 255
4 Environmental Baseline 265
4.1 Factors Affecting Johnson’s Seagrass and Johnson’s Seagrass Critical Habitat in the Action Area 265
4.1.1 Federal and State Actions 265

4.1.2 Conservation and Recovery Activities That May Benefit Johnson's Seagrass and Johnson's Seagrass Critical Habitat 267
4.2 Factors Affecting Smalltooth Sawfish Critical Habitat within the Action Area 267
4.2.1 Federal Actions 267
4.2.2 State or Private Actions 267
4.2.3 Other Potential Factors 268
5 Effects of the Action 268
5.1 Effects to Johnson's Seagrass 268
5.2 Effects to Johnson's Seagrass Critical Habitat 269
5.3 Effects to Smalltooth Sawfish Critical Habitat 270
6 Cumulative Effects 271
6.1 Cumulative Effects to Johnson's Seagrass and Johnson's Seagrass Critical Habitat .. 271
6.2 Cumulative Effects to Smalltooth Sawfish Critical Habitat 272
7 Jeopardy Analysis 273
7.1 Johnson's Seagrass 273
8 Destruction and Adverse Modification Analysis 275
8.1 Johnson's Seagrass Critical Habitat 276
8.2 Smalltooth Sawfish Critical Habitat 277
8.2.1 Protect and Restore Smalltooth Sawfish Habitat (Recovery Objective #2) 278
Shallow, Euryhaline Essential Feature Impacts 279
Red Mangrove Essential Feature Impacts 281
Summary of Impacts to the Essential Features 283
8.2.2 Ensure Smalltooth Sawfish Abundance Increases (Recovery Objective #3) 284
9 Conclusion 284
10 Incidental Take Statement 285
11 Conservation Recommendations 286
12 Reinitiation of Consultation 287
13 Literature Cited 287
14 Appendix A: Authorities under which an Action Will Be Conducted 303
14.1.1 Current Permits Used to Authorize Projects in Florida under NMFS Jurisdiction 303
15 Appendix B: In-water Construction Noise 308
15.1 Glossary of Acoustic Terms 308
15.2 How in-water Noise effects ESA-listed Species Are Evaluated 310
15.2.1 Exposure Criteria Used to Determine Potential Effects 312
15.3 Calculations of Noise Thresholds for Pile Driving 314

15.3.1 Pile-Driving Noise Calculations 316
15.3.2 Noise Control Measures to Reduce Injury 320
15.3.3 Bubble Curtain Specifications for Pile Driving 322
15.4 How to Calculate Noise Impacts 324
15.4.1 Calculation Steps for Pile Driving 324
15.4.2 Example Noise Calculation for a Single Family Dock 329
16 Appendix C: North Atlantic Right Whale Information Form 332
17 Appendix D: Frac-Out Plan Example 333

List of Figures

Figure 1. Smalltooth sawfish limited exclusion zones 25

Figure 2. Gulf sturgeon critical habitat. Estuarine critical habitat units under NMFS's jurisdiction shaded and the rivers under USFWS's jurisdiction labeled (Images provided on the NMFS website at http://sero.nmfs.noaa.gov/maps_gis_data/protected_resources/critical_habitat/index.html). 29

Figure 3. Atlantic sturgeon critical habitat (Images provided on the NMFS website at http://sero.nmfs.noaa.gov/protected_resources/sturgeon/documents/critical_habitat_maps.pdf). 30

Figure 4. North Atlantic right whale educational sign zones. 32

Figure 5. Sea turtle critical habitat in the U.S. Caribbean. NA DPS of green sea turtle critical habitat (left image), hawksbill sea turtle critical habitat (center image), and leatherback sea turtle critical habitat (right image) 34

Figure 6. Bryde's whale exclusion zone. 35

Figure 7. Number of registered vessels in Florida from 2005 to 2015 (Florida Department of Highway Safety and Motor Vehicle website: http://www.flhsmv.gov/dmv/vslfacts.html) 82

Figure 8. Example of a confined space (left) and an open-water environment (right) for a noise analysis. 85

Figure 9. Example images of shoreline armoring and stabilization. The left image is a concrete slab seawall, the middle is a riprap shoreline, and the right is a vinyl seawall. (Images provided by the Florida Marine Contractors Association in 2014) 97

Figure 10. Examples of dock shapes, including T-shaped and L-shaped docks (©2014 Google). 110

Figure 11. Pile-supported Structures. Example of a marginal dock on the left, boatlift with I-beam in the middle, and a chickee on the right. (The left and middle photos were provided by the Florida Marine Contractors Association and right photo from www.cnn.com.). 110

Figure 12. Sample Marina Images. The left image shows an example of an open water marina (provided by the Florida Marine Contractors Association), while the right image shows an example of marina contained within an upland cut basin (©2014 Google). 111

Figure 13. Canal dredging footprint drawing. 135

Figure 14. Mechanical dredge (clamshell bucket and barge). 136

Figure 15. Cutterhead pipeline dredge schematic and representative close-up photographs (provided by USACE).. 137

Figure 16. Sample drawing of an outfall pipe with a manatee grate. Manatee grates are typically attached to the pipe, but in this case, piles are placed in front of the pipe................................. 153

Figure 17. Example drawing of a boat ramp installed by placing prefabricated concrete slabs. Note that excavation for this example was minimal (removed approximately 10 cubic yards in this instance) and limited to shaping the slope of the boat ramp. This ramp extends to -3 ft MLW. Drawings prepared by Glen Boe and Associates, Inc. submitted to NMFS as part of a consultation request. 172

Figure 18. Oyster reefs. The left image shows oyster bags, the middle is an oyster mat, and the right is a barge filled with loose oyster cultch. All 3 images are from the Charlotte Harbor Habitat Restoration Plan (Boswell et al. 2012)... 182

Figure 19. Living shoreline. This sample living shoreline cross-section is provided by NOAA's Habitat Conservation and Restoration website (http://www.habitat.noaa.gov/restoration/techniques/lsimplementation.html).......................... 182

Figure 20. Seagrass restoration. The left image is the placement of sediment to return a blowhole to pre-injury elevation. The image on the right shows bird stakes placed in a restoration area (Both images are from www.darrp.noaa.gov). 183

Figure 21. Artificial reef materials. The left image is an open top and bottom tetrahedron design, the middle image is a series of discs mounted to a pile, and the right image is a reef ball. Left and middle images are from Reef Maker (http://www.reefmaker.com) and the right image is from the Reef Ball Foundation (www.reefball.org).. 183

Figure 22. Sample image of horizontal directional drilling (Image from Underground Solutions at http://www.undergroundsolutions.com) 204

Figure 23. Cathodic pile jacket (Image provided by USACE) 221

Figure 24. Structural cathodic pile jacket (Image provided by USACE) 222

Figure 25. Map of smalltooth sawfish critical habitat –CHEU and TTIEU 256

Figure 26. Diagram of a dredged channel 260

Figure 27. From left to right: current shoreline, + 3.5 in (+ 9 cm); + 18.5 in (+ 47 cm); and + 38.97 in (+ 99 cm) sea level rise by 2060. 263

Figure 28. The relative effects to animals: distance to/from a noise source. 311

Figure 29. Example of a confined space for a noise analysis. The left image shows a 150 ft radius in a channel resulting in the channel not being wide enough to ensure more than half the channel was free from cumulative injurious noise levels. The right image shows a portion of San Juan Harbor and a 260 ft radius that would not block movement of species if piles were installed at this location because species would be able to move along the left side of the image between the 2 structures. 316

Figure 30. An example of intermediate spreading loss where surface reflections result in non-uniform spreading of sound waves 325

Figure 31. Screenshot of the Spreading Loss Calculator. The dB loss over any range can be determined for 3 types spreading loss models (10 logR, 15 logR, and 20 logR). For example, at 50 m, there is a 25.5 dB reduction in noise from a pile due to intermediate transmission loss (15 logR). 328

Figure 32. An example graphic visualizing impact zones for a pile-driving project. Graphical representations of the impact zones are useful analytical tools in visualizing the area where project impacts will occur within the species' habitat. 328

Figure 33. Screenshot of original Spreading Loss Calculator prior to any modifications 330

Figure 34. Screenshot of the Spreading Loss Calculator after the first column was modified.. 331

List of Tables

Table 1. Limited Exclusion Zones in Smalltooth Sawfish Critical Habitat 25

Table 2. Gulf sturgeon critical habitat migratory restriction zones 28

Table 3. North Atlantic Right Whale Educational Sign Zone 32

Table 4. USACE Project Effects Determinations for Activities Occurring in Florida 37

Table 5. Listed Species NMFS Believes Are Likely to Occur in or near the Action Area 38

Table 6. Designated Critical Habitat NMFS Believes is In or Near the Action Area 39

Table 7. Essential Features/PCEs/PBFs of Each Critical Habitat Unit in Florida and the U.S. Caribbean 40

Table 8. Projected Number of Authorizations Occurring in Certain Critical Habitat Units per Activity for 5-year Period 46

Table 9. NMFS Effects Determinations for Johnson's Seagrass 54

Table 10. NMFS Effects Determinations for Nassau Grouper 58

Table 11. NMFS Effects Determinations for the Central and Southwest Atlantic DPS of Scalloped Hammerhead Shark 60

Table 12. NMFS Effects Determinations for ESA-listed Whales 62

Table 13. NMFS Effects Determinations for NWA DPS of Loggerhead Sea Turtle Critical Habitat 66

Table 14. NMFS Effects Determinations for *Acropora* Critical Habitat 67

Table 15. NMFS Effects Determination for North Atlantic Right Whale Critical Habitat 68

Table 16. NMFS Effects Determination for Green, Hawksbill, and Leatherback Sea Turtle Critical Habitat 70

Table 17. NMFS Effects Determination for Atlantic Sturgeon Critical Habitat 71

Table 18. Impact Hammer Sound Source Levels and Impact Radius Distances 94

Table 19. Vibratory Hammer Sound Source Levels and Impact Radius Distances 95

Table 20. NMFS Effects Determinations for In-water Construction Noise Analyzed under this Opinion to Sea Turtles and ESA-listed Fish 96

Table 21. USACE and NMFS Determinations on the Effects of Shoreline Stabilization Activities (Activity 1) to ESA-listed Species listed in Table 5 102

Table 22. Estimated Amount of Waterbottom Affected By Shoreline Stabilization Projects per 5-Year Period 103

Table 23. USACE and NMFS Determinations on the Effects of Shoreline Stabilization Activities (Activity 1) to Designated Critical Habitat 106

Table 24. Estimated Amount of Waterbottom Affected By Shoreline Stabilization Projects in Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat per 5-Year Period 106

Table 25. USACE and NMFS Determinations on the Effects of Pile-Supported Structures and Anchored Buoys (Activity 2) to ESA-listed Species listed in Table 5 119

Table 26. Estimated Amount of Waterbottom Affected by Pile-Supported Structures and Anchored Buoys Occurring Outside of Johnson's Seagrass Critical per 5-Year Period 120

Table 27. Estimated Amount of Waterbottom Affected by Pile-Supported Structures and Anchored Buoys Occurring Within Johnson's Seagrass Critical Habitat per 5-Year Period 121

Table 28. USACE and NMFS Determinations on the Effects of Pile-Supported Structures and Anchored Buoys (Activity2) to Designated Critical Habitats 126

Table 29. Estimated Amount of Waterbottom Affected by Pile-Supported Structures and Anchored Buoys Occurring Within Smalltooth Sawfish Critical Habitat per 5-Year Period 127

Table 30. Estimated Amount of Waterbottom Affected by Pile-Supported Structures and Anchored Buoys Occurring Within Gulf Sturgeon Critical Habitat per 5-Year Period 129

Table 31. USACE and NMFS Determinations on the Effects of Dredging Activities (Activity 3) to ESA-listed Species listed in Table 5 143

Table 32. Estimated Amount of Waterbottom Affected by Dredging Activities Per 5-Year Period. 144

Table 33. USACE and NMFS Determinations on the Effect of Dredging Activities (Activity 3) on Designated Critical Habitat 148

Table 34. Total Waterbottom Affected by Dredging Projects within Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat.. 149

Table 35. USACE and NMFS Determinations on the Effects of Water-Management Outfall Structures and Associated Endwall Activities (Activity 4) to ESA-listed Species Listed in Table 5.. 156

Table 36. Estimated Amount of Waterbottom and Shoreline Areas and Mangrove Shoreline Affected by Water-Management Outfall Structures and Associated Endwall Projects per 5-Year Period. 157

Table 37. USACE and NMFS Determinations on the Effects of Water-Management and Endwall Activities (Activity 4) on Designated Critical Habitat 160

Table 38. Estimated Amount of Waterbottom and Shoreline Areas Affected by Water-Management Outfall Structures and Associated Endwall Projects in Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat.. 160

Table 39. USACE and NMFS Determinations on the Effects of Scientific Survey Device Activities (Activity 5) to ESA-listed Species Listed in Table 5 166

Table 40. Estimated Number of Scientific Survey Activities and the Associated Temporary Habitat Impacts over a 5-Year Period.. 166

Table 41. USACE and NMFS Determinations on the Effects of Scientific Survey Device Activities (Activity 5) to Designated Critical Habitat 169

Table 42. Estimated Number of Scientific Survey Device Projects and Associated Temporary Impacts in Critical Habitat with Effects Determinations.. 169

Table 43. USACE and NMFS Determinations on the Effects of Boat Ramp Activities (Activity 6) on ESA-listed Species Listed in Table 5 175

Table 44. Estimated Amount of Waterbottom Affected by from Boat Ramp per 5-Year Period 175

Table 45. USACE and NMFS Determinations on the Effects of Boat Ramp Activities (Activity 6) to Designated Critical Habitat 178

Table 46. Estimated Amount of Waterbottom Affected by Boat Ramp Activities in Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat per 5-Year Period........ 178

Table 47. USACE's Estimated Number of Aquatic Enhancement Projects per 5-year Period and the Anticipated Impacts per Project. 189

Table 48. USACE and NMFS Determinations of the Effects of Aquatic Enhancement, Enhancement (Activity 7) on ESA-listed Species Listed in Table 5 190

Table 49. Estimated Amount of Waterbottom Affected by Aquatic Enhancement per 5-Year Period 191

Table 50. USACE and NMFS Determinations on the Effects of Aquatic Enhancement (Activity 7) to Designated Critical Habitat 196

Table 51. Maximum Area Supporting the Essential Features of Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat that May Be Affected by Aquatic Restoration Projects per 5-Year Period 198

Table 52. USACE and NMFS Determinations on the Effects of Transmission and Utility Line Projects on ESA-listed Species Listed in Table 5........ 208

Table 53. Estimated Waterbottom Covered by Transmission and Utility Line Projects Per Project 208

Table 54. Estimated Potential Impacts to Areas Supporting the Essential Features of Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat from Transmission and Utility Line Projects Per 5-Year Period. 212

Table 55. USACE and NMFS Determinations on the Effects of Transmission and Utility Line Projects (Activity 8) on Designated Critical Habitat 213

Table 56. USACE and NMFS Determinations on the Effects of Marine Debris Removal Activities (Activity 9) to ESA-listed Species listed in Table 5 218

Table 57. USACE and NMFS Determinations on the Effects of Marine Debris Removal (Activity 9) to Designated Critical Habitats 219

Table 58. USACE and NMFS Determinations on the Effects of Temporary Platforms, Fill, and Cofferdam Activities (Activity 10) on Sea Turtles, Smalltooth Sawfish, and Sturgeon 225

Table 59. Estimated Amount of Waterbottom Affected by Temporary Platforms, Fill, and Cofferdam Activities in Florida and the U.S. Caribbean per 5-Year Period 226

Table 60. USACE and NMFS Determinations on the Effects of Temporary Platform, Fill, and Cofferdam Activities under (Activity 10) to Designated Critical Habitat 228

Table 61. Estimated Amount of Waterbottom Affected by Temporary Platform, Fill, and Cofferdam Activities under (Activity 10) in Smalltooth Sawfish, Gulf sturgeon, and Johnson's Seagrass Critical Habitat per 5-Year Period 229

Table 62. Summary of NMFS Determination of Effects to Species by Activity Type 233

Table 63. Summary of NMFS Determination of Effects to Critical Habitat by Activity Type. 234

Table 64. Designated critical habitat units for Johnson's seagrass 253

Table 65. Impacts to Johnson's Seagrass Anticipated per 5-year period 269

Table 66. Impacts to Johnson's Seagrass Critical Habitat Anticipated per 5-year period 270

Table 67. Impacts to Smalltooth Sawfish Critical Habitat Anticipated per 5-year period 271

Table 68. Summary of Impacts to the Shallow, Euryhaline Habitat Essential Feature 281

Table 69. Summary of Impacts to the Red Mangrove Essential Feature 283

Table 70. NWPs used by the USACE Jacksonville District 304

Table 71. USACE General Permits in Florida and the U.S. Caribbean That May Affect Species within NMFS' Jursidiction 306

Table 72. Hearing ranges of listed species 311

Table 73. Impact pile-driving threshold noise levels for fish and sea turtles 312

Table 74. Continuous noise threshold levels for fish and turtles from exposure to vibratory pile-driving noise 313

Table 75. Impact Hammer sound source levels and impact radius distances 317

Table 76. Vibratory Hammer sound source levels and impact radius distances 318

Table 77. Effectiveness and cost of noise control measures for pile driving 320

Table 78. Back-Calculation of Source Levels 329

Table 79. Calculations of Threshold Exceedances 330

Table 80. Calculations of Impact Zones Based on Source Levels for the Project 331

Acronyms and Abbreviations

ADA	Americans with Disabilities Act
AIWW	Atlantic Intracoastal Waterway
ATON	Aid-to-Navigation

BMP	Best Management Practice
CHEU	Charlotte Harbor Estuary Unit
cSEL	Cumulative Sound Exposure Level
CWA	Clean Water Act
dB	decibels
dB re 1 μPa	decibels relative to 1 micro-Pascal-squared second
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FDEP	Florida Department of Environmental Protection
FKNMS	Florida Keys National Marine Sanctuary
FPL	Florida Power and Light
GIS	Geographic Information System
GIWW	Gulf Intracoastal Waterway
GP	General Permit
GRBO	Gulf of Mexico Regional Biological Opinion
ICW	Intracoastal Waterway
IP	Individual Permit
IPCC	Intergovernmental Panel on Climate Change
JAXBO	Jacksonville District's Programmatic Biological Opinion
LAA	Likely to Adversely Affect
LOP	Letters of Permission
MHW	Mean High Water
MHWL	Mean High Water Line
MLLW	Mean Lower Low Water
MLW	Mean Low Water
MMPA	Marine Mammal Protection Act
N	Number of Projects
N/A	Not Applicable
NA DPS	North Atlantic Distinct Population Segment
NE	No Effect
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NP	Not Present
NPS	National Park Service
NWA DPS	Northwest Atlantic Distinct Population Segment
NWP	Nationwide Permit
P	Present
PATON	Private Aid to Navigation
PBF	Physical and Biological Feature
PCE	Primary Constituent Element
PDC	Project Design Criteria
PGP	Programmatic General Permit

PRD	Protected Resources Division
PVC	Polyvinyl Chloride
RGP	Regional General Permit
RHA	Rivers and Harbors Act
RM	Red Mangrove
RMS	Root Mean Square
SAJ	South Atlantic Jacksonville
SARBO	South Atlantic Regional Biological Opinion
SH	Shallow, Euryhaline Habitat
SEL	Sound Exposure Level
SFWMD	South Florida Water Management District
SP	Standard Permit
SPGP	State Programmatic General Permit
sSEL	Single Strike Sound Exposure Level
SWPBO	Statewide Programmatic Biological Opinion
TNAP	Temporary Noise Attenuation Pile
TTIEU	Ten Thousand Islands/Everglades Unit
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
WCIND	West Coast Inland Navigational District

Units of Measurement

Temperature	
°F	degrees Fahrenheit
°C	degrees Celsius

Length and Area	
ac	acre(s)
cm	centimeter(s)
ft	foot/feet
ft^2	square foot/feet
in	inch(es)
km	kilometer(s)
lin ft	linear foot/feet
m	meter(s)
m^2	square meter(s)
mm	millimeter(s)
nmi	nautical mile(s)
nmi^2	square nautical mile(s)

Background
Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. §1531 *et seq*.), requires that each federal agency ensure that any action authorized, funded, or carried out by the 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 those species. When the action of a federal agency may affect a protected species or its critical habitat, that agency is required to consult with either the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the protected species or critical habitat that may be affected.

Consultations on most listed marine species and their designated critical habitat are conducted between the action agency and NMFS. Consultations are concluded after NMFS determines the action is not likely to adversely affect listed species or critical habitat or issues a Biological Opinion ("Opinion") that determines whether a proposed action is likely to jeopardize the continued existence of a federally listed species, or destroy or adversely modify federally designated critical habitat. The Opinion also states the amount or extent of listed species incidental take that may occur and develops non-discretionary measures that the action agency must take to reduce the effects of said anticipated/authorized take. The Opinion may also recommend discretionary conservation measures. No destruction or adverse modification of critical habitat may be authorized. The issuance of an Opinion detailing NMFS's findings concludes ESA Section 7 consultation.

This document represents NMFS's Opinion based on our review of impacts associated with 10 categories of in-water activities that the USACE's Jacksonville District authorizes under Section 10 of the Rivers and Harbors Act (RHA) of 1899 and Section 404 of the Clean Water Act (CWA) throughout Florida and the U.S. Caribbean, including:

1. Shoreline stabilization (e.g., installation, repair, and removal of structures)

2. Pile-supported structures and anchored buoys (e.g., installation, repair, and removal of structures)

3. Dredging including maintenance, minor, and muck dredging

4. Water-management outfall structures and associated endwalls[1] (e.g., installation, repair, and removal of water outfall structures)

5. Scientific survey devices (e.g., installation, repair, and removal of structures)

6. Boat ramps (e.g., installation, repair, and removal of structures)

[1] Endwalls are retaining walls at the end of the outfall structure that protect the area surrounding the outfall pipe from scouring.

7. Aquatic habitat enhancement, establishment, and restoration activities (oyster reef and living shorelines, seagrass restoration, artificial reefs, fill to restore natural contours or improve water quality)

8. Transmission and utility lines (e.g., installation, repair, and removal of aquatic and subaqueous lines)

9. Marine debris removal

10. Temporary platforms, fill, and cofferdams (e.g., installation, repair, and removal of structures)

We analyze the effects of these 10 categories of activities in Florida and the U.S. Caribbean on the endangered (E) and threatened (T) species and critical habitat under our jurisdiction, in accordance with Section 7 of the ESA. This Opinion is based on information provided by USACE and the best scientific and commercial data available.

Programmatic Consultations
Programmatic consultations[2] allow for streamlined review of groups of frequently occurring or routine activities or Federal action agency policies, plans, regulations or programs that have well-understood and predictable effects on ESA-listed species and designated critical habitat.[3] Programmatic consultations can be used to evaluate the effects of authorizing certain categories of frequently occurring activities or of agency policy or programs, where specifics of any individual future project (either of the given category or type of activity, or occurring under the policy or program), such as the specific location, are not definitively known at the time of the programmatic consultation.

As is done in this Opinion, a Programmatic Consultation generally identifies project design criteria (PDCs), which are the specific criteria, including the technical and engineering specifications, indicating how an individual project must be sited, constructed, or otherwise carried out to avoid or minimize adverse effects to ESA-listed species or designated critical habitat. The PDCs serve 2 important purposes. First, they ensure that the actions under consultation are sufficiently similar that their effects can be analyzed together. Second, the PDCs help protect species and critical habitat, and ensure that the action agency is meeting its obligation under Section 7(a)(2); in designing the PDCs, NMFS and the action agency work to establish conditions that avoid adverse effects on listed species or designated critical habitat or,

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[2] It is important to note that the term "programmatic" is defined differently by NMFS when discussing a Programmatic Consultation or Programmatic Biological Opinion than it is by USACE when discussing a Programmatic *General Permit* (see Appendix A).

[3] *See, e.g.*, Joint Services memorandum, *Alternative Approaches for Streamlining Section 7 Consultation on Hazardous Fuels Treatment Projects*, https://www.fws.gov/endangered/esa-library/pdf/streamlining.pdf; 68 FR 1628 (January 13, 2003).

where the adverse effect cannot be avoided, to limit them to predictable levels that will not jeopardize the continued existence of listed species or destroy or adversely modify critical habitat either at the individual project level or in aggregate.

The Programmatic Consultation document evaluates the aggregate effect of categories of related actions or of the agency program. This includes the amount or extent of incidental take that is expected, if sufficient information exists to estimate take. Since programmatic consultations evaluate effects of expected future actions, the action agency must provide projections of the number of activities and the extent of expected effects from the proposed activities. The Programmatic Consultation document must demonstrate that, when the PDCs are followed, the aggregate expected effect of all projects is not likely to adversely affect listed species or their critical habitat(s), or will not jeopardize species or destroy or adversely modify their critical habitat(s), as applicable. At the project-specific consultation stage, each proposed action is reviewed to determine if it can be implemented according to the PDCs. For example, an action agency may certify that the expected effect of the project to be authorized is consistent with the PDCs and other conditions in the Programmatic Consultation. Adjustments to the project(s) may be necessary to bring them into compliance with the Programmatic Consultation document. Finally, the project-specific consultation procedures provide contingencies for proposed projects that cannot be implemented in accordance with the PDCs; for example, separate consultations may be performed on these projects if they are too dissimilar from those described in the Programmatic Consultation document. In addition, the Programmatic Consultation must provide a process for tracking the actual effects of the proposed activities, once implemented, and ensure that the number and scope of the effects do not exceed those analyzed in the consultation or otherwise require reinitiation. NMFS generally conducts a programmatic-level review of the actual effects and compliance with the Programmatic Consultation on an annual basis.

The following elements, which generally are included in a Programmatic Consultation to ensure its compliance with ESA Section 7 and its implementing regulations, have been included in this Opinion:

1. Description of the proposed action, including the categories of similar projects under consultation (referred to as the Activities) and the PDCs applicable to all activities (general PDCs) and to the individual categories of activities (activity-specific PDCs) that are designed to avoid or minimize future adverse effects on listed species and critical habitat (Section 2.2).

2. Description of the manner in which the projects, when implemented consistent with the general and activity-specific PDCs, may affect listed species and critical habitat and evaluation of expected effects of the covered projects (Section 2.2). For each activity, we describe the process we used, in coordination with the action agency, to evaluate the expected effects, including the assumptions about the number and scope of each expected project. This Programmatic Opinion does not authorize any take.

3. Procedures for streamlined project-specific review, and the process for separate consultations for projects that do not meet the requirements of the Opinion (Section 2.3).

4. Procedures for monitoring projects and validating the predicted effects, and for the comprehensive review of the projects authorized in reliance on the Opinion as a whole (Section 2.4).

1 Consultation History

On December 14, 2015, the USACE requested a Programmatic Biological Opinion to address certain activities authorized under Section 10 of the RHA and Section 404 of the CWA in Florida. Consultation was initiated that day, though we continued to work with USACE to refine the proposed action. The original request was to address 11 categories of USACE-authorized activities. Through discussion with the USACE, the 11 categories of activities were reduced to 10 by combining 2 activities. In particular, we combined the reconfiguration and repair of existing docking facilities within a USACE-authorized marina with installation, repair, replacement, and removal of pile-supported structures and anchored buoys, since both categories primarily involve pile-supported structures. Additionally, this Opinion modifies some of the PDCs that the USACE included in its consultation request.

The USACE requested that this Opinion analyze activities authorized under its multiple existing and proposed general permits (GPs) in Florida. As explained below, the USACE had previously consulted with us on several of these GPs and this Opinion covers the activities authorized under 5 such permits, as noted below. Including the activities authorized under multiple GPs in this Opinion allowed us to review the majority of the minor in-water construction activities that the USACE permits in Florida under Section 10 of the RHA and Section 404 of the CWA, and to analyze the cumulative effects of these actions.

Once the USACE completes any process and other requirements (e.g., public notices or comment periods) necessary for full implementation, this Opinion will address the effects of activities authorized by the following renewals of existing GPs, and replaces and supersedes any prior consultations on the permits or prior iterations of these permits:

- Renewal of the Florida State Programmatic General Permit (SPGP). The USACE requested programmatic consultation on this renewal on August 26, 2015. We did not complete a separate programmatic consultation on that GP, but rather incorporated the actions authorized under that permit in this Opinion. The previous SPGP was evaluated through a Programmatic Opinion issued by NMFS on December 21, 2011 (SPGP IV-RI, SER-2011-05980),

- Renewal of the 12 USACE South Atlantic Jacksonville (SAJ) District GPs, which were previously evaluated through a Programmatic Opinion issued by NMFS on December 19, 2012 (12 USACE SAJ General Permits, SER 2011-01939).

- Renewal of the GP SAJ-82, which was previously evaluated in a Biological Opinion issued by NMFS on June 10, 2014 (SER-2008-02958).

- Renewal of the Programmatic General Permit (PGP) SAJ-42, which was previously evaluated in a Biological Opinion issued by NMFS on February 10, 2011 (SER-2008-01790).

Additionally, this Opinion will supersede the Florida Statewide Programmatic Biological Opinion (SWPBO) issued by NMFS on December 4, 2015 (SER-2013-12540).

This Programmatic Opinion will not address the following completed or in progress consultations:

- Renewal of SAJ-99 (SER-2014-13378) or SAJ-71 (SER-2015-17183) used for the deposition of aquaculture materials.

- Completion of the proposed SAJ-112 for coral propagation and nursery structures off the Florida, Puerto Rico, and U.S. Virgin Islands (SER-2014-15282).

- South Atlantic Regional Biological Opinion (SARBO) (NMFS 1997) and the Gulf of Mexico Regional Biological Opinion (GRBO) (NMFS 2007b), which both address federal actions associated with maintenance dredging.

In the SWPBO issued on December 4, 2015, we evaluated the USACE's authorization of 11 categories of minor in-water activities under Nationwide Permits (NWPs) or Individual Permits (IPs). Although this Opinion includes the same categories of activities as SWPBO,[4] it is broader than the SWPBO because it also considers those activities when authorized under USACE regional, general, and programmatic permits (i.e., it is not simply limited to authorization of those activities under USACE NWPs or IPs).

After working directly with the USACE to develop the updated PDCs for this Opinion, we sent a draft of the consultation history, descriptions of the actions, PDCs, and the assumptions that went into estimating the effects of the activities to the USACE on March 10, 2016. The USACE provided comments on March 17, 2016.

On November 14, 2016, the USACE requested programmatic consultation on 11 categories of activities associated with the proposed 2017 Nationwide Permits for work in Puerto Rico and the U.S. Virgin Islands.

On January 12 and 31, 2017, we met with the USACE to discuss expanding this consultation to include not only activities authorized under the proposed 2017 NWPs in Puerto Rico and the U.S. Virgin Islands, but also activities authorized under IPs within that area. Together with the USACE, we drafted and reviewed additional PDCs and we decided it was appropriate to expand the consultation. The USACE requested to consult on the same 10 categories of activities as

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[4] As we explained above, we have revised the description of the covered categories from 11 categories to 10 categories by combining "the reconfiguration and repair of existing docking facilities within a USACE-authorized marina" with "installation, repair, replacement, and removal of pile-supported structures and anchored buoys," since both categories primarily involve pile-supported structures. Thus, although the SWPBO covered 11 categories of activities, and this Opinion covers 10, the Opinions discuss the same categories of actions.

analyzed in this Opinion, and an additional 11th category, aquaculture. NMFS and the USACE decided to not consult on aquaculture in this Opinion.

At the USACE's request, we provided the USACE a draft of the entire document for review before we completed the consultation.

2 Description of the Proposed Action and Potential Routes of Effect to Species and Critical Habitat

This Programmatic Opinion evaluates 10 categories of the most common, minor in-water activities that the USACE regularly authorizes in the state of Florida and the U.S. Caribbean under Section 404 of the CWA and Section 10 of the RHA. The USACE authorizes these activities using a variety of mechanisms including regional general permits (RGPs), PGPs, NWPs, and IPs. This Opinion does not cover all types of activities or projects that the USACE permits under its CWA or RHA authority, but instead focuses on those minor projects that the USACE regularly authorizes that have predictable effects. This Opinion does not directly link each activity to a specific USACE CWA or RHA permit (by which we mean we are not consulting on a particular RGP, PGP, or NWP). Instead, the Opinion focuses on the categories of activities authorized under the USACE's CWA and RHA permitting authority and the effects those activities may have on species and critical habitat under NMFS's purview.

The goal of this Opinion is to streamline and consolidate ESA Section 7 consultation for the majority of minor in-water coastal development activities that the USACE Jacksonville District authorizes in Florida and the U.S. Caribbean. In this Opinion, we are able to provide a more comprehensive and cohesive review of the majority of the minor in-water construction projects in Florida and the U.S. Caribbean that are permitted by the USACE under Section 10 of the RHA and Section 404 of the CWA and to analyze the cumulative effects of these actions, than if we consulted on a project-by-project basis.

Below, we provide a description of:

- How the Opinion may be used (described below)

- The areas in Florida and the U.S. Caribbean in which the permitted activities covered under this Opinion occur, including areas where additional restrictions apply (Section 2.1).

- The 10 categories of activities covered by this Opinion, including the PDCs those activities must meet to be covered (Section 2.2).

- An estimate of the number of activities that the USACE (or an entity with delegated authority from the USACE) will permit over a 5-year period that are covered by this Opinion (Section 2.2).

- The project-specific review (Section 2.3) and programmatic review (Section 2.4) requirements necessary to ensure that the reliance on this Opinion is limited to those actions in Florida and the U.S. Caribbean that meet the PDCs in this Opinion and are consistent with this Opinion.

Use of the Opinion
As explained above, the USACE requested programmatic consultation on the effect of authorizing projects falling within 10 categories of activities occuring throughout the state of Florida and the U.S. Caribbean. The USACE determined that the 9 out of the 10 categories of activities may affect certain ESA-listed species or designated critical habitat within NMFS's purview (all but Activity 9, marine debris removal; see Section 2.1.2 for the USACE's effects determinations). NMFS believes that all of the activities described below, if carried out as described, will have effects on ESA-listed species and/or critical habitat as discussed herein. The USACE may rely on this Opinion to meet its ESA Section 7 consultation requirements when authorizing activities that meet the PDCs and other requirements of the Opinion. Nothing in this Opinion precludes the USACE from determining that a future project does not affect an ESA-listed species or designated critical habitat. NMFS and the USACE will continue to discuss the Opinion as it is applied, at the project-specific and programmatic reviews described in Sections 2.3 and 2.4, and may refine it in the future.

Two USACE Divisions, the USACE Regulatory Division and the USACE Civil Works Division, have responsibility for authorizing and/or implementing in-water projects under the CWA and the RHA and consulting on the effects of those projects under the ESA. Both Divisions can satisfy their ESA Section 7 requirements by relying on this Opinion for projects meeting the requirements of this Opinion.

In addition, entities to which the USACE has delegated certain CWA Section 404 and/or RHA Section 10 permitting authority—such as the Florida Department of Environmental Protection (FDEP), a water management district, or a local government with delegated authority under Section 373.441, F.S.—also may rely on this Opinion to satisfy their ESA Section 7 obligations, again, to the extent the authorized activities are consistent with the PDCs and the other requirements of the Opinion. Unless the USACE has negotiated with the entity otherwise, the delegated authority must submit information on its authorized projects under the project-specific review procedures set forth in Section 2.3 to both NMFS and the USACE, but NMFS will coordinate directly with the USACE on any issues raised during the project-specific review. The USACE remains responsible for the programmatic review, as set forth in Section 2.4.

The USACE also may share responsibility for authorizing the activities addressed in this Opinion with another federal action agency. When 2 or more federal agencies are involved in authorizing, funding, or carrying out an activity that may affect listed species or critical habitat, a single agency may be designated as the lead for consultation under Section 7 of the ESA, per the factors in 50 CFR 402.07, which include the "time sequence in which the agencies would become involved, the magnitude of their respective involvement, and their relative expertise with respect to the environmental effects of the action."[5] If a federal action agency other than the USACE has been designated the lead action agency for the Section 7 consultation on a project that fits within 1 or more of the activities covered under this Opinion, that agency may rely on this Opinion in meeting its ESA Section 7 requirements, as long as the USACE is part of the

[5] 50 CFR § 402.07 requires the lead agency to provide written notification of the designation to NMFS.

consultation and the project under consultation meets the PDCs and all other requirements of the Opinion, as described in the examples below. The USACE remains responsible for meeting the project-specific review and programmatic review requirements, according to the procedures outlined in Section 2.3 and 2.4 of this Opinion. Since the non-USACE federal action agency may be aware of a proposed project first, we suggest the non-USACE federal action agency contact the USACE early in the process to ensure that both federal action agencies have the necessary information from the applicant to complete both the ESA Section 7 requirements and their own permitting, funding, or other requirements.

For example, the following projects may require ESA Section 7 consultation coordination between the USACE and another federal action agency:

- The National Park Service (NPS) may wish to install a new aids-to-navigation (ATON). In addition to requiring authorization from USACE under Section 10 of the RHA, the NPS would need authorization from the U.S. Coast Guard (USCG). Both federal authorizations (USACE and USCG) would require Section 7 consultation and either the USCG or the USACE could be the lead action agency for the consultation. If the USCG was the lead action agency, and the USACE was a co-consulting action agency, the USCG could use this Opinion in satisfying its ESA Section 7 requirements; as long as the ATON met the general and activity-specific PDCs of this Opinion (ATONs fall within Category 2, below).

- The Federal Emergency Management Agency (FEMA) or the National Oceanic and Atmospheric Administration (NOAA) Restoration Division may request ESA Section 7 consultation on its action to fund 1 of the 10 categories of in-water work covered under this Opinion. As long as FEMA or NOAA Restoration Center's action has a nexus to the Opinion—i.e., FEMA or NOAA Restoration is funding a project for which the applicant also must apply for a USACE permit for 1 of the 10 categories of activities covered under this Opinion—if FEMA or NOAA Restoration Center is designated as the lead federal action agency for Section 7 consultation, and the USACE was a co-consulting action agency, FEMA or NOAA Restoration Center may rely on the Opinion.

In the federal coordination examples above, the USACE remains responsible for meeting the project-specific review and programmatic review requirements, according to the procedures outlined in Section 2.3 and 2.4 of this Opinion. Throughout the Opinion, we use the term USACE to refer to the USACE or any entity that is taking the lead for or otherwise responsible for the Section 7 consultation as described above, unless otherwise noted.

This Opinion may not be used to consult on 1 portion of a larger project. In order to rely on this Programmatic Opinion to meet the ESA Section 7 consultation requirements, all of the activities within the project must be covered under this Opinion and must meet the PDCs of the Opinion, unless all aspects of the project have been considered and are covered under this Opinion and other programmatic opinions. For example, the USACE could rely on this Opinion for its decision to issue a permit allowing for construction of a dock and seawall and for minor dredging if all of the general PDCs and all of PDCs for those specific activities (the docks, seawalls, and minor dredging) were met. However, if 1 activity did not meet the PDCs, then the USACE would have to consult on the entire project with NMFS separately via an individual consultation.

For example, if the seawall did not meet PDC A.1.1.1 because it was greater than 500 ft in length, then the USACE would have to request an individual consultation that covers all components of the project. The USACE could not rely on this Opinion to consult on the minor dredging and the dock, and separately consult on the seawall. However, if all aspects of the project are covered in 2 or more programmatic opinions, the USACE may rely on those opinions and need not seek individual consultation on the project. NMFS expects this Opinion may be used in combination with the upcoming Programmatic Opinion on the Effects of Research, Restoration, and Relocation on Threatened Caribbean Corals (referred to as the 3Rs Programmatic Biological Opinion, NMFS tracking number SER-2016-18298). For example, if a project covered under this Opinion had coral onsite that was removed prior to starting construction, the coral relocation would be covered under the 3Rs Programmatic Biological Opinion and the construction of the project would be covered under this Opinion. In this instance, the USACE would have to meet the project specific and programmatic review requirements of each opinion, but would not be required to separately consult on the coral relocation and construction project as a whole.

In addition, if the project under consultation is broader than the covered activities, the USACE (or other entity that can rely on this Opinion) cannot rely on this Opinion and should consult on the broader project individually. For example, if, in the same grant, FEMA was proposing to fund both repairs to previously installed shoreline stabilization materials requiring USACE authorization (which is covered under Activity 1) and repairs to an adjacent fishing pier requiring USACE authorization (which is not covered under the Opinion), then either FEMA or the USACE, depending on which agency was the lead for Section 7 consultation, should consult on the entire project. Neither FEMA nor the USACE could rely on the Opinion with respect to Activity 1 and limit individual consultation to repairing the fishing pier. The one exception to this limitation pertains to the in-water disposal of material dredge via dredging that meets the requirements of this Opinion (Activity 3). If the USACE has separately consulted with NMFS on the in-water disposal, the USACE can rely on this Opinion to satisfy its consultation requirements associated with authorizing the dredging (Activity 3). If the project proposes to dispose of the material at an in-water disposal location not previously consulted on by NMFS, then the entire project (both dredging and disposal) should be consulted on separately. This exception is explained in more detail in Activity 3 (PDC A3.3).

The examples above might involve more than one federal authorization or federal action. NMFS has limited reliance on this Opinion to facilitate a comprehensive review of a given project.

2.1 Project Action Area

The action area is defined by regulation as “all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action” (50 CFR 402.02). Indirect effects are those that are caused by the proposed action that occur later in time, but still are reasonably certain to occur. The Opinion applies to 10 categories of in-water activities that the USACE’s Jacksonville District authorizes in Florida and the U.S. Caribbean (Puerto Rico and the U.S. Virgin Islands, including St. Croix, St. John, and St. Thomas). In this Opinion, the largest area where indirect effects are expected is the area associated with vessel traffic originating from docks and marinas (Activity 2) and boat ramps (Activity 6). The distance these vessels travel is related to the preferred destination for fishing, sailing, sightseeing, diving an artificial reef, or other recreational activity. The distance and seasonal timing of trips also is variable by the vessel size and type, vessel origination point, and is seasonally variable. We believe vessels may travel out to 35 nautical miles (nmi) from shore, based on a recent study that documented recreational vessels traveling up to 35 nmi offshore in the northeast Florida to southeast Georgia region (Montes et al. 2016). Larger vessels such as ferries, tankers, and barges, which are excluded by PDC A2.1.1 in Section 2.2.2, may travel further offshore, but as these vessels are not included in the Opinion, we believe it is reasonable to limit the action area to the area within 35 nmi. Therefore, we will consider the action area to include waters within the Florida and the U.S. Caribbean, where the USACE authorizes the covered activities and NMFS manages species and critical habitat, including waters up to 35 nmi from shore.

2.1.1 Species Specific Restriction and Exclusion Zones within the Action Area

The Opinion covers 10 categories of actions occurring in the state of Florida and the U.S. Caribbean. To protect ESA resources, the Opinion establishes specific areas where additional restrictions apply (restriction zones) and areas where an otherwise eligible activity may not occur if seeking coverage under the Opinion (exclusion zones). These areas have specific value for ESA-listed resources, as described below. Maps of all exclusion and restriction zones described in this section are currently being developed as Geographic Information System (GIS) layers and will be provided to the USACE and will be available for download on our website upon completion at: http://sero.nmfs.noaa.gov/maps_gis_data/index.html.

2.1.1.1 Smalltooth Sawfish Critical Habitat Limited Exclusion Zones

This Opinion excludes many activities occurring in smalltooth sawfish critical habitat limited exclusion zones. As defined in the activity-specific PDCs in Section 2.2, shoreline stabilization (Activity 1), pile-supported structures (Activity 2), dredging (Activity 3), water-management outfall structures (Activity 4), boat ramps (Activity 6), aquatic enhancement (Activity 7), transmission and utility lines (Activity 8), and temporary platforms, fill, and cofferdams (Activity 10) do not qualify for coverage under this Opinion if they occur in areas identified as limited exclusion zones within smalltooth sawfish critical habitat (Table 1 and Figure 1). Because certain activities can take place in these areas (e.g., temporary placement of scientific survey devices [Activity 5] and marine debris removal [Activity 9]), we will refer to these areas as limited exclusion zones. The smalltooth sawfish critical habitat limited exclusion zones are based on studies that have identified certain areas as supporting higher levels of smalltooth sawfish pupping. Excluding activities occurring in these areas from coverage under this Opinion means that those projects will be subject to individual ESA Section 7 consultation and is aimed at protecting reproductive female smalltooth sawfish during pupping (see Section 3.2.2).
The limited exclusion zones identified in this Opinion are based on current data. If we or the USACE determine that additional areas need protection or if the areas defined below require modification, we will discuss the necessary changes with the USACE at the programmatic review meetings between us and the USACE (see Section 2.4), and any revisions will be included in this Opinion by addendum.

Table 1. Limited Exclusion Zones in Smalltooth Sawfish Critical Habitat

Name	Latitude	Longitude
U.S. 41 Bridges (the area between the following coordinates)		
U.S. 41 (northwest corner)	26.660413°N	81.885243°W
U.S. 41 (northeast corner)	26.666827°N	81.872966°W
U.S. 41 (southwest corner)	26.642991°N	81.873880°W
U.S. 41 (southeast corner)	26.649405°N	81.861605°W
Iona Cove (the area between the following coordinates)		
Iona Cove (northwest corner)	26.521437°N	81.991586°W
Iona Cove (northeast corner)	26.521212°N	81.976191°W
Iona Cove (southwest corner)	26.511762°N	81.991762°W
Iona Cove (southeast corner)	26.511537°N	81.976368°W
Glover Bight (the area between the following coordinates)		
Glover Bight (northwest corner)	26.542971°N	81.997791°W
Glover Bight (northeast corner)	26.542678°N	81.977745°W
Glover Bight (southwest corner)	26.529478°N	81.998035°W
Glover Bight (southeast corner)	26.529185°N	81.977992°W
Cape Coral (the area between the following coordinates)		
Cape Coral (point 1)	26.551662°N	81.947412°W
Cape Coral (point 2)	26.551561°N	81.940683°W
Cape Coral (point 3)	26.539075°N	81.940916°W
Cape Coral (point 4)	26.539205°N	81.951049°W
Cape Coral (point 5)	26.542181°N	81.951047°W
Cape Coral (point 6)	26.542133°N	81.947776°W

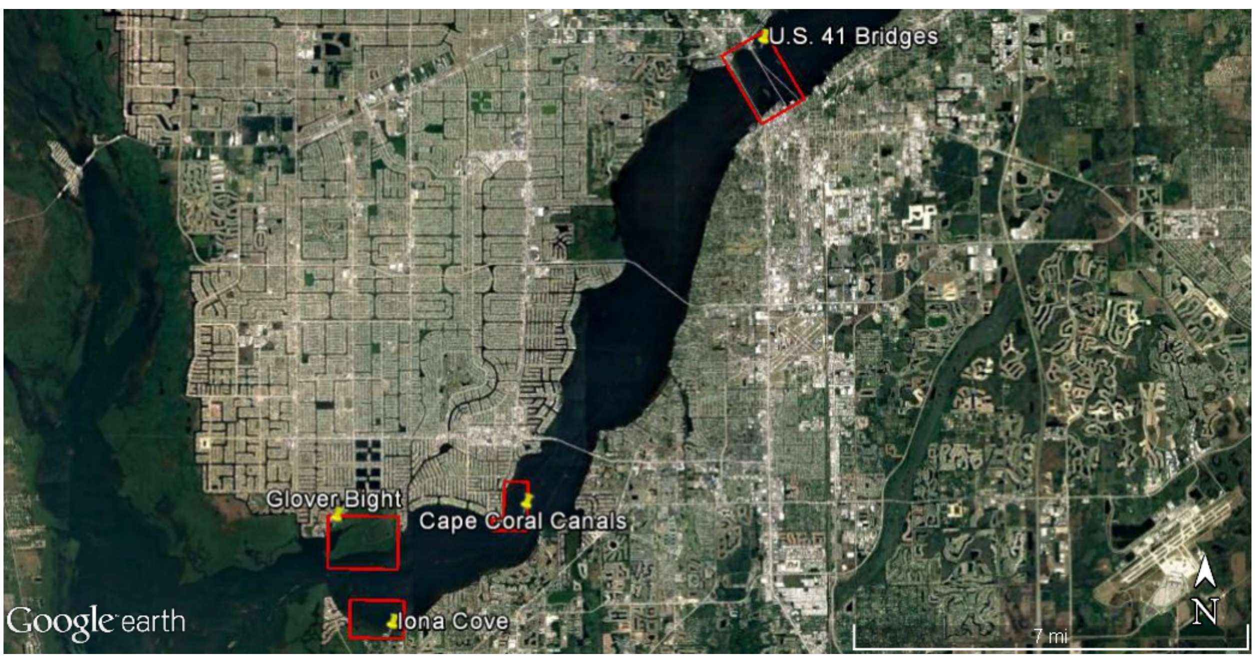

Figure 1. Smalltooth sawfish limited exclusion zones.

2.1.1.2 Gulf Sturgeon Critical Habitat Migratory Restriction Zones

We have identified specific zones at the mouth of Gulf sturgeon spawning rivers and narrow inlets where additional restrictions apply to protect sturgeon that are migrating to and from spawning rivers (referred to as the "Gulf sturgeon critical habitat migratory restriction zones"). These restrictions limit noise generated during pile and sheet pile installation associated with shoreline stabilization (Activity 1), pile-supported structures (Activity 2), water-management outfall structures (Activity 4), boat ramps (Activity 6), aquatic enhancement (Activity 7), transmission and utility lines (Activity 8), and temporary platforms, fill, and cofferdams (Activity 10) activities in Gulf sturgeon critical habitat migratory restriction zones. They also limit placement of materials that cover large areas of sediment and could block movement through these narrow passes, including the placement of living shoreline, oyster reef, and artificial reef materials (Activity 7) and temporary platforms, fill, and cofferdams (Activity 10). In Florida, Gulf sturgeon spawning rivers include the Escambia River, Blackwater and Yellow Rivers, Choctawhatchee River, Apalachicola River, and Suwannee River (Figure 2). Limitations also apply to narrow inlets in Gulf sturgeon critical habitat, including narrow inlets in Apalachicola Bay (Indian Pass and Government Cut) and Destin Pass in Choctawhatchee Bay. Projects occurring in the estuarine Gulf sturgeon critical habitat units are under NMFS's jurisdiction, while the riverine critical habitat areas are under the jurisdiction of the USFWS. This delineation between the Services occurs at the mouth of each river. The mouth is defined as river kilometer 0/ river mile 0. Although the interface of fresh and saltwater, referred to as the saltwater wedge, occurs within the lower-most reach of a river, for ease in delineating critical habitat units, we are defining the boundary between the riverine and estuarine units as river kilometer 0/ river mile 0 (50 CFR 226.214; 68 FR 13370).

The following restrictions apply to projects proposed in the zones identified in Table 2. As is explained below, certain projects occurring in these zones are excluded from the Opinion and require separate consultation. We developed these restrictions and exclusions because in-water construction noise in these areas can discourage Gulf sturgeon from returning to spawning rivers from the open ocean and materials placed in these areas can block migration.

PDCs Specific to the Gulf Sturgeon Critical Habitat Migratory Restriction Zones

- This Opinion does not apply to the placement of living shoreline, oyster reef, and artificial reef materials (Activity 7, PDC A7.26) and temporary platform, fill, and cofferdams (Activity 10, PDC A10.11) in Gulf sturgeon critical habitat migratory restriction zones.

- This Opinion does not apply to new transmission and utility line installation in the Gulf sturgeon critical habitat migratory restriction zones between September and March, when sturgeon are likely to be present in these areas. Emergency repair/replacement of transmission and utility lines may occur in these areas during this time frame if the work is conducted without the use of heavy in-water equipment (e.g., dredging equipment) (Activity 8, PDC A8.10).

- This Opinion does not apply to the installation of metal piles and metal sheet piles by impact hammer in the areas identified as Gulf sturgeon critical habitat migratory restriction zones.

- The allowable pile and sheet pile driving activities vary depending on the width of the project action area, as described below.

- <u>Areas that are 0-500 ft wide</u>: In areas up to 500 ft wide, the allowable pile or sheet pile driving activities within the Gulf sturgeon critical habitat migratory restriction zones are:

  1. Creating a pilot hole for any type of pile using an auger or drop punch
  2. Trenching a shoreline with mechanical equipment to create a space to install any type of sheet pile and backfilling behind it
  3. Installing any type of piles and sheet piles by jetting.

- <u>Areas that are 501-1,400 ft wide</u>: In areas over 500 ft wide, but less than 1,400 ft wide, the allowable pile or sheet pile driving activities within the Gulf sturgeon critical habitat migratory restriction zones are:

  The activities described in 1-3 above, and

  4. Installing any type of piles and sheet piles by vibratory hammer.

- <u>Areas over 1,401 ft wide</u>: In areas 1,401 ft wide or wider, the allowable pile or sheet pile driving activities within the Gulf sturgeon critical habitat migratory restriction zones are:

  The activities described in 1-4 above, and

  5. Installing wood, vinyl, and concrete piles and sheet piles by impact hammer.

If additional measures or areas are deemed necessary for protection, or if the areas defined below require modification, we will discuss these changes with the USACE at the programmatic review meetings (see Section 2.4), and any revisions will be included in this Opinion by addendum.

Table 2. Gulf sturgeon critical habitat migratory restriction zones

Water Body	**Delineation Type**	**Point A**	**Point B**	**Point C**	**Point D**
Escambia River		30.5146361°N 87.16093°W	30.5323916°N87.13192°W		
Blackwater/ Yellow Rivers	Line	30.5047°N 87.0475°W	30.5047°N 87.0196583°W		
Choctawhatchee Bay	Line	30.385183°N 86.515394°W	30.3814861°N 86.50684°W		
Choctawhatchee River	Line	30.429794°N 86.147725°W	30.37842°N 86.1252°W		
Apalachicola Bay	Polygon	29.675561°N 85.240283°W	29.6751°N 85.2160583°W	29.681216°N 85.2160583°W	29.684875°N 85.221502°W
Apalachicola Bay	Polygon	29.6308694°N 85.1060027°W	29.6223194°N 85.097038°W	29.6267861°N 85.093172°W	29.63268°N 85.09687°W
Apalachicola Bay	Polygon	29.611361°N 84.958483°W	29.611872°N 84.957338°W	29.61736°N 84.95926°W	29.6161583°N 84.9626638°W
Apalachicola Bay	Polygon	29.765272°N 84.6916361°W	29.77816°N 84.6669027°W	29.78695°N 84.674269°W	29.7721°N 84.695294°W
Apalachicola River	Polygon	29.7131027°N 84.99772°W	29.7120916°N 84.9744472°W	29.734772°N 84.9701027°W	29.731505°N 84.9846027°W
Suwanee River	Line	29.328483°N 83.167525°W	29.291116°N 83.1669694°W		
Suwanee River	Line	29.291116°N, 83.1669694°W	29.2670194°N 83.0946805°W		
Lines (Points A and B) create a line marking the approximate mouth of the river. Projects on the marine side of the mouth of these rivers (i.e., areas under NMFS jurisdiction) must follow the migratory restrictions defined in this section. Polygons (Points A-D) create an area between the points marking restricted sections of a bay or pass. Projects in these defined areas must follow the migratory restriction requirements defined in this section.					

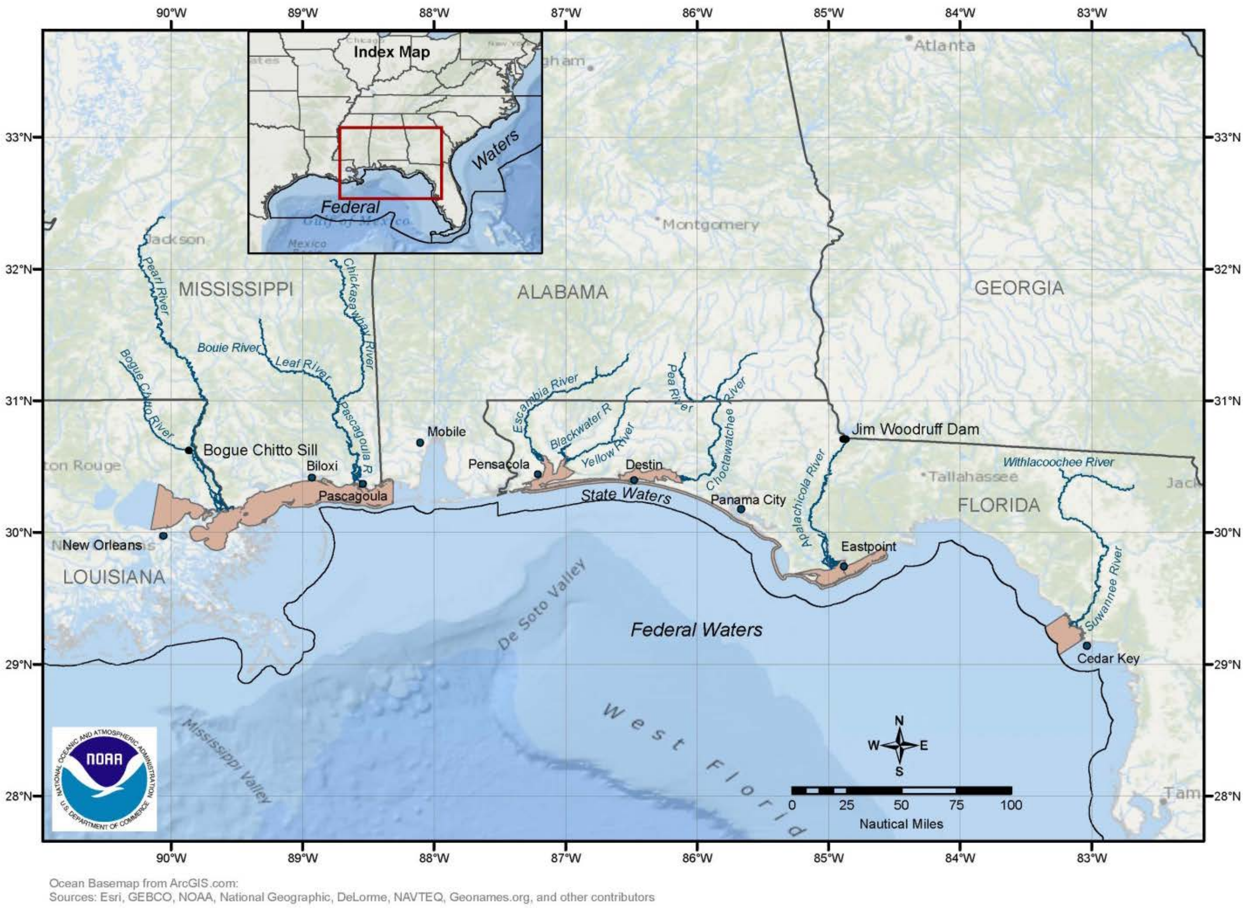

Figure 2. Gulf sturgeon critical habitat. Estuarine critical habitat units under NMFS's jurisdiction shaded and the rivers under USFWS's jurisdiction labeled (Images provided on the NMFS website at http://sero.nmfs.noaa.gov/maps_gis_data/protected_resources/critical_habitat/index.html).

2.1.1.3 Atlantic Sturgeon Critical Habitat Exclusion Zone (St. Marys River)

This Opinion does not cover activities proposed in the St. Marys River, which has been designated as Atlantic sturgeon critical habitat, as shown in Figure 3 below as SA7. Atlantic sturgeon riverine critical habitat is under NMFS's jurisdiction. The only Atlantic sturgeon critical habitat area occurring in within the action area is within the Florida portion of the St. Marys River (i.e., generally along the south side of the river). NMFS and the USACE jointly decided to exclude projects occurring in St. Marys River from coverage under this Opinion. . The USACE does not expect to receive many applications for proposed projects in St. Marys River and will consult on those projects on an individual basis, as warranted.

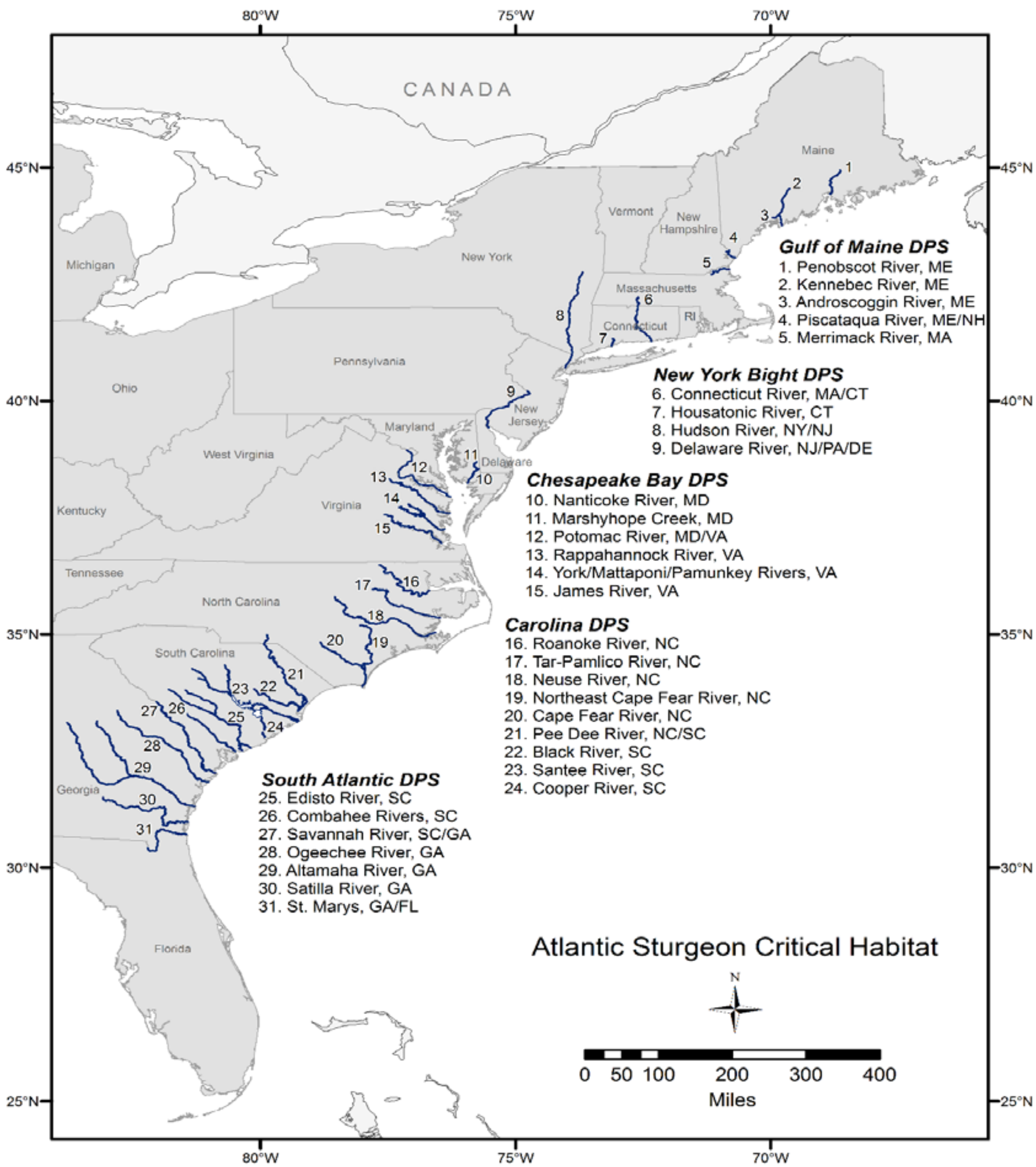

Figure 3. Atlantic sturgeon critical habitat (Images provided on the NMFS website at http://sero.nmfs.noaa.gov/protected_resources/sturgeon/documents/critical_habitat_maps.pdf).

2.1.1.4 North Atlantic Right Whales Educational Sign Zones

North Atlantic right whales are susceptible to vessel collisions given the time they spend at the surface. NMFS designated critical habitat for the North Atlantic right whale off the east coast of Florida to protect North Atlantic right whale calving grounds. NMFS recently expanded the critical habitat designation to include the area from Cape Fear, North Carolina south to approximately 27 nmi south of Cape Canaveral, Florida (81 FR 4837, January 27, 2016). To avoid and minimize the risk of vessel strikes with mothers and calves, especially during the known right whale core calving season of December through March, educational signs must be placed at public locations such as marinas, multi-family docking facilities, and boat ramps that are located within 11 nmi of an inlet that leads to areas within the known range of North Atlantic right whales (PDC A2.2 and PDC A6.3.2). Homeowners proposing to construct, repair, or replace a private dock within 11 nmi of an inlet that leads to areas within the known range of North Atlantic right whale, will be provided a handout with their USACE permit describing the presence of North Atlantic right whales in the area and the Federal regulations governing the approach to North Atlantic right whales (50 CFR 224.103(c)), (PDC A2.4 and Appendix C). The coordinates for the center points of these 11 nmi radii are provided in Table 3 below and images of the areas are shown in Figure 4. These zones are the North Atlantic right whale educational sign zones.

The 11 nmi radius was chosen based on a recent study on Offshore Recreational Boating Characterization in the Southeast U.S (Sea Grant 2016). In this study, 958 vessel owners responded to a questionnaire regarding vessel use. Based on the study results, we believe that the average recreational vessel owner is willing to travel 11 nmi to reach an inlet leading to open ocean, and thus we are requiring educational signs where the inlet is within 11 nmi of areas where the vessels might encounter North Atlantic right whales (i.e., within the known range for the species). Once recreational vessels reach open water, the questionnaire respondents indicated that they would be willing to travel up to 35 nmi offshore (as discussed in Section 2.1 defining the limits of the action area).

Speed restrictions already apply in specific locations, primarily at key port entrances, and in certain times in seasonal management areas. The restrictions apply to all vessels 65 ft and greater in length (73 FR 60173, October 10, 2008), including those that may be stored at structures authorized under this Opinion. NMFS also has already established a Dynamic Management Area program whereby vessels are requested, but not required, to either travel at 10 knots or less or route around locations when certain aggregations of right whales are detected outside seasonal management areas. NMFS also established regulations restricting approaches within 500 yards (460 m) of a right whale, whether by vessel of any size, aircraft or other means, to reduce disturbance and the potential for vessel interaction (62 FR 6729). The educational signs required by PDC A2.2 and PDC A6.3 (and described in the discussion on Activity 2 and Activity 6) are provided as additional educational outreach for vessel operators that transit the same general geographic region as the existing speed restriction and management areas.

Table 3. North Atlantic Right Whale Educational Sign Zone

Name	Latitude	Longitude
Cumberland Sound	30.719564°N	81.449467°W
Nassau Sound	30.516611°N	81.444278°W
St. John's River	30.408053°N	81.399467°W
St Augustine Inlet	29.918411°N	81.288117°W
Matanzas Inlet	29.713831°N	81.227000°W
Ponce Inlet	29.083056°N	80.916494°W
Port Canaveral	28.409306°N	80.586689°W
Sebastian Inlet	27.860833°N	80.446725°W
Fort Pierce Inlet	27.471711°N	80.290378°W
St. Lucie Inlet	27.165567°N	80.157236°W
Jupiter Inlet	26.943950°N	80.070908°W
Riviera Beach	26.772353°N	80.034508°W

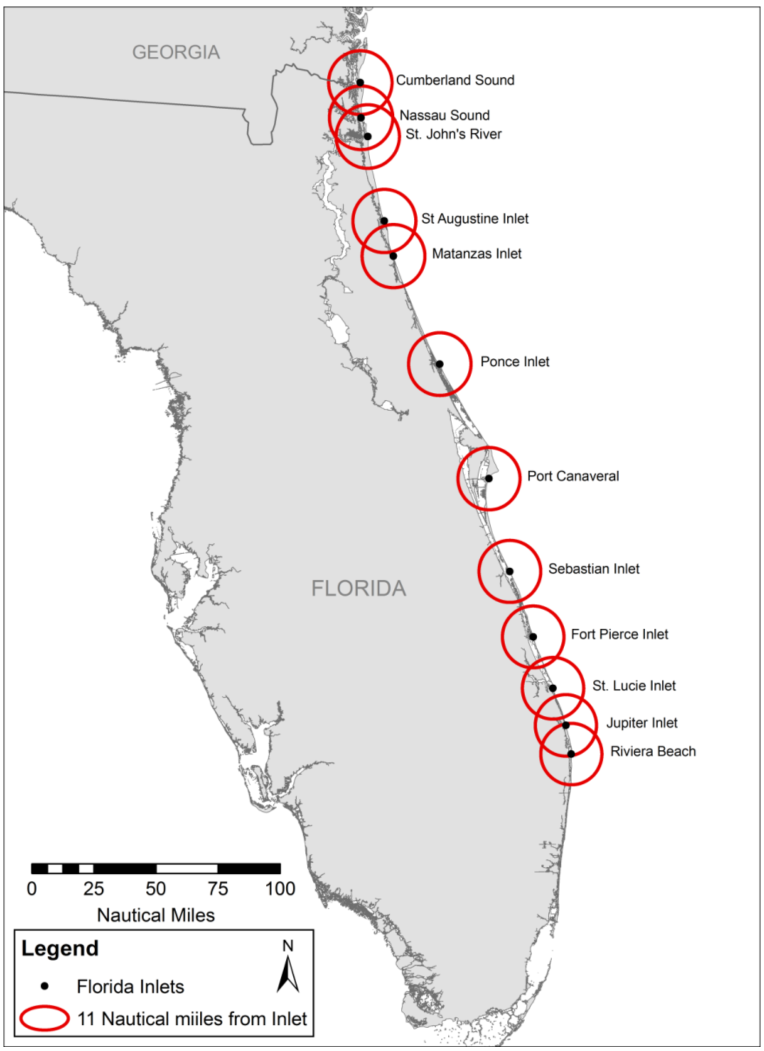

Figure 4. North Atlantic right whale educational sign zones.

2.1.1.5 U.S. Caribbean Sea Turtle Critical Habitat Restriction Zones

In sea turtle critical habitat in the U.S. Caribbean (Figure 5) (i.e., critical habitat for hawksbill, leatherback, and the North Atlantic distinct population segment of green sea turtles (NA DPS), this Opinion only applies to certain activities. This Opinion does not apply to water-management outfall structures (Activity 4, PDC A4.7) and aquatic enhancement (Activity 7, PDC A7.31) occurring in critical habitat for hawksbill, leatherback, and the NA DPS of green sea turtles. Within these areas, the Opinion is limited to the removal, repair, and replacement of existing structures including shoreline stabilization projects (Activity 1, PDC A1.12), boat ramps (Activity 6, PDC A6.11), and transmission and utility lines (Activity 8, PDC A8.11). Pile-supported structures (Activity 2), dredging (Activity 3), scientific survey devices (Activity 5), marine debris removal (Activity 9), and temporary cofferdams (Activity 10) can occur in these areas without limitation.

Sea turtle critical habitat within the U.S. Caribbean encompasses relatively small areas around specific islands or small areas of an island. For example, critical habitat for the NA DPS of green sea turtles encompasses just Culebra Island and the surrounding smaller islands,[6] many of which are under the management of the Culebra National Wildlife Refuge. Hawksbill sea turtle critical habitat includes only Mona Island, and the entire island is under the management of Mona Island Nature Preserve; therefore, common residential projects will not occur in this location. Leatherback sea turtle critical habitat includes only the southwest section of St. Croix Island. As stated above, this Opinion only applies to certain projects occurring in sea turtle critical habitat in the U.S. Caribbean due to the limited spatial size of these critical habitat units and the unique resources in these areas, including nesting beaches. The USACE does not expect to receive many applications for proposed projects in sea turtle critical habitat in the U.S. Caribbean compared to the number of projects addressed in other areas and will consult on those projects not covered under this Opinion separately, as necessary.

[6] On April 6, 2016, NMFS published a final rule listing 11 DPSs of the green sea turtle, including the NA DPS. 81 FR 20058; April 6, 2016. NMFS will issue a rule designating critical habitat for the DPSs in a future rulemaking. In the interim, the existing critical habitat designation (i.e., waters surrounding Culebra Island, Puerto Rico; 63 FR 46693; Sept. 2, 1998) remains in effect for the NA DPS. 81 FR 20058; April 6, 2016.

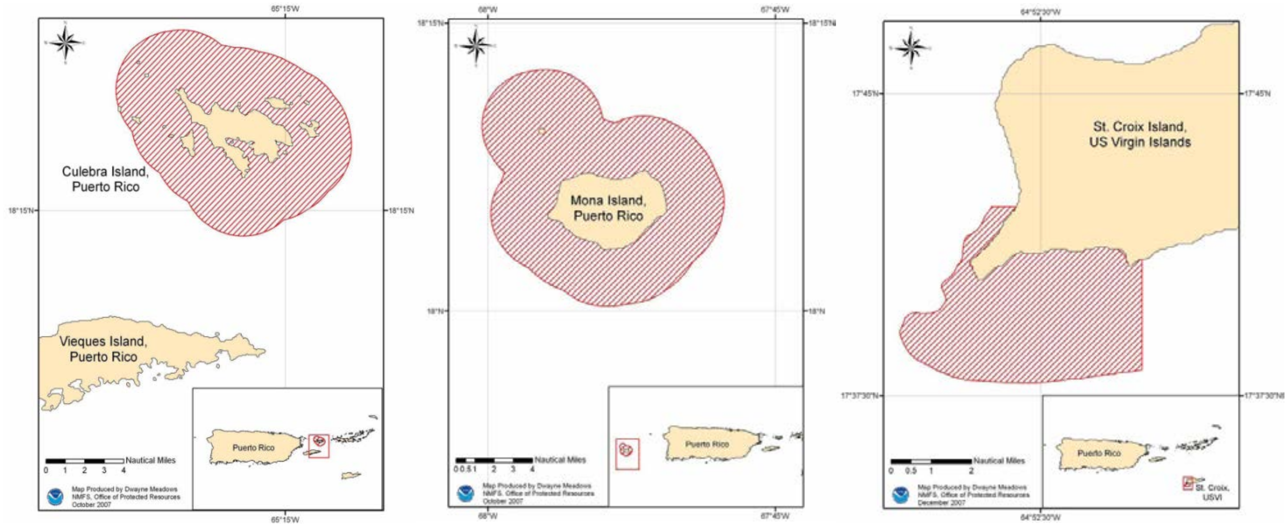

Figure 5. Sea turtle critical habitat in the U.S. Caribbean. NA DPS of green sea turtle critical habitat (left image), hawksbill sea turtle critical habitat (center image), and leatherback sea turtle critical habitat (right image).

2.1.1.6 Bryde's Whale Exclusion Zone

According to the proposed listing rule for Bryde's whale (81 FR 88639, December 8, 2016), sightings of Bryde's whales in the Gulf of Mexico have been concentrated in the De Soto Canyon area, along the continental shelf break between 100 m and 300 m depth. Bryde's whales have been sighted in all seasons within the De Soto Canyon area (Maze-Foley and Mullin 2006; MMIQT 2015; Mullin 2007; Mullin and Hoggard 2000). Consequently, LaBrecque et al. (2015) considered this area, home to the small resident population of Bryde's whale in the northeastern Gulf of Mexico, as a Biologically Important Area (Figure 6). Biologically Important Areas are reproductive areas, feeding areas, migratory corridors, and areas in which small and resident populations are concentrated. Classifying an area as a Biologically Important Area does not have direct or immediate regulatory consequences. Rather, these classifications are intended to provide the best available science to help inform regulatory and management decisions, in order to minimize impacts from anthropogenic activities on marine mammals (LaBrecque et al. 2015). Due to the lack of information available on Bryde's whale and the proposed listing of the species as endangered, this Opinion excludes all activities occurring in the Bryde's whale exclusion zone, defined as the De Soto Canyon at depths from 100-300 m. The USACE will conference or consult on projects in this area on an individual basis, as necessary.

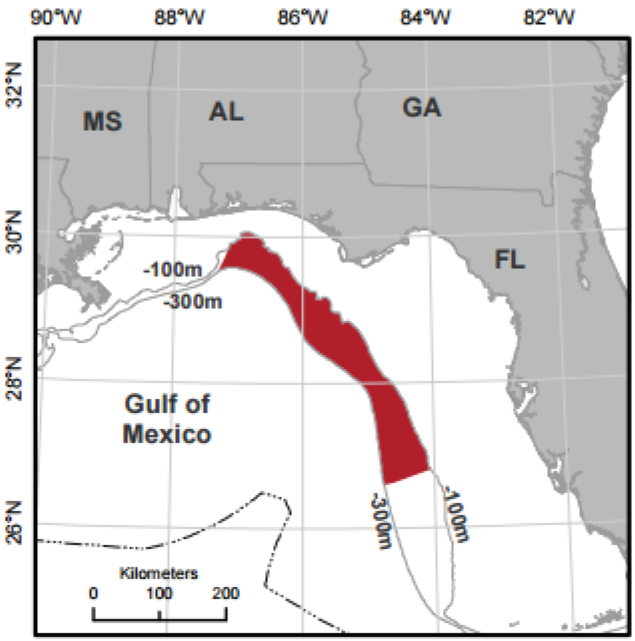

Figure 6. Bryde's whale exclusion zone.

2.1.2 USACE Effect Determinations for Listed Species and Critical Habitat

Based on an evaluation of the 10 categories of activities occurring within the action area, the USACE made the following determinations about the listed species and critical habitat that may be affected by each category of activity (Table 4). The effects determinations in Table 4 represent the USACE's final effects determinations provided for activities in Florida. The USACE initially provided different determinations with its request for consultation, but revised those determinations after completing the PDCs and re-evaluating the effects to species and critical habitat in light of the PDCs.

The USACE later provided effects determinations for the U.S. Caribbean in a request for consultation dated November 14, 2016. In that letter, the USACE stated that the activities on which they were seeking consultation may affect, but are not likely to adversely affect the following species and critical habitat in the U.S. Caribbean: sea turtles (green, Kemp's ridley, leatherback, loggerhead, hawksbill), Nassau grouper, coral (elkhorn, staghorn, mountainous star, lobed star, rough cactus, pillar), whales (blue, fin, humpback, sei, sperm); and critical habitat for sea turtles (green, hawksbill, leatherback, loggerhead) and coral (elkhorn and staghorn). The following species and critical habitat designations have changed since the request for consultation for this Opinion:

- The humpback whales that may occur within the action area are no longer listed under the ESA. On September 8, 2016, we revised the humpback whale listing to identify 14 distinct population segments (DPSs), 1 of which we determined is threatened, 4 of which we determined are endangered, and 9 of which did not warrant listing (81 FR 62259, Publication September 8, 2016). The whales found in the action area belong to the West Indies DPSs, which we found does not warrant listing, and therefore humpback whales are not considered in this Opinion.

- Nassau Grouper, which occurs within the action area, was listed as threatened (81 FR 42268, Publication July 29, 2016) and is therefore included in this Opinion. The USACE sought consultation on the effect of the projects occurring in the U.S. Caribbean on Nassau grouper. Because the species' range includes portions of southern Florida, we are consulting on the effects to the species in both Florida and the U.S. Caribbean.

- Atlantic sturgeon critical habitat was proposed in June 2016 (81 FR 36077, June 3, 2016) and finalized in August 2017 (82 FR 39160, August 17, 2017). The action area includes areas designated as critical habitat, and therefore we are consulting on Atlantic sturgeon critical habitat in this Opinion.

- Bryde's whale, which occurs within the action area, was proposed for listing as an endangered species (81 FR 88639, December 8, 2016) and is therefore included in this Opinion.[7]

- In our listing decision, we explained that the Central and Southwest Atlantic DPSs of scalloped hammerhead shark were thought to occur within the U.S. Caribbean (79 FR 38213, July 3, 2014). In designating critical habitat for this species (80 FR 71774, November 17, 2015), however, we determined that there is no evidence that the scalloped hammerhead shark was, or is, present within the U.S. Caribbean. Since that time, in connection with our consultation on fishery independent monitoring in the U.S. Caribbean, we learned that the species may be present in the U.S. Caribbean, based on a single recorded interaction during hook-and-line fishery monitoring (SER-2009-07541). We have continued to collect information on the species presence in the U.S. Caribbean and are aware of a few additional interactions. Therefore, we believe the species may be present in the U.S. Caribbean portion of the action area and are consulting on potential effects to the species in that area. The Central and Southwest Atlantic DPS for scalloped hammerhead shark is found in waters of the U.S. Caribbean, among other areas, but is not found in waters off of Florida. Therefore, we do not consult on this species in Florida.

[7] NMFS has proposed to list Bryde's whale as endangered (81 FR 88639, December 8, 2016). Although not required by Section 7(a)(4) of the ESA, we are including a conference consultation on the effects of this action on Bryde's whale. This conference consultation will become the final consultation for this species if it is listed as proposed and if there are no changes to this proposed action that cause effects to Bryde's whale that were not considered in this conference consultation.

Table 4. USACE Project Effects Determinations for Activities Occurring in Florida

	Activity	Swimming sea turtles	Smalltooth sawfish	Gulf, shortnose, and Atlantic sturgeon	Johnson's seagrass	*Acropora* corals	Boulder star, mountainous star, lobed star, rough cactus, and pillar coral	North Atlantic right whale	North Atlantic right whale critical habitat	Smalltooth sawfish critical habitat	Gulf sturgeon critical habitat	Johnson's seagrass critical habitat	Loggerhead sea turtle critical habitat	*Acropora* critical habitat
1	Shoreline stabilization	NLAA	NLAA	NLAA	NE	NE	NE	NE	NE	LAA	NLAA	LAA	NE	NE
2	Pile-supported structures	NLAA	NLAA	NLAA	LAA	NE	NE	NLAA	NE	LAA	NLAA	LAA	NE	NE
3	Dredging	NLAA	NLAA	NLAA	LAA	NE	NE	NE	NE	NLAA	NLAA	LAA	NE	NE
4	Water-management outfall structures	NLAA	NLAA	NLAA	NE	NE	NE	NE	NE	LAA	NLAA	LAA	NE	NE
5	Scientific survey devices	NLAA	NLAA	NLAA	NE	NE	NE	NE	NE	LAA	NLAA	LAA	NE	LAA
6	Boat ramps	NLAA	NLAA	NLAA	NE	NE	NE	NLAA	NE	NLAA	LAA	NE	NE	NE
7	Aquatic enhancement	NLAA	NLAA	NLAA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
8	Transmission/ utility lines	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	NLAA	LAA	LAA	NE	NE
9	Marine debris removal	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
10	Temporary platforms, fill, and cofferdams	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	NE	LAA	LAA	NE	NE	NE

NE = no effect; NLAA = may affect, not likely to adversely affect; LAA = may affect, likely to adversely affect

2.1.3 Listed Species and Critical Habitat Occurring within the Action Area

NMFS has determined that the following species (Table 5) and critical habitat (Table 6) occur within the action area and may be affected by activities analyzed under this Opinion.

Table 5. Listed Species NMFS Believes Are Likely to Occur in or near the Action Area

Species	ESA Listing Status	Present in Florida?	Present in U.S. Caribbean?
Sea Turtles			
Green (NA DPS and South Atlantic DPS)	T	P	P
Kemp's ridley	E	P	NP
Leatherback	E	P	P
Loggerhead (Northwest Atlantic Ocean DPS [NWA DPS])	T	P	P
Hawksbill	E	P	P
Fish			
Smalltooth sawfish (U.S. DPS)	E	P	NP
Gulf sturgeon (Atlantic sturgeon, Gulf subspecies)	T	P	NP
Shortnose sturgeon	E	P	NP
Atlantic sturgeon (All DPSs)	T/E[8]	P	NP
Nassau Grouper	T	P	P
Scalloped hammerhead (Central and Southwest Atlantic DPS)	T	NP[9]	P
Invertebrates and Marine Plants			
Elkhorn coral (*Acropora palmata)*	T	P	P
Staghorn coral (*Acropora cervicornis)*	T	P	P
Boulder star coral (*Orbicella franksi)*	T	P	P
Mountainous star coral (*Orbicella faveolata)*	T	P	P
Lobed star coral (*Orbicella annularis)*	T	P	P
Rough cactus coral (*Mycetophyllia ferox)*	T	P	P
Pillar coral (*Dendrogyra cylindrus)*	T	P	P
Johnson's seagrass	T	P	NP

[8] Activities occurring within river and inshore habitats in the action area may affect Atlantic sturgeon from the South Atlantic DPS; however, Atlantic sturgeon from all DPSs may be affected in offshore waters within the action area. The New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are listed as endangered; the Gulf of Maine DPS is listed as threatened. Activities covered under this Opinion cannot occur in-the St Marys River, but can occur in the St. John's River and inland areas where the South Atlantic DPS may be present.

[9] The Central and Southwest Atlantic DPS of scalloped hammerhead shark applies to scalloped hammerhead sharks originating from the Central and Southwest Atlantic Ocean, and includes species found within the waters of the Caribbean Sea, including the U.S. Virgin Islands and Puerto Rico. We identified a population of scalloped hammerhead shark that occurs in waters off of Florida, the Northwest Atlantic and Gulf of Mexico DPS for scalloped hammerhead shark, however, we determined that this DPS did not warrant listing (78 FR 20717, April 5, 2013; 79 FR 38213, July 3, 2014).

Marine Mammals			
North Atlantic right whale	E	P	NP
Blue whale	E	P	P
Fin whale	E	P	P
Sei whale	E	P	P
Sperm whale	E	P	P
Bryde's whale (proposed)	E	P	NP
E = endangered; T = threatened, P = Present, NP = Not Present			

Table 6. Designated Critical Habitat NMFS Believes is In or Near the Action Area

Species	Unit in Florida	Unit in U.S. Caribbean
Smalltooth sawfish	• Charlotte Harbor Estuary (CHEU) • Ten Thousand Islands/ Everglades (TTIEU)	N/A
Gulf sturgeon	Units 9-14[10]	N/A
Loggerhead sea turtle (NWA DPS)	• Nearshore Reproductive Habitat: Units LOGG-N-14 to 32 • Breeding Habitat: Units LOGG-N-17, 19 • Migratory Habitat: Units LOGG-N-17, 18, 19 • *Sargassum* Habitat: Unit LOGG-S-01	N/A
Green sea turtle (NA DPS)	N/A	Culebra Island
Hawksbill sea turtle	N/A	Mona and Monita Island
Leatherback sea turtle	N/A	St Croix Island
Staghorn and elkhorn coral	Area 1: Florida	• Area 2: Puerto Rico and Associated Islands • Area 3: St, John/St. Thomas, U.S. Virgin Islands • Area 4: St. Croix, U.S. Virgin Islands
Johnson's seagrass	Units A-J	N/A
North Atlantic right whale	Unit 2	N/A
Atlantic sturgeon	South Atlantic Unit 7[11]	N/A
N/A = Not applicable		

Table 7 (below) provides a complete list of the essential features/primary constituent elements (PCEs) of each critical habitat unit that occurs in Florida and the U.S. Caribbean. Note that the table below refers to both essential features and PCEs of critical habitat. This duality of terms is

[10] Gulf sturgeon critical habitat is under the joint jurisdiction of the USFWS and NMFS, with the USFWS managing riverine habitat and NMFS managing estuarine and marine habitats. Units 9-14 are the only areas under NMFS's jurisdiction that are found in the action area.

[11] The South Atlantic Unit 7 (St. Marys Unit) includes the St. Marys River in (1) Camden and Charlton Counties in Georgia and (2) Baker and Nassau Counties in Florida.

because the USFWS uses the term "PCE" and NMFS uses "essential features" when describing critical habitat. When we develop a critical habitat rule jointly with USFWS, the term PCE is often used. Recent amendments to the Services' joint regulations implementing the ESA, however, removed reference to "primary constituent elements" (81 FR 7414, Feb. 11, 2016). As we explained in the final rule, removing this phrase is not intended to substantively alter anything about the designation of critical habitat, but to eliminate redundancy in how we describe the physical or biological features. New critical habitat rules will describe physical biological features (PBFs) to help identify habitat essential to the conservation of the species. In this Opinion, we refer to the features as they were described in the rule designating that critical habitat. For example, the Gulf sturgeon critical habitat rule refers to PCEs, and thus we have used that term in the table below. Critical habitat boundary maps are available at http://sero.nmfs.noaa.gov/maps_gis_data/protected_resources/critical_habitat/index.html.

Table 7. Essential Features/PCEs/PBFs of Each Critical Habitat Unit in Florida and the U.S. Caribbean

Smalltooth sawfish (74 FR 45353, Sept. 2, 2009)	The physical and biological features essential to the conservation of the U.S. DPS of smalltooth sawfish, which provide nursery area functions are: red mangroves and shallow euryhaline habitats characterized by water depths between the Mean High Water line and 3 ft (0.9 m) measured at Mean Lower Low Water (MLLW). These features are included in critical habitat within the boundaries of the specific areas in paragraph (b) of this section, except where the features were not physically accessible to sawfish at the time of this designation (September 2009); for example, areas where existing water control structures prevent sawfish passage to habitats beyond the structure.
Gulf sturgeon (68 FR 13370, March 19, 2003)	Based on the best available information, there are 7 PCEs essential for the conservation of the Gulf sturgeon. Only the following 4 are under NMFS's jurisdiction: 1. Abundant prey items within estuarine and marine habitats and substrates for juvenile, subadult, and adult life stages; 2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; 3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; and 4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., a river unobstructed by any permanent structure, or a dammed river that still allows for passage).

Loggerhead sea turtle (79 FR 39855, July 10, 2014)	1. Nearshore reproductive habitat: The PBF of nearshore reproductive habitat 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 PCEs support this habitat: (i) Nearshore waters directly off the highest density nesting beaches and their adjacent beaches, as identified in 50 CFR 17.95(c), to 1.6 kilometer (km) offshore; (ii) Waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and (iii) 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. 2. Winter areas: Florida does not contain any winter areas. 3. Breeding areas: the PBF of concentrated breeding habitat as those sites with high densities of both male and female adult individuals during the breeding season. PCEs that support this habitat are the following: (i) High densities of reproductive male and female loggerheads; (ii) Proximity to primary Florida migratory corridor; and (iii) Proximity to Florida nesting grounds. 4. Constricted migratory habitat: the PBF of constricted migratory habitat as high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side. PCEs that support this habitat are the following: (i) Constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways; and (ii) Passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas. 5. *Sargassum* habitat: the PBF of loggerhead *Sargassum* habitat as developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum.* PCEs that support this habitat are the following: (i) Convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads; (ii) *Sargassum* in concentrations that support adequate prey abundance and cover; (iii) Available prey and other material associated with *Sargassum* habitat including, but not limited to, plants and cyanobacteria and animals native to the *Sargassum* community such as hydroids and copepods; and (iv) Sufficient water depth and proximity to available currents to ensure offshore transport (out of the surf zone), and foraging and cover requirements by *Sargassum* for post-hatchling loggerheads, i.e., > 10-m depth.

Acropora (Staghorn and elkhorn coral) (73 FR 72210, Nov. 26, 2008)	The physical feature essential to the conservation of elkhorn and staghorn corals is: substrate of suitable quality and availability to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. "Substrate of suitable quality and availability" is defined as natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover.
Johnson's seagrass (65 FR 17786, April 5, 2000)	Based on the best available information, general physical and biological features of the critical habitat areas include adequate water quality, salinity levels, water transparency, and stable, unconsolidated sediments that are free from physical disturbance.
North Atlantic right whale (81 FR 4837, Jan. 27, 2016)	Critical habitat includes 2 areas (Units) located in the Gulf of Maine and Georges Bank Region (Unit 1) and off the coast of North Carolina, South Carolina, Georgia and Florida (Unit 2). Only Unit 2 occurs within the action area. The physical features essential to the conservation of the North Atlantic right whale, which provide calving area functions in Unit 2, are: 1. Sea surface conditions associated with Force 4 or less on the Beaufort Scale 2. Sea surface temperatures of 7°C to 17°C 3. Water depths of 20-92 ft (6- 28 m), where these features simultaneously co-occur over contiguous areas of at least 231 squared nautical miles (nmi^2) of ocean waters during the months of November through April. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves.
Atlantic sturgeon (82 FR 39160, August 17, 2017)	The physical features essential for the conservation of Atlantic sturgeon belonging to the Carolina and South Atlantic DPSs are those habitat components that support successful reproduction and recruitment. These are: 1. Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0-0.5 parts per thousand range) for settlement of fertilized eggs and refuge, growth, and development of early life stages; 2. Aquatic habitat inclusive of waters with a gradual downstream gradient of 0.5 up to as high as 30 parts per thousand and soft substrate (e.g., sand, mud) between the river mouth and spawning sites for juvenile foraging and physiological development; 3. Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support: (i) Unimpeded movement of adults to and from spawning sites; (ii) Seasonal and physiologically dependent movement of juvenile

	Atlantic sturgeon to appropriate salinity zones within the river estuary; and (iii) Staging, resting, or holding of subadults or spawning condition adults. Water depths in main river channels must also be deep enough (at least 1.2 meters) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river; 4. Water quality conditions, especially in the bottom meter of the water column, with temperature and oxygen values that support: (i) Spawning; (ii) Annual and inter-annual adult, subadult, larval, and juvenile survival; and (iii) Larval, juvenile, and subadult growth, development, and recruitment. Appropriate temperature and oxygen values will vary interdependently, and depending on salinity in a particular habitat. For example, 6.0 mg/L dissolved oxygen or greater likely supports juvenile rearing habitat, whereas dissolved oxygen less than 5.0 mg/L for longer than 30 days is less likely to support rearing when water temperature is greater than 25°C. In temperatures greater than 26°C, dissolved oxygen greater than 4.3 mg/L is needed to protect survival and growth. Temperatures of 13 to 26 °C likely support spawning habitat.
Green sea turtle (63 FR 46693, Sept. 2,1998)	Critical habitat for the green sea turtle is designated in the waters surrounding the island of Culebra, Puerto Rico, from the mean high water line (MHWL) seaward to 3 nmi. These waters include Culebra's outlying Keys, including Cayo Norte, Cayo Ballena, Cayos Geniquí, Isla Culebrita, Arrecife Culebrita, Cayo de Luís Peña, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo Botijuela, Alcarraza, Los Gemelos, and Piedra Steven. At the time of designation, essential features to critical habitat were not precisely defined; however, the critical habitat was designated to provide protection for important developmental and resting habitats. Juvenile and adult green sea turtles depend on seagrasses as the principal dietary component for foraging. In addition, coral reefs and other topographic features within the waters around Culebra Island and surrounding islands and cays provide green turtles with shelter during interforaging periods that serve as refuge from predators. On April 6, 2016, NMFS published a final rule listing 11 DPSs of the green sea turtle, including the NA DPS. 81 FR 20058; April 6, 2016. NMFS will issue a rule designating critical habitat for the DPSs in a future rulemaking. In the interim, the existing critical habitat designation described herein remains in effect for the NA DPS of green sea turtles.
Hawksbill sea turtles (63 FR 46693,	Critical habitat for the hawksbill sea turtle has been designated in the waters surrounding the islands of Mona and Monito, Puerto Rico, from the MHWL seaward to 3 nmi. At the time of designation, essential features to critical

Sept. 2, 1998)	habitat were not precisely defined; however, the critical habitat was designated to provide protection for important developmental and resting habitats. Hawksbill sea turtles depend on sponges as their principal dietary component and healthy coral reefs for foraging and shelter habitats.
Leatherback sea turtles (44 FR 8491, March 23, 1979)	Critical habitat for the leatherback sea turtle has been designated in the waters adjacent to Sandy Point on the southwest corner of St. Croix, U.S. Virgin Islands, in waters from the 100-fathom curve shoreward to the level of mean high tide, with boundaries at 17°42′12"N and 64°50′00″W. At the time of designation, essential features to critical habitat were not precisely defined; however, critical habitat for leatherback sea turtles was designated to provide protection to sea turtles using these waters for courting, breeding, and as access to and from nesting areas on Sandy Point Beach, St. Croix, U.S. Virgin Islands.

2.2 Activities Analyzed, Project Design Criteria, and Potential Routes of Effect

In this section of the Opinion, we describe the categories of activities under consultation, the PDCs that each activity must meet to be covered under this Opinion, and the expected effects of each category of activities on ESA-listed species and designated critical habitat. In particular, for each category of activity covered by this Opinion, we will provide the following information:

1. Activity Description: A general description of how the activity typically is implemented with sample photos and drawings. We are providing a general overview of the typical implementation for context; the installation materials, methods, and locations are limited by the PDCs.

2. PDCs: A description of the non-discretionary PDCs applicable to all projects covered under this Opinion. The general PDCs ensure that the covered activities meet certain thresholds designed to avoid or minimize impacts on ESA-listed species and critical habitat.

   In addition to the general PDCs, each of the 10 categories of covered activities is subject to additional activity-specific PDCs. Like the general PDCs, activity-specific PDCs are non-discretionary requirements for coverage under the Opinion that avoid or minimize the potential effects of permitted activities on ESA-listed species and designated critical habitat.

   All PDCs were developed based on information from the USACE's past permitting practices and review of consultations on USACE-authorized in-water construction activities in Florida and the U.S. Caribbean. The activity-specific PDCs are typical of measures used to protect ESA listed species and designated critical habitat and are substantially similar to the PDCs that NMFS included in other programmatic consultations with the USACE in the last 5 years including the SWPBO, 12 SAJ General Permit Programmatic, SAJ-42, SAJ-82, and SPGP IV-R1.

   In addition, PDCs designed to avoid or minimize effects on critical habitat are provided at the end of each category of activity when additional protections, beyond the general and activity-specific PDCs, are required to avoid or minimize effects on a particular critical habitat unit.

Note: The critical habitat-protective PDCs are in addition to those applicable to the category of activity and, in some cases, supersede all other applicable PDCs, for example, if they are in conflict (i.e., more restrictive) than those otherwise applicable to that category of activity.

3. Assumptions: A description of the assumptions that the USACE used to estimate how each category of activity would affect ESA-listed species and designated critical habitat.

   The USACE provided a series of assumptions regarding the location, number, magnitude, and other pertinent facts about the covered activities that could be used to estimate the effects of those activities on ESA-listed species or designated critical habitat. For example, the USACE estimated the number of projects expected to occur in critical habitat units as an activity's anticipated effects may vary if the activity occurs within a particular critical habitat unit. In developing these assumptions, the USACE looked to its past permits and previous analyses of how the permitted activities affected ESA-listed species and designated critical habitat.

   The USACE also estimated the number of projects within each of the 10 categories of activities covered under this Opinion that it expects to authorize per 5-year period in both Florida and the U.S. Caribbean, based on number of similar projects that it authorized in the past in reliance on prior programmatic Opinions (and, for a small subset as applicable, authorizations associated with non-programmatic consultations). The USACE then applied an increase for Florida based on forecasts of population growth (assuming that this will result in authorizations for new development), and based on its assumption that it would receive increasing requests to improve and repair infrastructure as a result of past population growth. The USACE's estimates recognize the cyclic nature of when it will receive permit applications, and assume that economic recovery will continue. The USACE applied a similar increase for the U.S. Caribbean despite current economic conditions because of variable nature of development in that area and the great potential for increasing development. This may overestimate the amount of expected development in the U.S. Caribbean, but will ensure that we have evaluated the potential worst-case (highest development) scenario.

4. Potential Routes of Effect: A description of the ways in which each category of activity may potentially affect ESA-listed species and designated critical habitat.

   In the sections entitled Potential Routes of Effect, we analyze the potential routes of effect from each category of activity covered under this Opinion on each of the listed species (Table 5) and critical habitat units (Table 6) likely to occur in or near the action area (see Section 2.1). For each category of activity, we provide the rationale for our effects analysis in a stepwise approach based on each species and/or critical habitat that may be affected. Activities that we believe are likely to adversely affect species or critical habitats listed in Tables 5 and 6 are discussed further in Section 3 and throughout the remainder of the Opinion.

Table 8. Projected Number of Authorizations Occurring in Certain Critical Habitat Units per Activity for 5-year Period

	Category of Activity	Smalltooth sawfish critical habitat	Gulf sturgeon critical habitat	Johnson's seagrass critical habitat	*Acropora* critical habitat	North Atlantic right whale critical habitat	Loggerhead sea turtle critical habitat	Green sea turtle critical habitat	Hawksbill sea turtle critical habitat	Leatherback sea turtle critical habitat	Total outside of critical habitat	Total (in and outside of) critical habitat
1	Shoreline stabilization	1,012	165	306	116	0	135	4	0	2	5,363	7,102
2	Pile-supported structures	4,125	724	491	301	85	503	76	5	7	27,257	33,574
3	Dredging	150	51	31	64	7	124	2	0	2	890	1,320
4	Water-management outfall structures	19	24	7	28	0	50	0	0	0	2	129
5	Scientific survey devices	2	2	17	7	2	2	4	1	0	52	89
6	Boat ramps	22	30	2	145	7	138	4	1	1	359	708
7	Aquatic enhancement	46	91	7	68	0	7	0	0	0	48	267
8	Transmission/ utility lines	9	28	12	12	0	33	5	0	2	187	288
9	Marine debris removal	11	7	11	8	2	2	4	1	3	6	54
10	Temporary platforms, access fill, and cofferdams	31	12	12	1	0	3	4	0	2	51	116
	Total	5,426	1,134	894	749	102	997	103	8	19	34,215	43,646

General PDCs Applicable to All Projects:

AP.1. The applicant must agree to adhere to PDCs for *In-Water Activities* (provided below).

AP.2. All projects involving the installation of piles or sheet piles shall follow the PDCs for *In-Water Noise from Pile and Sheet Pile Installation* (Section 2.2). This Opinion does not cover projects that use seismic surveys, low frequency sonar, explosions, and seismic air guns.

AP.3. All projects proposed in or near areas with mangroves, seagrasses, corals, or hard bottom habitat must refer to PDCs for *Mangroves, Seagrasses, Corals, and Hard Bottom for All Projects* (provided below) to determine whether the project is covered under the Opinion and, if it is covered, to ensure it is sited, designated, and implemented following all of the PDCs in that section.

AP.4. For every project, the USACE must determine if the project is located within:

- Smalltooth sawfish critical habitat limited exclusion zones (Section 2.1.1.1)
- Gulf sturgeon critical habitat migratory restriction zones (Section 2.1.1.2)
- Atlantic sturgeon critical habitat exclusion zone (St. Marys River) (Section 2.1.1.3)
- North Atlantic right whale educational sign zones (Section 2.1.1.4)
- U.S. Caribbean sea turtle critical habitat restriction zones (Section 2.1.1.5)
- Bryde's whale exclusion zone (Section 2.1.1.6)

Where the activity is excluded from the Opinion within a particular zone, the application must be processed under a separate consultation. Where additional restrictions apply to activities within that zone, the USACE or other authorizing entity must ensure that the project meets the requirements for that zone.

AP.5. This Opinion only covers new construction (i.e., installation, repair, replacement) and does not apply to after-the-fact consultations or enforcement actions handled by the USACE.

AP.6. All activities must be completed during daylight hours.

PDCs for In-Water Activities

For an activity to be covered under this Opinion, the USACE authorization must include the following conditions. Failure to comply with these conditions could result in enforcement action by the USACE and/or NMFS.

AP.7. **Education and Observation**: The permittee must ensure that all personnel associated with the project are instructed about the potential presence of species protected under the ESA and the Marine Mammal Protection Act (MMPA). All on-site project personnel are responsible for observing water-related activities for the presence of protected species. All personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing ESA-listed species or marine mammals. To determine which species may be found in the project area, please review the relevant Protected Species List at:
http://sero.nmfs.noaa.gov/protected_resources/section_7/threatened_endangered/index.html

AP.8. **Reporting** of interactions with protected species:

a) Any collision(s) with and/or injury to any sea turtle, sawfish, whale, or sturgeon occurring during the construction of a project, shall be reported immediately to NMFS's Protected Resources Division (PRD) at (1-727-824-5312) or by email to takereport.nmfsser@noaa.gov and SAJ-RD-Enforcement@usace.army.mil. .
b) Smalltooth sawfish: Report sightings to 1-844-SAWFISH or email Sawfish@MyFWC.com
c) Sturgeon: Report dead sturgeon to 1-844-STURG 911 (1-844-788-7491) or email nmfs.ser.sturgeonnetwork@noaa.gov
d) Sea turtles and marine mammals: Report stranded, injured, or dead animals to 1-877-WHALE HELP (1-877-942-5343).
e) North Atlantic right whale: Report injured, dead, or entangled right whales to the USCG via VHF Channel 16.

AP.9. **Vessel Traffic and Construction Equipment**: All vessel operators must watch for and avoid collision with species protected under the ESA and MMPA. Vessel operators must avoid potential interactions with protected species and operate in accordance with the following protective measures:

a) *Construction Equipment*:
   i) All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while operating in water depths where the draft of the vessel provides less than a 4-foot (ft) clearance from the bottom, and in all depths after a protected species has been observed in and has departed the area.
   ii) All vessels will follow marked channels and/or routes using the maximum water depth whenever possible.
   iii) Operation of any mechanical construction equipment, including vessels, shall cease immediately if a listed species is observed within a 50-ft radius of construction equipment and shall not resume until the species has departed the area of its own volition.

iv) If the detection of species is not possible during certain weather conditions (e.g., fog, rain, wind), then in-water operations will cease until weather conditions improve and detection is again feasible.

b) *All Vessels*:

i) Sea turtles: Maintain a minimum distance of 150 ft.

ii) North Atlantic right whale: Maintain a minimum 1,500-ft distance (500 yards).

iii) Vessels 65 ft in length or longer must comply with the Right Whale Ship Strike Reduction Rule (50 CFR 224.105) which includes reducing speeds to 10 knots or less in Seasonal Management Areas (http://www.fisheries.noaa.gov/pr/shipstrike/).

iv) Mariners shall check various communication media for general information regarding avoiding ship strikes and specific information regarding right whale sightings in the area. These include NOAA weather radio, USCG NAVTEX broadcasts, and Notices to Mariners.

v) Marine mammals (i.e., dolphins, whales [other than North Atlantic right whales], and porpoises): Maintain a minimum distance of 300 ft.

vi) When these animals are sighted while the vessel is underway (e.g., bow-riding), attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until they have left the area.

vii) Reduce speed to 10 knots or less when mother/calf pairs or groups of marine mammals are observed, when safety permits.

AP.10. **Turbidity Control Measures during Construction:** Turbidity must be monitored and controlled. Prior to initiating any of the work covered under this Opinion, the Permittee shall install turbidity curtains as described below. In some instances, the use of turbidity curtains may be waived by the USACE project manager if the project is deemed too minimal to generate turbidity (e.g., certain ATON installation, scientific survey device placement, marine debris removal) or if the current is too strong for the curtains to stay in place. Turbidity curtains specifications:

a) Install floating turbidity barriers with weighted skirts that extend to within 1 ft of the bottom around all work areas that are in, or adjacent to, surface waters.

b) Use these turbidity barriers throughout construction to control erosion and siltation and ensure that turbidity levels within the project area do not exceed background conditions.

c) Position turbidity barriers in a way that does not block species' entry to or exit from designated critical habitat.

d) Monitor and maintain turbidity barriers in place until the authorized work has been completed and the water quality in the project area has returned to background conditions.

e) In the range of ESA-listed corals (St. Lucie Inlet, Martin County south to the Dry Tortugas and the U.S. Caribbean) and Johnson's seagrass (Turkey Creek/Palm Bay south to central Biscayne Bay in the lagoon systems on the east coast of Florida):

- Projects that include upland earth moving (e.g., grading to install a building or parking lot associated with a dock and seawall project), must install sediment control barriers to prevent any upland sediments from reaching estuarine or marine waters.
- The turbidity curtain requirement cannot be waived for any project that moves or removes sediment (e.g., dredging, auger to create a pile, trenching to install a cable

line). If turbidity curtains are not feasible in an area based on site conditions such as water current, high wave action, or stormy conditions, the project must undergo individual Section 7 consultation and is not covered under this Programmatic Opinion.

AP.11. **Entanglement:** All turbidity curtains and other in-water equipment must be properly secured with materials that reduce the risk of entanglement of marine species (described below). Turbidity curtains likewise must be made of materials that reduce the risk of entanglement of marine species.

a) In-water lines (rope, chain, and cable, including the lines to secure turbidity curtains) must be stiff, taut, and non-looping. Examples of such lines are heavy metal chains or heavy cables that do not readily loop and tangle. Flexible in-water lines, such as nylon rope or any lines that could loop or tangle, must be enclosed in a plastic or rubber sleeve/tube to add rigidity and prevent the line from looping and tangling. In all instances, no excess line is allowed in the water.
b) Turbidity curtains and other in-water equipment must be placed in a manner that does not entrap species within the construction area or block access for them to navigate around the construction area.

PDCs for Mangroves, Seagrasses, Corals and Hard Bottom for All Projects

Note: **For projects authorized in reliance on this Opinion only**, the PDCs below supercede any other guidance documents otherwise applicable to reduce or avoid impacts to mangroves, seagrasses, and corals. This includes the NMFS's *Construction Guidelines in Florida for Minor Piling-Supported Structures Constructed in or over Submerged Aquatic Vegetation, Marsh, or Mangrove Habitat* dated August 2001, and NMFS's *Key for Construction Conditions for Docks or Other Minor Structures Constructed in or over Johnson's Seagrass* (*Halophila johnsonii*), dated October 2002. NMFS may still apply these guidance documents in other consultations, including consultations on Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act, as appropriate.

AP.12. **Mangroves**

- To qualify for coverage under this Opinion, all projects must be sited and designed to avoid or minimize impacts to mangroves.

- Mangrove removal must be conductedin a manner that avoids any unnecessary removal and is limited to the following instances:
  - Removal to install up to a 4-ft-wide walkway for a dock.
  - Removal to install up to an 8-ft-wide walkway for public docks, where the walkway is necessary to address compliance with the Americans with Disability Act (ADA).
  - Removal to install culverts necessary to improve water quality or restore hydrology between 2 water bodies. Such mangrove removal is limited to a maximum of 20 linear feet (lin ft) of shoreline per culvert opening.
  - Removal of mangroves above mean high water (MHW) provided that the tree does not have any prop roots that extend into the water below the MHWL.

- Mangrove Trimming. Mangrove trimming is regulated by FDEP, Puerto Rico Department of Natural and Environmental Resources, and U.S. Virgin Islands Department of Planning and Natural Resources. Consistent with those authorities, when used in this Opinion, mangrove trimming refers to the removal (using hand equipment such as chain saws and/or machetes) of lateral branches (i.e., no alteration of the trunk of the tree) in a manner that ensures survival of the tree. This Opinion does not limit or supersede any restrictions on mangrove removal required under any federal, state, or local law.
    - This Opinion only covers projects with associated mangrove trimming occurring waterward of MHW if such trimming (1) occurs within the area where the authorized structures are placed or will be placed (e.g., removal of branches that overhang a dock), (2) is necessary to provide temporary construction access, and (3) is conducted in a manner that avoids any unnecessary trimming.
    - The Opinion does not apply to projects proposing to remove red mangrove props roots waterward of MHW, except for removal to install the dock walkways, as described above (up to a 4-ft walkway and up to a 8-ft ADA compliant walkway) and to install culverts necessary to improve water quality or restore hydrology between 2 water bodies.

AP.13. **<u>Seagrass</u>**:

- Pile-supported structures must follow the PDCs for *Docks or Other Minor Structures* (PDC A2.17**,** Section 2.2.2)

Johnson's seagrass:

- This Opinion does not apply to projects where Johnson's seagrass is found within the project footprint except for:
    - Installation of pile-supported structures that meet the PDCs for *Docks or Other Minor Structures* (PDC A2.17, Section 2.2.2).
    - Maintenance dredging of previously authorized areas. This is limited to the removal of no more than 0.1 acre (ac) (4,356 ft^2) of Johnson's seagrass per year (Activity 3; see Section 2.2.3)
    - Transmission/utility line repairs within the same footprint of the lines being repaired (Activity 8; see Section 2.2.8).

Non-listed seagrasses:

- All impacts to non-ESA listed native, non-invasive seagrasses should be avoided and minimized to the extent practicable.

- This Opinion does not apply to projects located within the geographic boundary of U.S. Caribbean sea turtle critical habitat (hawksbill, leatherback, and the NA DPS of green sea turtle critical habitat identified in Section 2.1.1.5) if non-ESA listed, native, non-invasive seagrasses are found within the project footprint.

AP.14. Coral and Hard Bottom Habitat

- This Opinion does not apply to projects that may affect, directly or indirectly, ESA-listed corals.

- Projects occurring within in the Florida Keys National Marine Sanctuary (FKNMS) may require separate consultation or authorization from NOAA's FKNMS. Projects authorized to occur in the FKNMS shall comply with any measures NOAA FKNMS has developed to avoid, minimize, and/or mitigate any effects on non-listed corals. For projects occurring outside of the FKNMS, if non-listed corals are found within the project footprint, we recommend relocating all non-listed corals, when possible, in a manner that is protective of the corals.

- This Opinion does not apply to projects where hard bottom habitat is found within the project footprint, except for the temporary placement (up to 24 months) of scientific survey devices (Activity 5) that have a footprint of less than 1 square foot (ft^2) per device and are installed in a manner that does not permanently alter the hardbottom (e.g., the devices are not installed by drilling). For this Opinion, we define hard bottom in 2 ways:
  - Natural consolidated hard substrate that is suitable to support corals, coral larval settlement, reattachment and recruitment of asexual coral fragments. These areas of hard bottom or dead coral skeleton must be free from fleshy or turf macroalgae cover and sediment cover.
  - Nearshore and surf-zone, low-profile hard bottom outcroppings (e.g., worm-rock reef [sabellariid worm reefs] and eolianite, granodiorite). This habitat can be persistent or ephemeral, cycling through periods of exposure and cover by sand. The range of this hard bottom habitat extends along the southeastern coast of Florida from Cape Canaveral to Miami-Dade County and in the U.S. Caribbean. It is an important developmental habitat for juvenile hawksbill and green sea turtles, which use it for both foraging and refuge.

Given implementation of the general PDCs provided above, which apply to each of the 10 categories of activities covered under the Opinion, and some of the project-specific PDCs below, we are able to analyze how the covered activities may affect certain ESA-listed species and designated critical habitat. Since this analysis is completed up front, these species and critical habitats are not analyzed further in the Opinion unless stated otherwise.

Determinations by Species for Specific Categories of Activities
Based on our knowledge of the species presence (or absence) within the action area and the general PDCs (as well as some activity-specific PDCs discussed later in the Opinion), we believe the following ESA-listed species either will not be affected or may be affected, but are not likely to be adversely affected by some or all of the activities analyzed under this Opinion.

Corals
ESA-listed corals (elkhorn, staghorn, boulder star, mountainous star, lobed star, rough cactus, and pillar corals) may be found within the action area, from St. Lucie Inlet, Martin County south to the Dry Tortugas and in the U.S. Caribbean. In general, the types of activities evaluated in the

Opinion could affect ESA-listed corals through physical damage or removal of coral, or from turbidity, sedimentation, and changes in water quality. However, this Opinion does not apply to projects that could directly or indirectly affect ESA-listed corals (PDC AP.14). Therefore, if a project may affect ESA listed corals, a separate ESA consultation would be required. We note that the Opinion does not apply to dredging projects that penetrate or remove underlying hard substrate (e.g., bedrock, hardbottom) in *Acropora* critical habitat using any methods including blasting or fracturing since those methods may result in increased fine sediment that does not settle easily and could result in increased damage to corals (PDC A3.7).

Johnson's seagrass

Three activities covered under this Opinion may affect Johnson's seagrass through removal, burial, shading, or reduced water quality. In particular, we believe Johnson's seagrass may be adversely affected by: (1) installation of pile-supported structures (Activity 2); (2) maintenance dredging of previously authorized locations (Activity 3); and (3) utility line repairs (Activity 8). Effects to Johnson's seagrass will be evaluated in each of the sections describing those categories of activities.

We believe the remaining 7 categories of covered activities (Activities 1, 4, 5, 6, 7, 9, and 10) will not affect Johnson's seagrass by covering or removing the species since PDC AP.13 excludes projects from this Opinion if Johnson's seagrass occurs within the project footprint. Therefore, we believe none of these 7 categories of activities will remove or shade Johnson's seagrass.

We believe that turbidity and sedimentation generated during in-water construction associated with Activities 1, 4, 6, and 10 may affect, but is not likely to adversely affect Johnson's seagrass near the project but outside the project footprint by burying or covering it in sedimentation. The effects of such turbidity and sedimentation are discussed below in the turbidity section. For this reason, we note these activities are "not likely to adversely affect" Johnson's seagrass in the table below. Activities 5, 7, and 9 do not generate turbidity. Therefore, we believe these activities will not affect the species via turbidity or otherwise given PDC AP.13.

In addition, changes in water quality from water discharged from water-management outfall structures (Activity 4) may affect Johnson's seagrass. Specific PDCs associated with Activity 4 (Section 2.2.4) apply in Johnson's seagrass critical habitat for the installation or repair of water-management outfall structures. For example:

- PDC A4.3 states that all outfall structures covered under this Opinion must be designed and implemented to prevent erosion and scouring so that these outfall structures do not generate sedimentation and turbidity through erosion after the structure is placed and operational.

- PDC A4.2 limits coverage under this Opinion to activities associated with outfall structures when the effluent from the outfall is authorized, conditionally authorized, specifically exempted, or in compliance with regulations issued under the National Pollutant Discharge Elimination System Program (CWA Section 402). Since seagrasses are sensitive to pollution in the water, this PDC requires project compliance with water quality regulations for the water discharged from the outfall structures to limit pollution and make it extremely unlikely that corals will be affected by pollution from these outfalls.

- In Johnson's seagrass critical habitat, additional restrictions apply to the water discharged from the water-management outfall structure. Specifically, the PDC requires that the outfall also contain an in-line treatment structure to reduce water velocities, sedimentation, nutrients, and pollutants discharged from the outfall structure into marine waters. These treatment structures may include nutrient baffle structures, filters, natural bio filters, and low impact development such as infiltration basins and trenches or vegetative swales. The additional measures in PDC A4.3 reduce the risk of sedimentation and pollutants entering the marine environment from the water discharged from water-management outfall structures in areas that could support Johnson's seagrass (i.e., in Johnson's seagrass critical habitat).

Based on the PDC restrictions to the water discharged from water-management outfall structures, we believe that the risk of sedimentation, turbidity, and pollution harming Johnson's seagrass in or around new outfall structures is extremely low and the effect is discountable.

Finally, restoration of an area to support seagrasses, including filling blow holes and leveling sediments to the surrounding elevation (Activity 7), and marine debris removal (Activity 9) may have a beneficial effect on Johnson's seagrass by providing additional area for the species to recruit to. These benefits are not certain, and depend on the proximity of the species to the restored area.

Based on the restrictions in the general PDCs described above, as well as some activity-specific PDCs associated with Activity 4, we have made the following effects determinations, as summarized below in Table 9.

Table 9. NMFS Effects Determinations for Johnson's Seagrass

	Activity	**NMFS Determination**
1	Shoreline stabilization	NLAA
2	Pile-supported structures	LAA
3	Dredging	LAA
4	Water-management outfall structures	NLAA
5	Scientific survey devices	NE
6	Boat ramps	NLAA
7	Aquatic enhancement	NE
8	Transmission/ utility lines	LAA
9	Marine debris removal	NE
10	Temporary platforms, fill, and cofferdams	NLAA

Nassau Grouper

We believe the current functional range of Nassau Grouper is limited to the Florida Keys and the U.S. Caribbean. Below, we discuss the potential effects to Nassau grouper based on activities in each of these areas.

<u>In the U.S. Caribbean</u>: We expect all life stages of Nassau grouper may be present throughout Puerto Rico and the U.S. Virgin Islands. Nassau grouper spawn in specific aggregation sites in in the Caribbean. They start out as planktonic larvae that transition from oceanic open water

environments to bottom dwelling juveniles living in nearshore areas. The preferred habitat of juvenile Nassau grouper is believed to be macroalgal clumps (primarily *Laurencia*), seagrass beds, and corals (particularly *Porites* spp.), though they have also been found in mangrove lined lagoons or creeks and in several microhabitats, including empty queen conch shells, debris adjacent to seagrass, and rubble mounds. As Nassau grouper transition to larger juveniles and adults, they shift to nearshore reef habitats and then progressively move further offshore from fore reef habitat to deeper water reefs, crevices, caves, and ledges up to 130 m deep.

In order to determine the effects to Nassau grouper from the 10 categories of activities covered under this Opinion, we must consider the life stage of these fish and the habitat preferences based on sizes discussed above. We believe the activities analyzed in this Opinion that could affect small juvenile Nassau Grouper in the U.S. Caribbean are those activities that would place materials on or remove macroalgae (Activities 1-10), seagrasses (all activities except Activity 9), and mangroves (Activities 2 and 4). We believe these effects will be insignificant since Nassau grouper are unspecialized feeders with a wide array of foraging and refuge options and because they are mobile species that will be able to move away from these areas during construction and forage or seek refuge in other surrounding areas. Specifically,

- Macroalgae and seagrasses are prevalent foraging resources found throughout the U.S Caribbean. Macroalgae is not protected under the ESA or this Opinion and may be affected by the activities under this Opinion. However, the small losses of macroalgae from nearshore projects covered under this Opinion are not expected to significantly diminish the availability of this foraging habitat for Nassau Grouper, and thus we expect any effect on the species to be insignificant. All of the covered activities (except for marine debris removal under Activity 9) may affect seagrasses. However, PDC AP.13 limits seagrass impacts by recommending that all projects be positioned to avoid and minimize impacts to non-ESA listed, native, non-invasive seagrasses to the extent practicable. Based on this PDC, we do not expect seagrass resources to be substantially diminished, and we do not expect any impacts to these resources to have a measureable effect on the species. Thus, we expect any impacts to both microalgae and seagrasses to have an insignificant effect on the species.

- Pile-supported structures (Activity 2) and water-management outfall structures (Activity 4) may affect mangroves. However, under PDC AP.12, all projects must be sited and designed to avoid or minimize impacts to mangroves, and all removal of mangroves shall be conducted in a manner that avoids any unnecessary removal. The Opinion does not cover activities involving the removal of red mangrove props roots below MHW, except for removal to install the dock walkways defined above (4-ft walkway and 8-ft ADA compliant walkway) and to install culverts necessary to improve water quality or restore hydrology between 2 water bodies. The small losses of mangroves from nearshore projects covered under this Opinion are not expected to significantly diminish the availability of this refuge habitat for Nassau Grouper, and we do expect any impacts to this resource to have a measureable effect on the species, and any effect will be insignificant.

As small juvenile Nassau grouper transition to the larger juveniles and adult size class, their habitat preference shifts to primarily hardbottom, coral reefs, or ledges that offer foraging and refuge habitat. These larger fish may also use nearshore available crevices for sheltering, including rock rubble habitat or crevices created in or around manmade structures such as docks and seawalls. As a result, the repair, replacement, or removal of shoreline stabilization projects (Activity 1), pile-supported structures (Activity 2), and marine debris removal (Activity 9) could affect sheltering habitat for larger juvenile and adult Nassau grouper. We believe these effects will be insignificant as we expect the species will move to nearby similar habitat including the extensive reefs habitat in the Caribbean and nearby structures such as seawalls and docks. Also, PDC AP.14 limits this Opinion to projects that do not directly or indirectly affect ESA-listed corals, and excludes projects if non-listed corals or hardbottom are found in the project footprint. Therefore, we do not expect any loss of reef or hardbottom refuge habitat used by large juvenile and adult Nassau grouper. The installation of living shorelines and artificial reefs (Activity 7) may result in a beneficial effect to large juveniles or adult Nassau grouper by providing additional refuge habitat in the U.S. Caribbean.

<u>In the Florida Keys and Miami Dade County</u>: We believe the current functional range is limited to the Florida Keys south of Government Cut on the north side of the Keys and up to the southern boundary of Everglades National Park on the south side of the Keys. The general absence of Nassau grouper outside of the Florida Keys is well documented by the lack of records in Florida Fish and Wildlife Conservation Commission’s, Fisheries Independent Monitoring data as well as various surveys conducted by the NMFS’s Southeast Fisheries Science Center. Adult and large juvenile Nassau grouper may be present in waters off of the Florida Keys and areas surrounding the Dry Tortugas, although available data suggests occurrence at low density. We do not expect any small juveniles in the Florida Keys and therefore do not expect Nassau grouper in the Keys to utilize macroalgae, seagrasses, or mangrove habitat. The larger juvenile and adult Nassau grouper in the Florida Keys may use hardbottom, reefs, ledges, rock rubble, and even existing docks and seawalls for refuge habitat if these areas provide adequate crevices for the species to hide. As we explained when discussing the potential effects on large juvenile and adult Nassau grouper in the U.S. Caribbean, we believe that the repair, replacement, or removal of shoreline stabilization projects (Activity 1), pile-supported structures (Activity 2), and marine debris removal (Activity 9) could affect sheltering habitat. We believe these effects will be insignificant as we expect Nassau grouper will move to nearby similar habitat, including the extensive reefs habitat found in the Florida Keys and nearby structures such as seawalls and dock found throughout this area. Also, PDC AP.14 limits this Opinion to projects that do not directly or indirectly affect ESA-listed corals, and excludes projects if non-listed corals or hardbottom are found in the project footprint. Therefore, we do not expect any loss of reef or hardbottom refuge habitat used by adult Nassau grouper. The installation of living shorelines and artificial reefs (Activity 7) may result in a beneficial effect to large juveniles or adult Nassau grouper by providing additional refuge habitat in the Florida Keys.

In addition to the effects described above, we believe mobile species, including Nassau grouper, may be affected by a number of what we are referring to as “common routes of effect,” which are routes of effect common to all of the activities described in this Opinion. These routes of effects and our analysis of whether and how they affect ESA-listed species and/or critical habitat are described in a section below, entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion*. Nassau grouper may be affected, but is not likely to be adversely affected by the following common routes of effect (the number corresponds to the section number in which the effect is discussed below):

1. Direct Physical Effects from Construction Activities
2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction
5. Limiting Species' Movement and Access to Habitat
6. Vessel Strikes
7. Noise

Based on the restrictions in the general PDCs described above, and our determinations regarding the common routes of effect, we have made the following determinations regarding the effects of the activities on Nassau grouper, as summarized below in Table 10.

Table 10. NMFS Effects Determinations for Nassau Grouper

	Activity	NMFS Determination in Florida north of Government Cut, and north of the southern boundary of Everglades National Park	NMFS Determination in the Florida Keys south of Government Cut on the north side of the Keys and up to the southern boundary of Everglades National Park on the south side of the Keys (small juveniles)	NMFS Determination in the Florida Keys south of Government Cut on the north side of the Keys and up to the southern boundary of Everglades National Park on the south side of the Keys (large juveniles and adults)	NMFS Determination in the U.S. Caribbean (all life stages)
1	Shoreline stabilization	NP	NP	NLAA	NLAA
2	Pile-supported structures	NP	NP	NLAA	NLAA
3	Dredging	NP	NP	NLAA	NLAA
4	Water-management outfall structures	NP	NP	NLAA	NLAA
5	Scientific survey devices	NP	NP	NLAA	NLAA
6	Boat ramps	NP	NP	NLAA	NLAA
7	Aquatic enhancement	NP	NP	NLAA	NLAA
8	Transmission/ utility lines	NP	NP	NLAA	NLAA
9	Marine debris removal	NP	NP	NLAA	NLAA
10	Temporary platforms, access fill, and cofferdams	NP	NP	NLAA	NLAA

Scalloped Hammerhead

At the time we listed the Central and Southwest Atlantic DPS of scalloped hammerhead shark, it was thought to occur within the U.S. Caribbean (79 FR 38213, July 3, 2014). In designating critical habitat for this species (80 FR 71774, November 17, 2015), we determined that there is no evidence that the scalloped hammerhead shark was present within the U.S. Caribbean. Since that time, in connection with our consultation on fishery independent monitoring in the U.S. Caribbean, we learned that the species may be present in the U.S. Caribbean, based on a recorded interaction during hook-and-line fishery monitoring SER-2009-7541). We have continued to collect information on the species presence in the U.S. Caribbean and are aware of a few additional interactions. The Central and Southwest Atlantic DPS for scalloped hammerhead shark is found in waters of the U.S. Caribbean, among other areas, but is not found in waters off of Florida. Therefore, we do not consult on this species in Florida. We identified a population of scalloped hammerhead shark that occurs in waters off of Florida, the Northwest Atlantic and Gulf of Mexico DPS for scalloped hammerhead shark, however, we determined that this DPS did not warrant listing (78 FR 20717, April 5, 2013; 79 FR 38213, July 3, 2014).

Scalloped hammerhead shark are highly mobile and partly migratory, and are likely the most abundant of the hammerhead species (Maguire et al. 2006). Although scalloped hammerhead sharks are highly mobile, this species rarely crosses entire oceans (Diemer et al. 2011; Duncan and Holland 2006; Kohler and Turner 2001). The median distance between mark and recapture of 3,278 tagged adults along the eastern U.S. was less than 65 miles (100 km) (Kohler and Turner 2001). Tagging studies reveal the tendency for scalloped hammerhead shark to aggregate around and travel to and from core areas within locations (Bessudo et al. 2011; Duncan and Holland 2006; Hearn et al. 2010; Holland et al. 1993).

Both juvenile and adult scalloped hammerhead sharks occur as solitary individuals, pairs, or in schools (Compagno 1984). Adult aggregations are most common offshore over seamounts and near islands (Bessudo et al. 2011; CITES 2010; Compagno 1984; Hearn et al. 2010). Neonate and juvenile aggregations are more common in nearshore shallow water nursery habitats (Bejarano-Álvarez et al. 2011; Diemer et al. 2011; Duncan and Holland 2006).

The scalloped hammerhead shark is a high trophic level predator (Cortés 1999) and an opportunistic feeder with a diet that includes a wide variety of mobile species such as bony fish, octopi, cuttlefish, squid, crabs, lobsters, and rays (Bush 2003; Compagno 1984; Júnior et al. 2009; Noriega et al. 2011). In the listing rule, we identified commercial fishing as one of the primary threats to the Central and SW Atlantic DPS of scalloped hammerhead shark, and found it was unlikely that loss of habitat was contributing to the species' extinction risk (79 FR 38213). Therefore, we believe that any effects to offshore and nearshore potential foraging habitat caused by the minor construction projects analyzed in this Opinion will have an insignificant effect on the species.

We believe a mobile species, such as the Central and Southwest Atlantic DPS of scalloped hammerhead shark, may be affected by a number of what we are referring to as "common routes of effect," which are routes of effect common to all of the activities described in this Opinion. These routes of effects and our analysis of whether and how they affect ESA-listed species and/or critical habitat are described in a section below, entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion*. The Central and Southwest Atlantic DPS of scalloped hammerhead shark may be affected, but is not likely to be adversely affected by the following common routes of effect (the number corresponds to the section number in which the effect is discussed below):

1. Direct Physical Effects from Construction Activities
2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction
5. Limiting Species' Movement and Access to Habitat

6. Vessel Strikes
7. Noise

Based on the restrictions in the general PDCs described above, and our determinations regarding the common routes of effect, we have made the following determinations regarding the effects of the activities on the Central and Southwest Atlantic DPS of scalloped hammerhead shark, as summarized below in Table 11.

Table 11. NMFS Effects Determinations for the Central and Southwest Atlantic DPS of Scalloped Hammerhead Shark

	Activity	NMFS Determination in Florida[12]	NMFS Determination in the U.S. Caribbean
1	Shoreline stabilization	N/A	NLAA
2	Pile-supported structures	N/A	NLAA
3	Dredging	N/A	NLAA
4	Water-management outfall structures	N/A	NLAA
5	Scientific survey devices	N/A	NLAA
6	Boat ramps	N/A	NLAA
7	Aquatic enhancement	N/A	NLAA
8	Transmission/ utility lines	N/A	NLAA
9	Marine debris removal	N/A	NLAA
10	Temporary platforms, access fill, and cofferdams	N/A	NLAA

ESA-listed Whales

ESA-listed whales (North Atlantic right, blue, fin, sei, sperm, and Bryde's whale) may be found within the action area. Blue, fin, sei, sperm, and Bryde's whales generally occur in deeper waters while North Atlantic right whales frequently come much closer to shore.

The Bryde's whale, which we recently proposed to list as an endangered species, has limited distribution; it appears to be restricted to the De Soto Canyon area of the Gulf of Mexico at water depths of -100 to -300 m. This Opinion does not apply to activities within this area, defined as the Bryde's whale exclusion zone in Section 2.1.1.6, per PDC AP.4. Therefore, we believe that there will be no effect to Bryde's whale from any of the activities covered under this Opinion.

The only activities analyzed in this Opinion that occur in waters accessible to the other ESA-listed whales (North Atlantic right, blue, fin, sei, and sperm) are the installation of buoys (Activity 2), temporary scientific survey devices (Activity 5), artificial reef placement (Activity

[12] The individuals in the Central and Southwest Atlantic DPS for scalloped hammerhead shark are not found within waters off of Florida. Therefore, we do not consult on the effects to this species from activities occurring in Florida. The Northwest Atlantic and Gulf of Mexico DPS for this species includes species originating from the Northwest Atlantic and Gulf of Mexico, which includes waters off of Florida, however, we determined that this DPS did not warrant listing (78 FR 20717, April 5, 2013; 79 FR 38213, July 3, 2014).

7), and marine debris removal (Activity 9). None of the remaining activities occur in waters deep enough for whales to be present (i.e., Activity 1, 3, 4, 6, 8, 10). For those activities that can occur in waters accessible to whales, we believe:

- Activities 2 and 5: ESA-listed whales can become entangled by encountering in-water lines, such as buoy lines that may be associated with anchored buoys (Activity 2) or scientific survey devices (Activity 5). However, we believe that ESA-listed whales will not become entangled in in-water lines associated with Activities 2 and 5 since PDC AP.11 of the PDCs for *In-Water Activities* require that in-water lines be made of materials and installed in a manner to minimize the risk of entanglement. Under that PDC, for an activity to be covered under this Opinion, it must use thick, heavy, and taut lines that do not readily loop or entangle and all in-water lines must be stiff, taut, non-looping, and cannot have excess line in the water. There are no reports of whales becoming entangled in thick, taut lines. Therefore, we believe there will be no effect to ESA-listed whales from entanglement from lines associated with Activities 2 and 5.

- Activity 7: We also believe that ESA-listed whales may be affected by the placement of artificial reefs (Activity 7) if the reef placement restricts their ability to transit in or to waters in the action area used for calving. In particular, North Atlantic right whales may be affected by the placement of artificial reefs (Activity 7, Section 2.2.7) if the reef placement restricts their ability to transit waters in the action area used for calving. Effects to North Atlantic right whales from the placement of artificial reefs are analyzed in Section 2.2.7. On the other hand, reefs placed in deeper water where blue, fin, sei, and sperm whales may occur would not restrict movement of these whales because of the available space above the placed reef material and therefore there would not affect these whale species.

- Activity 9: Marine debris removal (Activity 9) will have no effect on whales (North Atlantic right, blue, fin, sei, and sperm) since debris is removed by divers in the water. Even if marine debris removal could affect ESA-listed whales, divers would be able to identify and avoid interaction with whales in the area. Also, marine debris removal is typically completed in a given area in less than a day, thereby limiting the time in which whale interactions could occur.

In addition to the effects described above, we believe mobile species, including ESA-listed whales, may be affected by a number of "common routes of effect," which are routes of effect common to all of the activities described in this Opinion. These routes of effect, and our analysis of whether and how they affect ESA-listed species and/or critical habitat, are described in a section below, entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion*. In particular, we analyzed the potential for the following routes of effect to have an effect on ESA-listed whales, except for Bryde's whale, and concluded each was a "no effect" on the species:

1. Direct Physical Effects from Construction Activities
3. Potential Entanglement in Construction Materials
5. Limiting Species' Movement and Access to Habitat

6. Vessel Strikes
7. Noise

With respect to Bryde's whale, because their range is generally restricted to the DeSoto Canyon in the Gulf of Mexico and activities covered under this Opinion are not allowed to occur in that area (PDC AP.4, as defined in Section 2.1.1.6), we believe there will be no effect to Bryde's whale.

In addition, we believe that North Atlantic right whales may be affected by the placement of artificial reefs (Activity 7) in their designated critical habitat. As described in that Section 2.2.7, we believe placement of artificial reefs in critical habitat for the North Atlantic right whale may affect, but is not likely to adversely affect the species.

Based on the restrictions in the general PDCs described above, and our determinations regarding the common routes of effect, we have made the following effects determinations, as summarized below in Table 12.

Table 12. NMFS Effects Determinations for ESA-listed Whales

	Activity	**NMFS Determination for North Atlantic Right Whale**	**NMFS Determination for Blue, Fin, Sei, and Sperm Whales and the proposed for listing Bryde's Whale**
1	Shoreline stabilization	NE	NE
2	Pile-supported structures	NE	NE
3	Dredging	NE	NE
4	Water- management outfall structures	NE	NE
5	Scientific survey devices	NE	NE
6	Boat ramps	NE	NE
7	Aquatic enhancement	NLAA	NE
8	Transmission/ utility lines	NE	NE
9	Marine debris removal	NE	NE
10	Temporary platforms, fill, and cofferdams	NE	NE

Determinations Regarding Effects to Critical Habitat from All Categories of Activities
Some of the areas that have been designated as critical habitat will not be affected by any of the activities analyzed in this Opinion. Below, we discuss the critical habitat that will not be affected by any activity and explain our no effect determinations. Effects to these critical habitats will not be discussed further in this Opinion. The essential features/ PCEs/ PBFs for each critical habitat unit are provided in Table 7, above.

NWA DPS of Loggerhead critical habitat

We believe that there will be no effect to critical habitat for the NWA DPS of loggerhead sea turtles from any of the categories of activities analyzed under this Opinion. Below we analyze the potential effects to each of the loggerhead critical habitat types that occur in Florida.

1. Nearshore reproductive habitat: We believe that there will be no effect to the PCEs of nearshore reproductive habitat of loggerhead critical habitat from any of the 10 categories of activities analyzed under this Opinion. As explained in Table 7, the PBF of nearshore reproductive habitat is the 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, which is supported by the following PCEs: (i) Nearshore waters directly off the highest density nesting beaches and their adjacent beaches, as identified in 50 CFR 17.95(c), to 1.6 km offshore; (ii) Waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and (iii) 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.
    - For example, under the activity-specific PDCs, shoreline stabilization (Activity 1, PDC A1.7), boat ramps (Activity 6, PDC A6.6), transmission/utility line (Activity 8, PDC A8.2), and temporary platform, fill, and cofferdams (Activity 10, PDC A10.7) activities cannot occur on or near beaches used for sea turtle nesting and would therefore not affect the PCEs of nearshore reproductive habitat for loggerhead critical habitat.

    - With respect to Activity 2, ATONs (pile-supported and anchored buoys) are the only pile-supported structures allowed in nearshore reproductive habitat (Activity 2, PDC A2.16). The placement of ATONs generally requires only a single pile or anchor line, neither of which is large enough in size to create obstructions, add lighting, aggregate predators, or disrupt wave patterns. Thus, they do not affect the PCEs that support this habitat type.

    - Dredging (Activity 3) does not create obstructions, aggregate predators, or disrupt wave patterns. In addition, PDC AP.6 requires all activities be completed during daylight hours so we do not expect any affects from lighting associated with dredging. Thus, dredging does not affect the PCEs that support this habitat type.

    - Stormwater outfall structures (Activities 4), temporary scientific survey devices (Activity 5), and marine debris removal (Activity 9), given how they are designed and implemented generally and under the PDCs of this Opinion, do not create obstructions, add lighting, aggregate predators, or disrupt wave patterns. Specifically, stormwater outfall structures occur along the shoreline and do not create an obstruction to movement, temporary scientific survey devices are small (average of 20 ft^2) so they are not large enough to create an obstruction, and marine debris removal removes structures so they do not create an obstruction. None of these structures are large enough or placed anywhere that they would attract fish and larger predators that would increase predation or are large enough or placed somewhere they would disrupt wave patterns. Also none of these structures have lighting. Thus, they will have no effect on the PCEs that support this habitat type.

- Artificial reefs (Activity 7) placed in nearshore reproductive habitat could result in an aggregation of predators attracted to reefs for increased prey availability; however, under the PDC A7.30, Section 2.2.7, structures cannot be placed in loggerhead critical habitat nearshore reproductive habitat and would therefore not affect the PCEs of nearshore reproductive habitat for loggerhead critical habitat.

Therefore, we believe that the 10 categories of activities analyzed herein will have no effect on the nearshore reproductive habitat of loggerhead critical habitat.

2. <u>Concentrated breeding habitat</u>: We believe that there will be no effect from any of the 10 categories of activities analyzed in this Opinion to any of the PCEs of concentrated breeding habitat of critical habitat of the NWA DPS of loggerhead. As we stated in Table 7, the PBF of concentrated breeding habitat is those sites with high densities of both male and female adult individuals during the breeding season. PCEs that support this habitat are the following: (i) High densities of reproductive male and female loggerheads; (ii) Proximity to primary Florida migratory corridor; and (iii) Proximity to Florida nesting grounds. None of the activities analyzed in this Opinion will result in the injury, death, or redistribution of loggerhead sea turtles, so there will be no effect to the density of reproductive male and female loggerhead turtles. Additionally, none of the activities analyzed in this Opinion will affect the proximity of the breeding habitat to the Florida migratory corridor or to the Florida nesting grounds. With respect to the nesting grounds, the only activities that could block access to nesting beaches are shoreline stabilization (Activity 1), boat ramps (Activity 6), and temporary platform, fill, and cofferdams (Activity 10). However, the PDCs for those specific activities preclude them from occurring on or near sea turtle nesting beaches (see PDC A1.7, PDC A6.6, and PDC A10.7). Therefore, we believe that the 10 categories of activities analyzed herein will have no effect on the concentrated breeding habitat of loggerhead critical habitat.

3. <u>Constricted migratory corridors</u>: We believe that there will be no effect from any of the 10 categories of activities analyzed in this Opinion to any of the PCEs of constricted migratory corridor habitat of NWA DPS of loggerhead critical habitat. As is set forth in Table 7, the PBF of constricted migratory habitat is high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side. PCEs that support this habitat are the following: (i) Constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways; and (ii) Passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas. The constricted migratory corridor in Florida is approximately 4 miles wide at its narrowest point.

   Only 4 of the covered activities may involve installation of structures within the constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways, including pile-supported structures and anchored buoys (Activity 2), scientific survey devices (Activity 5), artificial reefs (Activity 7), and utility and transmission lines (Activity 8). Since objects or structures deployed in these areas are spatially limited, we do not expect them to affect the PCEs of this habitat type, namely the amount of constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways or passage conditions that allow migration to and from nesting, breeding, or foraging habitats. Given the width of the corridor, even artificial reefs (Activity 7) placed in these areas would not restrict movement of turtles. Specifically, PDC A7.14 in Section 2.2.7 states that new reef sections covered under this Opinion are limited to 1 reef section measuring ¼- by ¼-nmi area (40 ac) in size with a distance of 500 ft between each section. In addition, turtles would not only be able to navigate around these structures, but also swim over them since artificial reefs are required to maintain enough space between the top of the structure and the water's surface that they do not create navigational hazards, which will help ensure that the activities do not affect the passage conditions described above. Specifically, PDC A7.14 in Section 2.2.7 states that offshore reefs covered under this Opinion must maintain a minimum vertical clearance of twice the height of the structure from the top of the deployed material relative to the MLW at all times. Therefore, we believe that the 10 categories of activities analyzed herein will have no effect on the constricted migratory corridor habitat of the NWA DPS of loggerhead critical habitat.

4. *Sargassum* habitat: We believe that there will be no effect from any of the 10 categories of activities analyzed in this Opinion to any of the PCEs for *Sargassum* habitat of critical habitat for the NWA DPS of loggerhead sea turtles. As stated in Table 7 above, the PBF of loggerhead *Sargassum* habitat is developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum.* PCEs that support this habitat are the following: (i) Convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads; (ii) *Sargassum* in concentrations that support adequate prey abundance and cover; (iii) Available prey and other material associated with *Sargassum* habitat including, but not limited to, plants and cyanobacteria and animals native to the *Sargassum* community such as hydroids and copepods; and (iv) Sufficient water depth and proximity to available currents to ensure offshore transport (out of the surf zone), and foraging and cover requirements by *Sargassum* for post-hatchling loggerheads, i.e., > 10-m depth.

   - These floating algae mats on the ocean surface occur miles offshore beyond the limits of most of the categories of activities discussed in this Opinion, and therefore the majority of projects conducted under this Opinion (those associated with Activities 1, 3, 4, 6, 8, and 10) will not affect sargassum resources.

   - Placement of buoys (Activity 2), scientific devices (Activity 5), artificial reefs (Activity 7), and marine debris removal (Activity 9) could occur in *Sargassum* habitat; however, none of these activities has the potential to affect the concentration of floating *Sargassum* mats in amounts that support adequate prey abundance and cover or the availability of prey PCEs of *Sargassum* habitat. Buoys and scientific devices are too small to affect large areas of floating mats, and artificial reefs are located below the water surface.

- Marine debris is typically removed by manual means, and PDC A9.2 applicable to marine debris removal requires visual confirmation that the debris can be removed without causing further damage to aquatic resources. PDC A9.5 also requires that the marine debris be lifted straight up rather than dragged, which will also prevent removal of *Sargassum*.

- None of the activities evaluated in this Opinion is large enough to affect ocean currents such as location of convergence zones, or the water depth or proximity to currents necessary for offshore transport to sargassum beds for foraging, and cover.

Therefore, we believe that the 10 categories of activities analyzed herein will not affect the *Sargassum* habitat of critical habitat of the NWA DPS of loggerhead sea turtles.

Based on the restrictions in the general PDCs discussed above, as well as some activity specific PDCs provided above, our effects determinations are summarized below in Table 13.

Table 13. NMFS Effects Determinations for NWA DPS of Loggerhead Sea Turtle Critical Habitat

	Activity	**NMFS Determination**
1	Shoreline stabilization	NE
2	Pile-supported structures	NE
3	Dredging	NE
4	Water-management outfall structures	NE
5	Scientific survey devices	NE
6	Boat ramps	NE
7	Aquatic enhancement	NE
8	Transmission/ utility lines	NE
9	Marine debris removal	NE
10	Temporary platforms, fill, and cofferdams	NE

***Acropora* critical habitat**

We believe there will be no direct effect to the essential feature of *Acropora* critical habitat—substrate of suitable quality and availability to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments—from any of the categories of activities analyzed under this Opinion. Specifically under PDC AP.12 of the PDCs for *Mangroves, Seagrasses, Corals and Hard Bottom for All Projects,* hardbottom, including the hardbottom that meets the definition of the essential feature of *Acropora* critical habitat, cannot be within the project footprint. The only exception is for the temporary placement (up to 24 months) of scientific survey devices (Activity 5) that have a footprint of less than 1 ft^2 per device. We believe the temporary placement of scientific survey devices will not affect the hardbottom essential feature of *Acropora* critical habitat since it will not alter or change the feature. The devices are temporarily placed on the hardbottom habitat in a manner that does not damage the feature.

Activity-specific PDCs reiterate the general limitation in PDC AP.12, stating that the following activities are only allowed in *Acropora* critical habitat if the essential feature is not present: new and expanded shoreline stabilization projects (Activity 1, PDC A1.10); pile-supported structures (Activity 2, PDC A2.10); dredging (Activity 3, PDC A3.7); boat ramps (Activity 6, PDC A6.8); restoration and aquatic enhancement (Activity 7, PDC A7.28); and temporary platforms, fill, and cofferdams (Activity 10, PDC A10.9). For transmission and utility line projects (Activity 8), the activity-specific PDCs are broader for sub-categories of activities. Under those PDCs, the Opinion does not apply to the new installation of transmission and utility lines or to trenching and horizontal directional drilling within the geographic boundary of *Acropora* critical habitat, regardless of whether the essential feature is present (PDC A8.7). In addition, under that PDC, existing lines only may be repaired or replaced in areas where the essential feature is not present. Finally, with respect to marine debris removal (Activity 2), PDC A9.3 limits the Opinion to those removal activities that will not cause further damage to aquatic resources and PDC A9.5 excludes activities where debris is dragged through coral or hard bottom habitats from coverage. Therefore, we believe the activities covered under this Opinion will not physically damage or affect the essential feature of *Acropora* critical habitat through direct interaction with construction equipment or machinery.

For water-management outfall structures (Activity4), we do not expect any changes in water quality from the operation of water management outfall structures to affect *Acropora* critical habitat. PDC A4.3 states that all outfall structures covered under this Opinion must be designed and implemented to prevent erosion and scouring so that these outfall structures do not generate sedimentation and turbidity through erosion after the structure is placed and operational. Therefore, we believe that there will be no effect to *Acropora* critical habitat essential features from Activity 4.

Based on the restrictions in the general PDCs discussed above, as well as some activity specific PDCs provided above, our effects determinations are summarized below in Table 14.

Table 14. NMFS Effects Determinations for *Acropora* Critical Habitat

	Activity	**NMFS Determination**
1	Shoreline stabilization	NE
2	Pile-supported structures	NE
3	Dredging	NE
4	Water-management outfall structures	NE
5	Scientific survey devices	NE
6	Boat ramps	NE
7	Aquatic enhancement	NE
8	Transmission/ utility lines	NE
9	Marine debris removal	NE
10	Temporary platforms, fill, and cofferdams	NE

North Atlantic right whale critical habitat
We believe that there will be no effect to North Atlantic right whale critical habitat from any category of activity analyzed under this Opinion, except from the placement of artificial reef structures (Activity 7, Section 2.2.7), which we believe are not likely to adversely affect North Atlantic right whale critical habitat, as discussed in Section 2.2.7, below.

As provided in Table 7, the essential features which provide calving area functions in Unit 2, are (i) sea surface conditions associated with Force 4 or less on the Beaufort Scale, (ii) sea surface temperatures of 7°C to 17°C, and (iii) water depths of 20-92 ft (6- 28 m), where these features simultaneously co-occur over contiguous areas of at least 231 nmi^2 of ocean waters during the months of November through April. When these essential features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves.

The only activity that may affect these features is the placement of artificial reefs. None of the other minor activities analyzed under this Opinion are large enough in size or scale to change sea state conditions and none of the activities change water temperatures. The only activity that can change overall water depth is the placement of materials to create an artificial reef. The effects of artificial reefs on North Atlantic right whale critical habitat are discussed further in Section 2.2.7.

Our effects determinations are summarized below in Table 15.

Table 15. NMFS Effects Determination for North Atlantic Right Whale Critical Habitat

	Activity	**NMFS Determination**
1	Shoreline stabilization	NE
2	Pile-supported structures	NE
3	Dredging	NE
4	Water-management outfall structures	NE
5	Scientific survey devices	NE
6	Boat ramps	NE
7	Aquatic enhancement	NLAA
8	Transmission/ utility lines	NE
9	Marine debris removal	NE
10	Temporary platforms, fill, and cofferdams	NE

U.S. Caribbean Sea Turtle Critical Habitat (Green, Hawksbill, and Leatherback Sea Turtle Critical Habitat)
We believe that there will be no effect to the essential features of critical habitat for hawksbill, leatherback, or the NA DPS of green sea turtles from Activity 1 or Activities 3-10 analyzed under this Opinion. Within the action area, all 3 of these sea turtle critical habitat units occur only within the U.S. Caribbean. At that time of critical habitat designation for green, hawksbill, and leatherback sea turtle critical habitat, the essential features of the critical habitat were not precisely defined. However, the critical habitat was designated primarily to provide protection

for important developmental and resting habitats for green and hawksbill sea turtles and for leatherbacks, to provide protection to sea turtles using the designated waters for courting and breeding. Specifically:

- Green sea turtles (both juvenile and adults) depend on seagrasses as the principal dietary component of foraging. In addition, coral reefs and other topographic features within the waters around Culebra Island and surrounding islands and cays provide green turtles with shelter during interforaging periods that serve as refuge from predators.

- Hawksbill sea turtles depend on sponges as their principal dietary component and rely on healthy coral reefs for foraging and shelter habitats.

- Leatherback sea turtles require access to and from nesting areas on Sandy Point Beach, St. Croix, U.S. Virgin Islands.

To avoid impacts to these important foraging and sheltering habitats, PDC AP.13 states that the Opinion does not apply to projects in the U.S. Caribbean sea turtle critical habitat (hawksbill, leatherback, and the NA DPS of green sea turtle critical habitat identified in Section 2.1.1.5) if non-ESA listed, native, non-invasive seagrasses are found within the project footprint. Under PDC AP.14, the Opinion also does not apply to projects in areas where coral and/or hardbottom occur within the project footprint, unless the project is for the temporary placement (up to 24 months) of scientific survey devices (Activity 5) that have a footprint of less than 1 ft^2 per device. This Opinion further restricts the activities that can occur in sea turtle critical habitat in the U.S. Caribbean (hawksbill, leatherback, and the NA DPS of green sea turtles) so that they will not create an obstruction that would prevent access to and from nesting areas for leatherback sea turtles. Specifically:

- This Opinion does not apply to water-management outfall structures (Activity 4, PDC A4.7) and aquatic enhancement (Activity 7, PDC A7.31) projects occurring in sea turtle critical habitat in the U.S. Caribbean.

- Within sea turtle critical habitat in the U.S. Caribbean, some activities are limited to removal, repair, and replacement of existing structures, including shoreline stabilization projects (Activity 1, PDC A1.12), boat ramps (Activity 6, PDC A6.11), and transmission and utility lines (Activity 8, PDC A8.11). Since these projects will not expand the footprint of the existing structures, we believe they will not affect access to nesting beaches.

- Activity 2: Of the pile-supported structures and anchored buoys that are a part of this Opinion, only ATONs can be placed near sea turtle nesting beaches (PDC A2.16). No other pile-supported structures are allowed near sea turtle nesting beaches under this Opinion. The placement of ATONs is not expected to limit access to nesting beaches since ATONs are single small structures either mounted on a pile or anchored with a buoy.

- Activity 3: Though dredging may change the bottom contours in the area dredged, the removal of sediments does not create an obstruction to beach access.

- Activity 5: We do not believe that the temporary placement of scientific survey devices, which are small (estimated at 1-50 ft^2), will create an obstruction to sea turtles accessing beaches.

- Activity 9: Marine debris removal only removes items that may have created an obstruction or blocked foraging or shelter access and does not create any new obstacles.

- Activity 10: Of the temporary platforms, fills, and cofferdams covered under this Opinion, only temporary cofferdams placed in conjunction with other construction activities that are covered under this Opinion can be placed in sea turtle critical habitat in the U.S. Caribbean. These structures cannot occur on or contiguous to ocean beaches that may be used by nesting sea turtles (PDC A10.12) so they would not obstruct access to nesting beaches.

Therefore, we believe there will be no effect to the essential features of critical habitat from any activity that can be permitted under this Opinion (Table 16).

Table 16. NMFS Effects Determination for Green, Hawksbill, and Leatherback Sea Turtle Critical Habitat

	Activity	NMFS Determination
1	Shoreline stabilization	NE
2	Pile-supported structures	NE
3	Dredging	NE
4	Water-management outfall structures	NE
5	Scientific survey devices	NE
6	Boat ramps	NE
7	Aquatic enhancement	NE
8	Transmission/ utility lines	NE
9	Marine debris removal	NE
10	Temporary platforms, fill, and cofferdams	NE

Atlantic sturgeon critical habitat

The only Atlantic sturgeon critical habitat in Florida is located in the St. Marys River. We believe that there will be no effect (Table 17) to Atlantic sturgeon critical habitat because this Opinion does not cover projects that occur in the St. Marys River as set forth in Section 2.1 (Action Area).

Table 17. NMFS Effects Determination for Atlantic Sturgeon Critical Habitat

	Activity	NMFS Determination
1	Shoreline stabilization	NE
2	Pile-supported structures	NE
3	Dredging	NE
4	Water-management outfall structures	NE
5	Scientific survey devices	NE
6	Boat ramps	NE
7	Aquatic enhancement	NE
8	Transmission/ utility lines	NE
9	Marine debris removal	NE
10	Temporary platforms, fill, and cofferdams	NE

Construction Related Effects for All Categories of Activities Analyzed under this Opinion

This Opinion covers 10 categories of in-water construction activities, each of which could affect the ESA-listed species listed in similar ways. For example, species could interact with construction equipment from the covered activities or could be affected by turbidity from the covered activities in the same way. The general construction-related routes of effect are limited by the general PDCs that are required for all projects and are discussed below.

1. Direct Physical Effects from Construction Activities

Potential effects to mobile species listed in Table 5 including whales (i.e., sea turtles, smalltooth sawfish, sturgeon, Nassau grouper, Central and Southwest Atlantic DPS of scalloped hammerhead shark, and whales) include the risk of interaction with construction equipment from land-based and barge-mounted equipment, small boats, and the placement or removal of materials associated with each of the 10 categories of activities covered under this Opinion. We believe the potential for these species to be adversely affected by interactions with equipment or materials used for any of the activities analyzed under this Opinion is extremely unlikely, and thus that the effect of such interactions is discountable. These species are mobile and are very likely to avoid the construction noise, moving equipment, and placement or removal of materials during construction, making interactions extremely unlikely. In addition:

- PDC AP.7 of the PDCs for *In-Water Activities* requires the permittee to instruct all personnel associated with the project about the potential presence of species protected under the ESA and the MMPA, and makes clear that all on-site project personnel are responsible for observing water-related activities for the presence of protected species.

- PDC AP.9 of the PDCs for *In-Water Activities* requires that all vessel operators watch for and avoid collisions with species protected under the ESA and MMPA. This PDC establishes speed restrictions and safe operating distances, and requires operation of mechanical construction equipment to cease when a listed species is observed within a 50-ft radius of construction equipment.

One activity, dredging (Activity 3), has the potential to physically harm mobile species listed in Table 5 except for whales (i.e., sea turtles, smalltooth sawfish, Nassau grouper, and sturgeon); however, the PDCs for Activity 3, and the general PDCs, render such interactions extremely unlikely. PDC A3.2 applicable to Activity 3 excludes projects using hopper dredging from coverage under the Opinion. Dredging covered under this Opinion is limited to minor dredging projects, maintenance dredging, muck dredging, and dredging/grading areas for the placement of seawalls and boat ramps. Hence, dredging will be completed using smaller equipment (e.g., backhoe, clamshell, hydraulic vacuum, cutterhead dredges [likely 18-in diameter or less]). NMFS has previously determined (NMFS 2007b) that, while ocean-going hopper-type dredges may lethally entrain protected species including sea turtles and sturgeon, non-hopper type dredging methods (e.g., mechanical such as clamshell, and bucket dredging; hydraulic [suction] cutterhead, and pipeline) are slower and extremely unlikely to adversely affect sea turtles and sturgeon. Despite rare reports of cold-stunned turtles (i.e., lethargic, dying, or previously dead) being taken by cutterhead dredges, in Laguna Madre, Texas (Robert Hauch, Galveston USACE, pers. comm. to Eric Hawk, NMFS PRD, March 6, 2012), NMFS has no new information that would change our conclusion that the effects of non-hopper type dredging methods are discountable. Due to these species' mobility, the use of non-hopper-type dredges, and adherence to the PDCs for *In-Water Activities*, it is extremely unlikely that these species' would be struck or otherwise adversely affected by the dredging equipment, therefore, the effects to these species from dredging is discountable.

Based on the restrictions in the general PDCs discussed above, as well as some activity specific PDCs provided above, we believe that effects to ESA-listed species from interaction with construction equipment from land-based and barge-mounted equipment, small boats, and the placement or removal of materials associated with any of the categories of activities covered under this Opinion will be discountable.

2. Turbidity

Sedimentation and turbidity may be generated during sediment moving activities such as dredging to place a seawall (Activity 1); auguring to place a pile (Activity 2); maintenance, minor, or muck dredging (Activity 3); dredging to place an outfall structure (Activity 4) or boat ramp (Activity 6); trenching to place a subaqueous utility line (Activity 8), or placement of fill (Activity 10). To control and reduce turbidity, PDC AP.10 requires the use of turbidity curtains, which will be installed prior to and throughout all in-water construction. Turbidity curtains will remain in place post-construction until all turbidity and siltation subsides from in-water construction.

Turbidity curtains are designed to avoid and minimize the effects of turbidity and sedimentation outside of the curtains, though some turbidity and sedimentation may escape the curtains, either due to imperfections in the curtain material or installation, or in the event of an unexpected curtain failure. In a few, limited instances, the USACE project manager may waive the turbidity curtain requirement. For example, the project manager may waive the requirement for projects that are so small that turbidity is not expected (PDC AP.10). Similarly the requirement can be waived for projects that are not expected to affect water quality (PDC AP.10) such as for the placement of a single pile or removal of marine debris, which would not be expected to generate enough turbidity to affect water quality or to affect ESA-listed species. Another instance where the turbidity curtains requirement may be waived is when the project is located in an area with high wave energy where securing turbidity curtains would not be feasible (PDC AP.10). If not properly secured, the curtains are at an increased risk of becoming loose and entangling animals or damaging nearby habitat. In high wave energy areas, turbidity would dissipate quickly, minimizing species' exposure to turbidity in the area.

We believe turbidity and sedimentation from in-water construction will have different effects to ESA-listed species based on whether they are mobile (i.e., sea turtles, smalltooth sawfish, sturgeon, and Nassau grouper, Central and Southwest Atlantic DPS of scalloped hammerhead shark) or stationary (Johnson's seagrass). Mobile species are able to swim through or avoid any potential turbidity without harm. These species are naturally exposed to turbidity or sedimentation throughout their environment in areas of naturally lower water clarity. Therefore, we believe any potential exposure to turbidity outside of the turbidity curtains will have no effect on mobile ESA-listed species.

ESA-listed stationary species (Johnson's seagrass) are unable to avoid turbidity and sedimentation that may be generated during in-water construction. Johnson's seagrass is susceptible to harm from being covered or buried by sedimentation generated by turbidity. For that reason, the following additional protective measures are required in the range of Johnson's seagrass:

- Turbidity curtains cannot be waived when the project is within the range of Johnson's seagrass, even if the project would be located in dynamic systems like high wave and current areas (PDC AP.10). If turbidity curtains are not feasible in these areas, the project cannot be covered under this Opinion and individual Section 7 consultation would be required.

- Dredging projects must ensure that the dewatering, transfer, and storage of dredge materials be contained and not result in sedimentation and turbidity that could cover and harm corals or Johnson's seagrass in the area (PDC A3.3.2).

Based on these PDC restrictions and protections, we believe that the risk of sedimentation and turbidity harming or affecting Johnson's seagrass is extremely low, and the effect of such sedimentation and turbidity is discountable.

3. Potential Entanglement in Construction Materials

The presence of flexible materials in the water, such as turbidity curtains (as required under PDC AP.11 for all activities generating turbidity) and in-water lines, such as those used to secure buoys covered in Activities 2 and temporary scientific survey devices covered under Activity 5, could create an entanglement risk to mobile species listed in Table 5 including whales (i.e., sea turtles, smalltooth sawfish, sturgeon, Nassau grouper, Central and Southwest Atlantic DPS of scalloped hammerhead shark, and whales). In particular, PDC AP.10 states that all activities covered under this Opinion must use turbidity curtains, unless the requirement has been waived as described in the PDC.

Although the turbidity curtains and in-water lines pose an entanglement risk to ESA-listed species in Table 5 including whales (i.e., sea turtles, smalltooth sawfish, sturgeon, Nassau grouper, Central and Southwest Atlantic DPS of scalloped hammerhead shark, and whales), PDC

AP.11, applicable to all projects, states that all in-water lines (e.g., rope, chain, and cable, including the lines to secure the turbidity curtains) must be stiff, taut, and non-looping to minimize the risk of entanglement. If flexible lines are used, they must be enclosed in plastic or rubber sleeves/tubes that add rigidity and prevent the line from looping and tangling. There are no reports of any listed species that have been entangled in turbidity curtains or stiff, taut, non-looping in-water lines or flexible lines enclosed in the plastic or rubber sleeves. In addition, PDC AP.11 requires all in-water lines, including the lines securing turbidity curtains, to be properly secured and for applicants to ensure that there is no excess line in the water. It also requires turbidity curtains and in-water equipment to be placed in a manner that does not entrap species within the construction area or block access for them to navigate around the construction area. Therefore, we believe that there will be no effect to these species from entanglement.

4. Exclusion from Areas during Construction

Use of turbidity curtains (required under PDC AP.10) and the construction activities and related construction noise may preclude or deter mobile species listed in Table 5, except whales (i.e., sea turtles, smalltooth sawfish, Nassau grouper, Central and Southwest Atlantic DPS of scalloped hammerhead shark, and sturgeon) from entering the project area. We believe the temporary exclusion of these species from a project area due to construction activities including related noise and presence of turbidity curtains will have insignificant effects on those species. Turbidity curtains will enclose the project site or portions of the project site at any given time and will be removed after construction. However, species excluded from the project area will be able to use surrounding areas during construction and return to the project site when construction is complete. Per PDCs AP.10 for *In-Water Activities,* turbidity curtains must be positioned in a way that does not block access to any designated critical habitat. Likewise, if an animal chooses to avoid the project site because of the activities and/or the related noise, it will be able to use surrounding areas and return to the project site when construction is complete. Therefore, we believe the temporary exclusion of areas from activities covered under this Opinion will have insignificant effects on these species.

5. Limiting Species' Movement and Access to Habitat

Activities conducted under this Opinion could affect movement and access to habitat of mobile species listed in Table 5, as discussed below. In this section, we analyze if the placement of materials from any of the activities or if the presence of construction equipment in a specific area could potentially affect the species' ability to move freely in an area, resulting in its inability to access resources needed for essential life functions such as access to areas used for reproduction, foraging, or refuge, or otherwise interfere with their ability to use areas for reproduction. The loss of foraging or refuge habitat from the placement of the materials is analyzed separately for each activity type discussed in Sections 2.2.1-2.2.10.

<u>Movement and access to foraging or refuge habitat</u>

We believe the following activities will have no effect on mobile species listed in Table 5, including whales (i.e., sea turtles, smalltooth sawfish, sturgeon, Nassau grouper, Central and Southwest Atlantic DPS of scalloped hammerhead shark, and whales) from limiting their movement and ability to access foraging or refuge habitat, as described below:

- Shoreline stabilization (Activity 1); pile-supported structures (Activity 2, with the exception of ATONs, which are typically installed on a single pile or buoy in open waters); water-management outfall structures (Activity 4), and boat ramps (Activity 6) are all activities that occur along the shoreline. The placement of such materials along the shoreline would not create an obstruction for species to move around these features to access foraging and refuge habitat in surrounding areas. The placement of a single pile or buoy for an ATON also would not create an obstruction when placed in open water. Therefore, we believe these activities have no effect on species movement and access to foraging and refuge habitat.

- Maintenance, minor, and muck dredging (Activity 3) and marine debris removal (Activity 9) do not result in the placement of materials in the marine environment and would therefore not create an obstruction to movement for species in the area. As stated in the PDCs for Activity 3 (dredging), this Opinion does not analyze or otherwise operate as a consultation on the placement of dredged material in the marine environment, but is limited to the placement of dredged material above MHW beyond the limit of NMFS' jurisdiction, where we believe there is no risk of limiting species movement and access to foraging and refuge habitat.

- Scientific survey devices (Activity 5) and transmission and utility lines (Activity 8) are small in size and not expected to create an obstruction to movement of species in an area. Scientific survey devices only allows the temporary placement of materials (PDC A5.3), which the USACE assumes will be under 50 ft^2 each based on previously authorized devices. Transmission and utility lines are either installed subaqueous or are supported on single piles spaced apart to support aerial transmission lines.

Therefore, we believe that the placement of materials associated with Activities 1-6, 8, and 9 will have no effect on species by limiting their ability to access foraging and refuge habitat.

We believe the following activities could be designed to be large enough or placed in a manner that could obstruct movement of mobile species listed in Table 5, as described below. However, the PDCs are designed to minimize these structures to an extent as to minimize effects on movement of species in an area so that the effect to species from movement obstructions is insignificant, as described below:

- The installation of long, linear living shoreline features (Activity 7) could reduce or prevent mobile species listed in Table 5 with the exception of whales (i.e., sea turtles, smalltooth sawfish, Nassau grouper, Central and Southwest Atlantic DPS of scalloped hammerhead shark, and sturgeon) from accessing an area between the shore and the living shoreline placed offshore. However, the PDC in Activity 7 for living shoreline projects (PDC A7.6) requires that intermittent gaps be included in the linear structures to ensure that the species can move through and around these areas to access habitat resources along the shore (e.g., mangroves habitat used by smalltooth sawfish) or in shallow waters along the shore (e.g., seagrasses, sponges, crustaceans used sea turtles; invertebrates for sturgeon; or bony fish, octopi, cuttlefish, squid, crabs, lobsters, and rays for Central and Southwest Atlantic DPS of scalloped hammerhead shark).

- The installation of artificial reefs (Activity 7) also could prevent movement of mobile species listed in Table 5, including whales (i.e., sea turtles, smalltooth sawfish, sturgeon, Nassau grouper, Central and Southwest Atlantic DPS of scalloped hammerhead shark, and whales); however, the PDC limitations (PDC A7.14) ensure that the size or placement is not so large as to obstruct species movement through an area. Since artificial reefs are placed offshore in deeper waters, mobile species can navigate over, between, or around these structures. Additional protective measures are required in North Atlantic right whale critical habitat to ensure that reef materials are placed and sized to allow adequate room for North Atlantic right whales to navigate above, between, and around these structures the (PDC A7.27). This Opinion also does not apply to artificial reefs if they are to be placed in Gulf sturgeon critical habitat (PDC A7.26). Therefore, we believe that the living shorelines and artificial reefs associated with Activity 7 are not likely to affect these species by impeding their movement or ability to access habitat.

- Activity 10 includes temporary platforms, fill, and cofferdams typically associated with bridge construction. Since these projects can occur in narrow areas spanned by bridges, PDCs (PDC A10.5) are in place to ensure the placement of these structured do not obstruct movement in confined areas such as a channel or river and that they must be placed so that they do not impede normal downstream flows or species movement in the area of mobile species listed in Table 5, except whales (i.e., sea turtles, smalltooth sawfish, Nassau grouper, Central and Southwest Atlantic DPS of scalloped hammerhead shark, and sturgeon).

Therefore, we believe the placement of structures under Activities 7 and 10 will have an insignificant effect mobile species from limiting their movement or ability to access foraging and refuge habitat.

<u>Limiting species movement for reproduction</u>
In specific locations and during certain times of years, species migrate for reproductive purposes. Below is a discussion of the activities that could result in an obstruction to migrating species:

<u>Sea turtles</u>: Loggerhead, green, and leatherback sea turtles nest on Florida beaches and hawksbill, green, and leatherback sea turtles nest on beaches in the U.S. Caribbean. Female sea turtles migrate to nesting beaches to lay eggs and hatchlings migrate away from these beaches. The placement of materials or presence of equipment in front of (i.e., waterward of) nesting beaches could interfere with or obstruct sea turtles' ability to access or leave the beach. Also, the presence of lights in the area could disorient hatchlings leaving the beach that use the moon to navigate to sea. This Opinion includes PDCs designed to protect sea turtles so that there will be no effect to sea turtle migration or movement to, and use of, nesting beaches.

- PDCs preclude placement of materials on or near sea turtle nesting beaches, which prevents effects to sea turtles from reduced access to those resources from shoreline stabilization (Activity 1, PDC A1.7), boat ramps (Activity 6, PDC A6.6), and temporary platforms, fill, and cofferdams (Activity 10, PDC A10.7).

- Activities associated with pile-supported structures and ATONs (Activity 2), dredging (Activity 3), outfall structures (Activity 4), scientific survey devices (Activity 5), seagrass restoration (Activity 7), utility and transmission lines (Activity 8), and marine debris removal (Activity 9) will not create obstructions, add lighting, or otherwise disrupt access to and from nesting beaches, or otherwise interfere with the use of these areas, by adult or hatchling sea turtles. These activities (1) are small in size such they will not obstruct movement, (2) are typically completed during the day when turtles are not approaching the beaches for nesting, and (3) do not create lighting, structures, or other potential disruptions to nesting beach access.

- Under the PDCs for Activity 2, docks installed within visible distance of on ocean beaches are required to use turtle-friendly lighting if lighting is necessary for the project (Activity 2, PDC A2.8). Turtle-friendly lighting is lighting that is installed in a manner that does not allow light to be seen from the water so that it does not disorient hatchlings leaving the beach.

- Finally, under the PDCs described below, this Opinion does not apply to projects occurring in sea turtle critical habitat in the U.S. Caribbean, including the critical habitat for green, hawksbill, and leatherback sea turtles

Therefore, we believe that none of the activities will result in obstructions to sea turtles accessing nesting beaches or create lighting that would be disorienting to hatchling sea turtles, and thus we believe the activities will not affect sea turtles by limiting their ability to access or use nesting beaches.

<u>Smalltooth sawfish</u>: Studies have identified certain areas that are suspected to support higher levels of pupping in smalltooth sawfish critical habitat. These areas are identified in Section 2.1.1.1 as smalltooth sawfish limited exclusion zones.

- Under the activity-specific PDCs, certain categories of activities that could otherwise result in effects to sawfish migration and movement to and from pupping areas will not affect this migration or movement since these activities cannot occur in smalltooth sawfish limited exclusion zones (areas identified as areas supporting higher levels of smalltooth sawfish pupping). In particular, shoreline stabilization (Activity 1, PDC A1.8.5), pile-supported structures and ATONs (Activity 2, PDC A2.12), dredging and disposal (Activity 3, PDC A3.5.4), outfall structures (Activity 4, PDC A4.5), boat ramps (Activity 6, PDC A6.5.4), aquatic restoration activities (Activity 7, PDC A7.25), utility and transmission lines (Activity 8, PDC A8.8), and temporary platform, fill, and cofferdams (Activity 10, PDC A10.10) cannot occur in smalltooth sawfish limited exclusion zones. Because these activities cannot occur in sawfish limited exclusion zones, which include known hot spots and pupping areas, we believe those activities (Activities 1- 4, 6- 8, and 10) will not affect smalltooth sawfish by interfering with their migration to and use of areas for pupping.

- Scientific surveys (Activity 5) and marine debris removal (Activity 9) can occur in smalltooth sawfish limited exclusion zones; however, those activities do not block species movement or access to important areas. The PDCs specific to scientific surveys explicitly require that scientific survey devices do not block access of listed species to their habitat (PDC A5.2). Additionally, such devices can only be left in place for up to 24 months; thereafter, the site must be returned to pre-project conditions (PDC A5.3). Marine debris removal under this Opinion is not of a scale that could create obstructions, involving coordination between divers and a small number of vessels, and is completed quickly. Because installation of scientific survey devices (Activity 5) and marine debris removal (Activity 9) are very low impact activities completed quickly, and to be covered under the Opinion, cannot block access to and from sawfish pupping habitat, we believe these activities will have no effect on smalltooth sawfish from interfering with migration to and use of areas for pupping.

Therefore, we believe that none of the activities will result in obstructions to smalltooth sawfish to accessing or using areas that support known higher levels of pupping in smalltooth sawfish critical habitat, and will have no effect on smalltooth sawfish.

Sturgeon: Shortnose, Atlantic, and Gulf sturgeon migrate between estuaries and spawning rivers. None of these species occur or migrate in the U.S. Caribbean.

- Shortnose sturgeon are not known to spawn in Florida rivers, and therefore there will be no effect to their spawning migration from activities analyzed in this Opinion.

- Atlantic sturgeon are believed to spawn in the St. Marys River in Florida, but the Atlantic sturgeon critical habitat exclusion zone, identified in Section 2.1.1.3, excludes activities occurring in that river from this Opinion. Given this exclusion, there will be no effect to Atlantic sturgeon from effects to spawning migrations from activities analyzed in this Opinion.

- Gulf sturgeon spawning rivers are under the jurisdiction of the USFWS while the estuarine and marine environment used by these species is under the jurisdiction on NMFS. The mouth of Gulf sturgeon spawning rivers and narrow inlets used by Gulf sturgeon to access spawning rivers are identified in Section 2.1.1.2 as Gulf sturgeon critical habitat migratory restriction zones, where additional restrictions apply. To prevent Gulf sturgeon from being deterred from entering or exiting a spawning river, activities that have the potential to disrupt or prevent migration and movement of Gulf sturgeon, including shoreline stabilization (Activity 1), pile-supported structures and ATONs (Activity 2), dredging and disposal activities (Activity 3), water-management outfall structures (Activity 4), boat ramps (Activity 6), aquatic enhancement (Activity 7), transmission and utility lines (Activity 8), and temporary platforms, fill, and cofferdams (Activity 10), are subject to activity-specific PDCs that ensure that these activities do not obstruct access to or deter Gulf sturgeon from entering the mouths of spawning rivers or narrow inlets between marine and estuarine areas. In particular, these activities are subject to PDCs that implement the additional noise restrictions listed in Section 2.1.1.2 for the Gulf sturgeon critical habitat migratory restriction zones (PDC A1.9, PDC A2.11; PDC A4.6; PDC A6.10), limit dredging (PDC A3.6) and the installation of utility and transmission lines (PDC A8.10) to outside spawning periods, restrict aquatic restoration (oyster reefs, living shorelines, and seagrass to less than –6 ft and no artificial reefs) in Gulf sturgeon critical habitat to areas shallower than the Gulf sturgeon preferred foraging depths (PDC A7.26), prohibits living shoreline, oyster reef, and artificial reef activities (Activity 7, PDC A7.26) and fill projects (Activity 19, PDC A10.11) in the Gulf sturgeon critical habitat migratory restriction zones. Since Activities 1-4, 6-8, and 10 are limited or cannot occur in Gulf sturgeon critical habitat migratory restriction zones by activity-specific PDCs, we believe these activities will have no effect on sturgeon migration and no effect on the species from interference with migration.

- Scientific surveys (Activity 5) and marine debris removal (Activity 9can occur in the mouth of Gulf sturgeon spawning rivers and narrow inlets used by Gulf sturgeon to access spawning rivers that we identified as Gulf sturgeon critical habitat migratory restriction. However, the PDCs for scientific survey devices exclude installation of devices that have the potential to interfere with access of listed species to their habitat from the Opinion (PDC A5.2). Installation of scientific survey devices (Activity 5), which, based on information from the USACE, we assume will be less than 50 ft^2 in size, and marine debris removal activities (Activity 9) are very low impact activities that are completed quickly, often in less than a day. Thus, we believe that these small projects (in size, scope, and use of equipment) will not deter sturgeon from moving through narrow inlets or entering spawning rivers and therefore will have no effect on the migration of Gulf sturgeon.

Therefore, Activities 1-10 will have no effect on sturgeon (Atlantic, Gulf, or shortnose) from the placement of materials or presence of construction obstructing the species from accessing spawning rivers.

<u>Nassau grouper</u>: The only known spawning sites for Nassau grouper in the action area occur in the U.S. Caribbean. Nassau grouper spawn in known aggregation sites at night around a full moon from November to February. Since PDC AP.6 restricts all work to daytime hours, we believe that none of the activities will affect the ability for Nassau grouper to form aggregations for spawning.

<u>Central and Southwest Atlantic DPS of scalloped hammerhead shark</u>: At this time we are unaware of any specific reproductive areas for the Central and Southwest Atlantic DPS of scalloped hammerhead shark in the action area. Studies suggest that scalloped hammerhead sharks do not participate in natal homing, which would essentially restrict the species to a specific nursery ground, but instead have been found to use large estuaries as nursery habitats located 100 to 600 km from established nursery grounds (Duncan et al., 2006). Therefore, we believe that none of the activities are large enough to block access to an entire potential nursery area that the Central and Southwest Atlantic DPS of scalloped hammerhead shark may use for reproduction.

<u>Whales</u>: The only known reproductive area for whales in the action area is the area designated as North Atlantic right whale critical habitat. We designated these areas to protect the whales using the area for calving. The placement of artificial reefs in this area is the only type of activity analyzed in this Opinion that could be large enough in size or scale to obstruct movement of North Atlantic right whales calving. The effects of artificial reefs on North Atlantic right whale critical habitat are discussed further in Section 7.

6. Vessel Strikes

Vessel traffic, both recreational and commercial, has been documented in stranding reports to adversely affect protected marine mammals and sea turtles, but little information exists on interactions with smalltooth sawfish, Nassau Grouper, Central and Southwest Atlantic DPS of scalloped hammerhead shark, and sturgeon (Gulf sturgeon, shortnose, and Atlantic) as these species' primarily demersal habits would rarely put them at risk from vessels at the surface. No stranding reports indicate smalltooth sawfish or Nassau grouper have been struck by vessels. Limited stranding records show that sturgeon have been struck by large shipping vessels in narrow channels in the Northeast. These narrow channels combined with the deep drafts of the shipping vessels prevent sturgeon from being able to avoid interactions with the vessels. The action area does not contain narrow shipping channels that limit the species' ability to avoid the vessels as are found in the Northeast, so we do not expect such interactions here. In addition, independent of any of the PDCs in this Opinion, navigational markers alert both recreational and commercial boaters to shallow areas to prevent groundings. Because the vessels are likely to rely on these markers to avoid shallow areas for safety reasons (to prevent their boats from striking the bottom), there is little risk that the boats will be in these shallow waters and interact with species in these waters. Therefore, interactions with smalltooth sawfish, Nassau Grouper, and sturgeon are extremely unlike to occur and effects to those species from vessel strikes are discountable.

As stated above, vessel traffic can adversely affect listed whales (specifically the North Atlantic right whale) and sea turtles. Construction of pile-supported structures (Activity 2) and boat ramps (Activity 6) analyzed in this Opinion may indirectly result in increase in vessel use by introducing additional and increased shore-based transfer and support facilities. As such, the potential exists for adverse effects to these species from a possible increase in vessel usage. However, these activities are not expected to result in an increase in the number of vessels beyond the range identified in the following analysis.

The Florida Department of Highway Safety and Motor Vehicle website reports the total number of registered vessels per year in Florida over the past 16 years. The annual number of total registered vessels in Florida has varied up to 14% between the highest number of registered vessels in 2007 and the lowest number in 2000 and still has not returned to the highest number of registered vessels that occurred from 2005-2008. Even though it has fluctuated, the general trend has remained stable and unchanged. To confirm this, we conducted a statistical analysis of the data using a method called a one-way analysis of variance (also referred to as a one-way ANOVA) to access the potential differences in the total numbers of all registered vessels in 35 Florida coastal counties compared to the year (2005-2015). There was no significant difference in numbers of registered vessels in Florida coastal counties for the years 2005-2015 (based on the input values of alpha=0.05, $F(10,374) = 0.177$, $p=0.99$). We also compared various data sets to determine if distribution of registered vessels in Florida changed in a particular region. For this, we looked at the number of vessels registered per year in all Florida counties, in coastal counties only, in coastal counties that border Johnson's seagrass critical habitat only, in coastal counties that boarder North Atlantic right whale critical habitat only, and in coastal counties that boarder North Atlantic right whale critical habitat only where the vessels registered were classified as size Class 2 (26 ft to 39 ft 11 in) and Class 3 (40 ft to 64 ft 11 in). We reviewed the number of vessels registered in North Atlantic right whale critical habitat that were classified as size Class 2 and 3 because the size and speed of a vessel that may strike a North Atlantic right whale can affect the survivability of the whale. As we noted in the final rule listing the species, right whales struck by vessels over 65 ft in length and travelling at a certain speed may suffer mortality. 73 FR 60173, October 10, 2008. For this reason, vessels over 65 ft in length must comply with speed restrictions that reduce the likelihood of fatal collisions with right whales. These speed restrictions apply in specific locations, primarily at key port entrances, and in seasonal management areas at certain times, although there is an exception when navigational safety requires a deviation. Thus, we did not isolate vessels of this size because the speed restrictions reduce the potential for vessel strike. In addition, these larger vessels are included in our analysis of vessels in and adjacent to North Atlantic right whale critical habitat. Although we limited our speed restrictions to vessels over 65 ft in length, in the final rule, we recognized that right whales had been struck and killed by vessels in the 40-65 ft class, although but death occurred in just 2 of the 8 cases studied. We also noted a single reported case of a 33.7 ft vessel that struck and killed a right whale calf in Australia in 2009. Under our Dynamic Management Area program, these smaller vessels are requested, but not required, to either travel at 10 knots or less or route around locations when certain aggregations of right whales are detected outside seasonal management areas, but since those measures are voluntary, we are not assuming that they will be followed. Thus, because it is possible that vessels 33.7 ft in length could strike and kill right whales, we isolated the number of registrations for Class 2 (26 ft to 39 ft 11 in) and Class 3 (40 ft to 64 ft 11 in) vessels registered in counties that border North Atlantic Right whale critical habitat.

The number of registered vessels per year in each of these regions, and of the various sizes as discussed above, is shown in Figure 7 below. None showed statistically significant fluctuations in the number of registered vessels. Any minor fluctuations in registered vessels are likely linked to external factors including economic conditions and gas prices, which will continue to fluctuate throughout time. Thus, even though new vessels continue to be sold throughout the state of Florida and new structures continue to be constructed to store those vessels, the total number of registered vessels in Florida has remained relatively static, as discussed above. We assume that this is because (1) most old vessels are ultimately replaced with new vessels; (2) many new docks and marinas likely also replace older structures so a permit to construct a new structure does not necessarily mean the new structure will support new vessels; and (3) vessels stored at 1 location may be relocated, but are not new to the state of Florida. Also, new residential docks may be built that do not support vessel dockage or storage, or that change the location of existing vessels. In fact, in a 5-year period from 2010-2014, the USACE estimates that it issued 11,412 permits for new docks and marinas in Florida, yet the total number of registered vessels in Florida dropped by 41,954 during the same time period. This indicates that the number of registered vessels in Florida is not directly related to the number of permitted new structures. With respect to relocation and distribution, we conducted the analysis above to determine whether the vessels were being relocated to a particular area, including areas sensitive to additional vessel traffic. We did not find a statistically significant change in the number of vessels in a particular area. We do not have data about the number of registered vessels in the U.S. Caribbean; however, we assume that this consistent level of vessel registrations would also apply in the U.S. Caribbean since we would expect the Caribbean to be affected by the same factors that keep overall vessel numbers constant despite increasing dock construction (new docks may just relocate vessels, or replace older structures).

Therefore, we believe installation, repair, and replacement of pile-supported structures (Activity 2) and boat ramps (Activity 6) do not contribute to an increase the number of registered vessels in the State of Florida or the U.S. Caribbean. Based on the discussion above, we believe that it is extremely unlikely that the proposed action will increase the number of registered vessels or the level of vessel traffic in the action area, and thus it is extremely unlikely that these projects will increase the incidence of vessel strike. Therefore, the potential effect of vessel strikes resulting from Activities 2 and 6 analyzed in this Opinion on whales and sea turtles is discountable.

Moreover, regarding the potential for vessel strike of the North Atlantic right whale, though the addition of structures that support vessels analyzed in this Opinion is unlikely to result in additional vessels in Florida generally or in areas where North Atlantic right whales occur specifically, we did provide additional measures in this Opinion for the protection of the species. In particular, within the North Atlantic right whale educational sign zone (see Section 2.1.1.4), PDC A2.2 requires all commercial, multi-family, or public docking facilities to post educational signs alerting boaters of the presence of North Atlantic right whales. In addition, PDC A2.4 provides that private home owners proposing to construct, repair, or replace a dock structure within 11 nmi of North Atlantic right whale critical habitat will be provided a handout with their USACE permit describing the presence of North Atlantic right whales in the area and the Federal regulations governing the approach to North Atlantic right whales (Appendix C). These measures further reduce the risk of interaction.

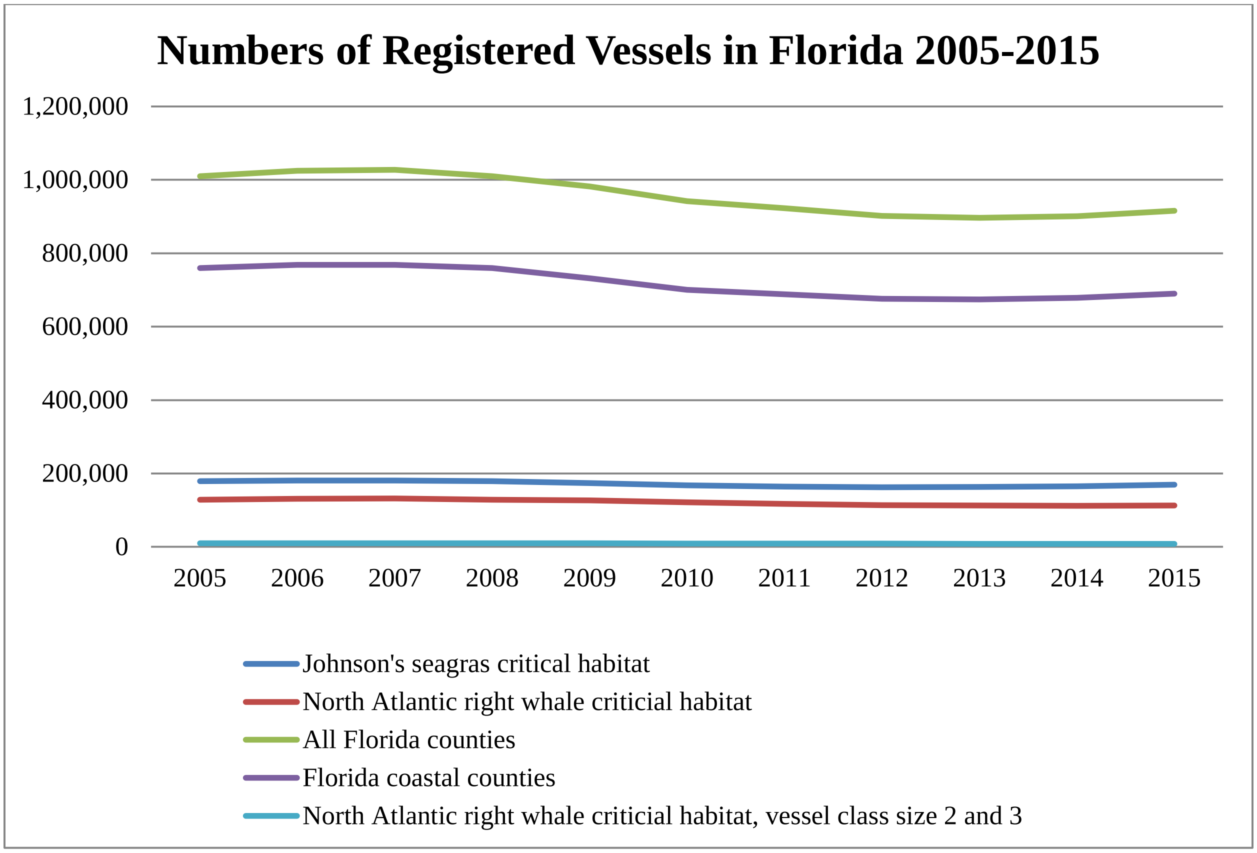

Figure 7. Number of registered vessels in Florida from 2005 to 2015 (Florida Department of Highway Safety and Motor Vehicle website: http://www.flhsmv.gov/dmv/vslfacts.html).

7. Noise

We believe that the noise generated by the minor in-water activities analyzed in this Opinion, including the noise generated by the installation of piles and sheet piles associated with shoreline stabilization (Activity 1) and pile-supported structures (Activity 2), may affect ESA-listed sea turtles, smalltooth sawfish, sturgeon, Nassau grouper, and the Central and Southwest Atlantic DPS of scalloped hammerhead shark. Other activities addressed in this Opinion that may involve the installation of piles or sheet piles include outfall structures (Activity 4), scientific survey devices (Activity 5), boat ramps (Activity 6), aquatic enhancement (Activity 7), aerial transmission lines (Activity 8), and platforms and cofferdams (Activity 10); however, because the portion of these activities requiring pile and sheet pile installation must comply with the PDCs for Activities 1 and 2, we are not separately analyzing the noise from pile driving associated with those activities. Our effects determinations related to in-water construction noise relies on and updates the analysis that we completed for NMFS's Programmatic Biological Opinion on SAJ-82 for Monroe County, Florida (NMFS 2014b). This Opinion considers the effect of noise on all species under NMFS's jurisdiction that are found within the action area of this Opinion, including sturgeon and the recently listed Nassau grouper, along with an explanation of the calculations and thresholds used to make these effects determinations (Appendix B of this Opinion).

Installing piles and sheet piles generates sound waves that can result in physical injuries to sea turtles and fish (e.g., smalltooth sawfish, sturgeon, Nassau grouper, and the Central and Southwest Atlantic DPS of scalloped hammerhead shark) or change their behavior, as explained in more detail below. In order to determine the hydroacoustic effects on the species from the installation of piles and sheet piles (generally referred to as noise effects in this Opinion), we need to calculate the area in which the noise levels will be elevated (also known as the ensonified zone) as well as the portion of the ensonified zone in which the species may experience potentially adverse behavioral effects (the behavioral zone), potentially adverse physical injuries (physical injury zone), and potentially adverse physical injuries from repeated exposure to noise (cumulative injurious zone). The physical injury zone is the area where the species would experience injury from a single strike, or single loud noise event, and the cumulative injurious zone is a larger area where the species could experience physical injury if it were exposed to noise over time.

Calculating the size of these zones requires knowing the material that the pile or sheet piles are made of (e.g., wood, concrete, metal), the size of the pile or sheet pile (i.e., diameter, width, length), the equipment that will be used to install it (e.g., sledge hammer, vibratory hammer, impact hammer), and the number of strikes or vibratory time required to install the pile or sheet pile. The PDCs in this section limit the types and sizes of materials that can be used and the allowable installation methods.

Calculating the effects of in-water noise on marine species within these zones requires knowing where the pile or sheet pile will be installed. Section 2.1.1.2 states the type of pile driving activities that can occur in Gulf sturgeon critical habitat migratory restriction zones and these limitations are implemented in PDC A1.9 and PDC A2.11 for Activities 1 and 2 respectively. In addition, no pile driving activities can occur in the smalltooth sawfish critical habitat limited exclusion zones (PDC A2.12).

Another consideration in evaluating the effects noise may have on species is whether the pile driving, and thus the noise generated, will occur in open water or in confined spaces. This differentiation is important. If a project occurs in a confined space, the animal may not be able to avoid the physical injury, cumulative injurious, and/or behavioral zones or may become trapped in an area (e.g., the terminal end of a canal) because those zones block the only escape route. Conversely, in an open-water environment, the animal would be able to move freely away from the noise without being forced to move through or stay in areas where the noise levels over time could cause injury. For our noise analysis, we define a *confined space* as any area that has a solid object (e.g., shorelines or seawalls) that creates a constricted passage area such that species attempting to move through the area would be forced to pass through the cumulative injurious zone (generally, the largest of the zones). To allow species to move through the project areas without being exposed to noise at levels that could be injurious over time, the PDCs limit certain pile types and installation methods in these confined spaces to ensure that the cumulative injurious zone is limited to a maximum of half the width of the confined area.

In Florida, we consider the confined space to be any area that has a solid object (e.g., shorelines or seawalls) within 150 ft of the pile or sheet pile installation site. In the U.S. Caribbean, we consider confined space to be any area that has a solid object within 260 ft of the pile or sheet pile installation site. These confined space distances were calculated by doubling the cumulative injurious zone for the large fish found in Florida and the smaller fish found in the U.S. Caribbean (calculations provided in Tables 18 and 19, and an example of a confined space shown in Figure 8). As discussed in Appendix B, the effects of in-water noise on fish is different for small fish and large fish. Fish weighing less than 2 grams are more susceptible to injury from impulsive noises, like impact pile driving, than fish weighing more than 2 grams. Similarly, fish weighing less than 102 grams are more susceptible to non-impulsive noises, like vibratory pile driving, than fish weighing at least 102 grams. The only fish in the action area that we expect to be less than 102 grams and less than 2 grams are newly recruited and small juvenile Nassau grouper in the U.S. Caribbean, as discussed in the Nassau grouper section above. Thus, we have provided a larger confined space zone in the U.S. Caribbean to be protective of the smaller fish that might be found there. Because the cumulative injurious zone for large and small fish is the same or greater than the cumulative injurious zone for sea turtles, these zones are protective of both sea turtles and fish. In particular, they ensure that a fish or sea turtle would have at least half the width of the escape route free from cumulative injurious noise so that they could move through the area as needed without being exposed to potentially injurious noise levels over time. Docks or other pile-supported structures do not stop or reflect noise and do not create a confined space.

Figure 8. Example of a confined space (left) and an open-water environment (right) for a noise analysis. The left image shows a man-made residential canal and a 150 ft sound radius that would block movement of species if piles were installed at this location because the canal is not wide enough to ensure more than half the escape route is free from cumulative injurious noise levels. The right image shows a portion of San Juan Harbor and a 260 ft sound radius that would not block movement of species if piles were installed at this location because species would be able to move freely away without passing through the area with cumulative injurious noise levels.

Project Design Criteria

Since the effects of in-water noise from pile and sheet pile installation are dependent on the type and size of material installed and the manner and location in which it is installed, the PDCs for pile and sheet pile installation are based on those factors, and are broken into different categories identified as A-E below. The tables below identify the PDC category for the type of activity, depending on whether it occurs in an open water environment or in a confined space. If the proposed project includes pile sizes outside the range of those described in the table below, then installation of those piles are not covered under this Opinion (e.g., installation of concrete piles larger than 24-in diameter are not covered under this Opinion).

PDCs for In-Water Noise from Pile and Sheet Pile Installation

Open Water

The letters A-E in the tables below specify the PDC category. Activities labeled A-D must follow the corresponding PDCs for labeled Category A-D below. Activities labeled E are excluded from this Opinion, as stated in Category E below.

	Trench and fill	Pilot hole (auger or drop punch)	Jetting	Vibratory	Impact hammer
Wood piles 14-inch (in) diameter or less when installed via impact hammer and 36-in or less for all other installation methods	A	A	A	A	B
Concrete pile 24-in diameter/width or less in open water	A	A	A	A	B
Metal pipe pile 36-in diameter or less	A	A	A	A	E
2 metal boatlift I-beams	A	A	A	A	B
Concrete slab wall- any size	A	A	A	A	B
Vinyl sheet pile- any size	A	A	A	A	B
Metal sheet pile- any size	A	A	A	A	E

Confined Space

In Florida, we consider the confined space to be any area that has a solid object (e.g., shorelines or seawalls) within 150 ft of the pile installation site and in the U.S. Caribbean we consider confined space to be any area that has a solid object within 260 ft of the pile installation site.

	Trench and fill	Pilot hole (auger or drop punch)	Jetting	Vibratory	Impact hammer
Wood pile 14-in diameter or less when installed via impact hammer and 36-in or less for all other installation methods	A	A	A	A	B
Concrete pile 24-in diameter/width or less (5 piles or less installed/day)	A	A	A	A	C
Concrete pile 24-in diameter/width or less (6-10 piles installed/day)	A	A	A	A	D
Metal pipe pile 36-in diameter or less	A	A	A	A	E
2 metal boatlift I-beams	A	A	A	A	B
Vinyl sheet pile – any size	A	A	A	A	B
Concrete slab wall- any size (5 slabs or less installed/day)	A	A	A	A	C
Concrete slab wall- any size (6-10 slabs installed/day)	A	A	A	A	D
Metal sheet pile- any size	A	A	A	A	E

A. The Projects identified as <u>A</u> above must comply with PDCs identified for all projects in this Opinion. Specific PDCs related to noise include:

1. All work must occur during daylight hours only (PDC AP.6).

2. All construction personnel are responsible for observing water-related activities to detect the presence of these species and avoid them (PDC AP.7).

B. The projects identified as B above must follow all of the conditions under A, above, AND also must limit the maximum number of piles installed per day to no more than 10 piles per day.

C. The projects identified as C above must follow all of the conditions under A, above, AND also must limit the maximum number of piles installed per day to no more than 5 piles per day.

D. The projects identified as D above must follow all of the conditions under A and B, above, AND also must abide by one of the noise abatement measures below, as chosen by the applicant:

1. Bubble curtain: The bubble curtain design must adhere to the guidelines for unconfined and confined bubble curtains described in Appendix B.

2. Temporary noise attenuation pile (TNAP) also known as a pile isolation casing: The TNAP design must be constructed of a double-walled tubular casing (a casing within a larger casing), with at least a 5-in-wide area between the casings that is dewatered to create a hollow space or 5-in wide area between the casings completely filled with closed-cell foam or other noise dampening material between the walls. The TNAP must be long enough to be seated firmly on the sea bottom, fit over the pile being driven, and extend at least 3 ft above the surface of the water.

3. The use of any other alternative noise control method must receive prior approval by NMFS and the USACE, as described in Section 2.3.

E. The projects identified as E are not covered under this Opinion.

Noise created by construction activities can physically injure or change animal behavior in the affected areas. Thus, we will evaluate 2 general categories of effects to listed species as a result of noise: physically injurious effects and behavioral effects. We discuss behavioral responses to noise first below because certain behavioral responses (i.e., avoidance) could affect whether the animal experiences physical injury because of noise.

Behavioral responses from in-water noise associated with pile installation

Animals may have varied behavioral responses to noise, depending on the level of noise, season, location, habitat, and life stage exposed to the noise. Different species also have different life histories and sound-detection capabilities that could influence their response, in addition to a different set of potential behavioral responses that may be triggered by a given stimulus (e.g., some may try to hide in the area while others may swim away). Although the behavioral response of noise avoidance is advantageous at preventing potential injury from the exposure to noise, avoidance behavior may disrupt or interfere with feeding, mating, migration, sheltering, or may increase the risk to individuals (e.g., via predation). Not all individuals are likely to have an avoidance response. Despite exposure to noise that may cause others to move away and abandon the area altogether, some individuals may be biologically motivated to remain in a habitat for feeding, sheltering, mating, or other biologically important reasons or because they are using the area as an established pathway between habitats.

To determine the potential effects from exposure to noise, it is important to understand the ways in which ESA-listed species in the action area may respond to the noise. Responses to pile or sheet pile driving from specific species in the action area are not well documented. However, we expect that species will avoid areas with construction activities that include the combination of the physical movement and presence of construction equipment, presence of turbidity curtains, general construction related noise and specifically louder noises generated from in-water pile and sheet pile installation. Specifically,

- Sea turtles: Studies have reported sea turtles responding to air gun noise and another loud impulsive noise source in the ocean by demonstrating alarm or avoidance behaviors (DeRuiter and Doukara 2010; McCauley et al. 2000a; McCauley et al. 2000b). Therefore, we would expect sea turtles would avoid in-water construction noise.

- Sturgeon: Krebs et al. (2012) reported that most tagged Atlantic sturgeon are likely to avoid areas during periods of high construction noise. As such, we would expect shortnose and Gulf sturgeon would also avoid in-water construction noise.

- Smalltooth sawfish and the Central and Southwest Atlantic DPS of scalloped hammerhead shark: No studies have evaluated how sawfish respond to elevated noise levels; however, Myrberg (2001) reported that sudden increases in sound beginning at 20 decibels above ambient caused shark (including hammerhead shark) to move away from a sound source. Since shark and sawfish are in the same Subclass (i.e., Elasmobranchs), we would expect sawfish to have a similar response to noise as shark.

- Juvenile fish: Smaller fish found in the action area (small juvenile Nassau grouper, juvenile smalltooth sawfish,[13] and juveniles of the Central and Southwest Atlantic DPS of scalloped hammerhead shark) may be less willing to move large distances than larger, adult fish due to

[13] Juvenile sturgeon also are less than 2 grams when in riverine habitat. However, the action area does not contain rivers supporting juvenile sturgeon that are under NMFS jurisdiction. Gulf sturgeon are under the jurisdiction of the USFWS when in riverine habitat. Within Florida and the U.S. Caribbean, juvenile Atlantic and shortnose sturgeon are only known to occur in the St. Johns and St Marys River. Due to man-made structures and alterations, spawning areas in the St. Johns River are not accessible and therefore do not support a reproducing population (81 FR 36077). Also, PDC AP.4 does not allow projects to be covered under this Opinion in the St. Marys River, thereby excluding the St. Mary's River from the action area.

associated increase in predation risk. However, we believe even smaller fish will move at least short distances to avoid both the physical commotion and noise of in-water construction. Nassau grouper are the smallest species in our action area that could be exposed to noise from activities covered under this Opinion and the only species in the action area that could be small enough to be more susceptible to injurious noise effects. They are known to spawn in off-shore areas in the U.S. Caribbean so we would expect that juvenile Nassau grouper will recruit to nearshore areas in the U.S. Caribbean. Juvenile smalltooth sawfish may also be found throughout Florida, especially in areas of smalltooth sawfish critical habitat in southeast Florida. A few records of juvenile scalloped hammerhead shark likely from the Central and Southwest Atlantic DPS have been reported in the U.S. Caribbean through hook-and-line capture data. Smaller fish are more susceptible to predation than larger fish so they must determine if moving to avoid a potential threat outweighs the risk of staying in a preferred location such as nearshore seagrass and algae beds. Smaller fish are also biologically more susceptible to physical injury from sound exposure and may need to move further than larger fish to avoid noise that could cause physical injury. Still, we believe that all small fish in the action area (juvenile smalltooth sawfish or scalloped hammerhead shark and even the smallest, small juvenile Nassau grouper that have just recruited to nearshore areas), would move away from an injurious noise source. Though movement to avoid sound exposure could increase their risk of predation, it is likely that predatory species (e.g., larger fish) would also be moving away from the noise source instead of foraging on these smaller species in the area during construction, making predation unlikely.

These behavioral responses to noise inform our effects analysis below.

Potential effects from in-water noise associated with pile and sheet pile installation
As stated earlier, noise generated during the installation of pile and sheet piles can cause physical injury or result in behavioral effects. Physically injurious effects from noise can occur in 2 ways. First, effects can result if a single noise event occurs that exceeds the peak pressure threshold for direct physical injury to an animal. This would result in an immediate adverse effect on the animal. Second, effects can result from prolonged exposure to noise levels that exceed the daily cumulative sound exposure level (cSEL) threshold for the animal, which results in a physical injury to the animals if exposed to the noise levels for sufficient periods.

Physical Injury
Physical injury can range from minor physiological effects to physiological effects that could potentially result in mortality. Potential physiological effects to both fish and turtles are highly diverse, and range from very small ruptures of capillaries such as in fish fins (which are relatively minor physical responses) to severe hemorrhaging of major organ systems such as the liver, kidney, or brain (Hastings and Popper 2005) which may ultimately result in mortality. Other potential effects include rupture of the swim bladder, which is the air-filled organ in the abdominal cavity of most bony fish species that is involved in maintenance of buoyancy. Both sturgeon and Nassau grouper have swim bladders that are susceptible to rupture from noise. Both smalltooth sawfish and scalloped hammerhead shark, like all elasmobranchs, do not have swim bladders; their oversized liver provides buoyancy, and, as such, it may be susceptible to physical injury.

ESA-listed species within the physical injury zone can suffer physical injury as described above and can also suffer from a reduction in their ability to hear (another form of physical injury), which can decrease their ability to detect and avoid predators, decrease their ability for passive listening to detect prey species, interfere with the detection of conspecifics (in vocal species), and inhibit their overall ability to detect cues in the acoustic soundscape. Permanent hearing loss (loss of hearing) or permanent threshold shift (change in hearing thresholds and frequencies), is the irreversible loss of hearing abilities (either total or partial). Permanent hearing loss and permanent threshold shift and other physical injuries could have negative consequences for an animal. Temporary hearing loss and temporary threshold shift are temporary hearing impairments from exposure to loud noises that are recoverable with time (hours to days). Neither is considered a permanent physical injury, but both could have some temporary effects to the auditory sense of an animal.

Physical injury can also result in adverse behavioral effects. An example of a behavioral effect resulting from a physical injury is if the temporary or permanent damage to hearing affected a species' ability to forage. Elasmobranch hearing sensitivity has been correlated with feeding behavior (Corwin 1977). Research has shown that pelagic, predatory sharks (such as the lemon shark (Nelson and Gruber 1963) and the bull shark (Kritzler and Wood 1961)) who feed on bony fishes have more sensitive low-frequency hearing than bottom-dwelling elasmobranchs (such as the little skate (Casper et al. 2003) and the horn shark (Kelly and Nelson 1975) that feed on other bottom-dwelling species (such as molluscs and crustaceans). The smalltooth sawfish is a mostly bottom-dwelling elasmobranch closely related to the little skate, and, like the little skate, would be expected to have less sensitive low frequency hearing and, therefore, rely more on senses that specialize in nearby detection such as electroreception, smell, and vision. Scalloped hammerhead shark would be expected to have more sensitive low-frequency hearing like other sharks. Currently, we do not understand precisely how sea turtles, smalltooth sawfish, scalloped hammerhead shark, sturgeon, and Nassau grouper use auditory cues in their environment and if temporary or permanent threshold shifts would alter their behavior or physiology in a way that was notable to the exposed individual.

We do not expect ESA-listed sea turtles and fish to suffer physical injury from the noise generated during pile and sheet pile installation covered under this Opinion. We also do not believe that it will cause temporary or permanent hearing loss or threshold shifts to these species that would cause physiological or behavioral changes in important life functions such as foraging.

As explained above and in Appendix B, physically injurious noise can occur from exposure to the noise generated during a single-strike (peak pressure) or the exposure to noise generated over the course of a day (as measured by cSEL).

- Physical injury (single-strike): For the types of pile and sheet pile installation analyzed in this Opinion, we would only expect a peak pressure injury from impact driving of metal piles or metal sheet piles; therefore, these are the only pile installation activities that are excluded from this Opinion, as described in the PDCs for *In-water Noise from Pile and Sheet Pile Installation* (provided above and listed as not covered, Category E) (see Appendix B for the calculations supporting this conclusion). None of the activities covered under this Opinion (as restricted by the PDCs of this Opinion) will result in single-strike injury to any of the species in the action area.

- Physical injury (cumulative exposure): To determine if ESA-listed sea turtles or fish in the action area would be affected by noise exposure over the course of a full day of construction (cSEL), we rely on the information provided above regarding how the species in our action area respond to noise (section entitled "Behavioral responses from in-water noise associated with pile installation"). As discussed above, we believe that all of these species will avoid the cumulative exposure area by moving out of the way of the noise. Because we expect mobile species to move away from the sound exposure, we believe it is extremely unlikely that the species would be exposed to the noise for the amount of time required to cause injury and that the effect from noise would be discountable.

In addition, for areas within the action area that we consider to be biologically significant (e.g., known areas used for reproduction or migration), additional PDCs are provided to ensure that noise from in-water construction does not interfere with species in those biologically significant areas, as described by species below.

- Smalltooth sawfish: Pile driving activities cannot occur in areas known to support smalltooth sawfish pupping (smalltooth sawfish limited exclusion zones, defined in Section 2.1.1.1). If an otherwise covered pile driving activity is proposed in the smalltooth sawfish limited exclusion zone, the USACE must separately consult on that activity given the location.

- Gulf sturgeon: Only the certain pile installation types that we believe will not cause harm to Gulf sturgeon are allowed in the Gulf sturgeon critical habitat migratory restriction zones, defined in Section 2.1.1.2. The USACE must separately consult on all other activities.

- Sea turtles: The Opinion does not apply to construction on or near sea turtle nesting beaches under the activity-specific PDCs for shoreline stabilization (Activity 1, PDC A1.7). If an otherwise covered shoreline stabilization activity is proposed in those areas, the USACE must separately consult on that activity given the location. Activity 2 allows only the installation of ATONS near sea turtle nesting beaches (Activity 2, PDCs A2.15 and A2.16). We believe that installing ATONs, which are structures limited in size to only a single pile or buoy, does not restrict access to nesting beaches. All other pile supported structures in these areas require separate consultation.

- Nassau Grouper are soniferous fishes (i.e., noise producing), and males make specific sounds related to courtship activities (Appeldoorn et al. 2013). Nassau grouper spawn in aggregation sites in the U.S. Caribbean (as well as in other areas outside of the action area of this Opinion). Therefore, in-water construction in those areas could interfere with mating; however, spawning aggregation sites are located in off-shore areas, away from nearshore construction activities, such as construction of docks and seawalls that may involve the noise-generating pile driving activities analyzed here. In addition, Nassau grouper spawn at night, and, under the PDCs for *In-Water Noise from Pile and Sheet Pile Installation*, all work must occur during daylight hours.

- The Central and Southwest Atlantic DPS of scalloped hammerhead sharks: At this time, we are unaware of any biologically important areas in the action area used by this species.

Therefore, we believe that the PDCs above will protect these species in biologically important areas, and thus that the noise generated during pile and sheet pile installation will have no effect on mobile species in biologically significant areas.

Behavioral Effects
Behavioral effects from noise can result if the species is exposed to noise at levels that could cause behavioral responses (within the behavioral effects zone), or the noise caused the species to change its behavior or interferes with biologically important behaviors. Species movement and migration is a factor when evaluating the behavioral effects of noise exposure in a specific project location. Certain project construction locations could impede the species' ability to move away from or around the sound source, and that is why we also consider if the project would occur in an open-water or confined location. In a confined location (described above), the species could be trapped and exposed to the noise throughout the course of the day's construction (construction is limited to daylight hours), resulting in exposure to sound that could cause behavioral responses (in the behavioral effects zone) or could interfere with foraging or other biologically important activities.

By limiting the work in these confined areas and limiting work to only daytime hours, species will be able to move to avoid any behavioral effects from the exposure to the noise in the behavioral effects zone by moving through or away from the area during quiet periods at night. The species are highly mobile, and we expect them to move away from the behavioral effects zone, and thus, such effects would be extremely unlikely to occur and discountable. In addition, since they will be able to leave or maneuver around the behavioral effects zone, they will be able to safely move to nearby similar habitat for foraging and refuge or move onto important biologically significant areas. Because we expect the species to be able to safely relocate to similar areas, the effect of being forced to move is insignificant. For the same reason, we believe species' movement away from the cumulative injury zone for physical injury (discussed above) will have an insignificant effect on the species.

In addition, as discussed in the preceding section, for areas within the action area that we consider to be biologically significant (e.g., known areas used for reproduction or migration), additional PDCs are provided to ensure that noise from in-water construction does not interfere with important biological functions and will have no effect on species by interfering with their ability to use these biologically significant areas as described by species.

Summary of Physically Injurious and Behavioral Effects
We believe that there will be no direct physical effects from exposure to peak pressure noise from pile or sheet pile driving allowed under this Opinion since the Opinion does not apply to

activities that could result in peak pressure injury. Additionally, we believe the cumulative injury zones are limited in size and location to allow ESA-listed fish and sea turtles to move around or avoid the zones, thus limiting the species exposure. As described above, these species are not expected to stay within the cumulative noise zones during construction and therefore we believe it is extremely unlikely that they will suffer injury, and the effect is discountable (Table 20).

We also believe that noise from pile driving allowed under this Opinion is not likely to adversely affect ESA-listed fish and sea turtles from exposure to behavioral noise zones (Table 20). The species are highly mobile and can avoid these zones, making it extremely unlikely that they will experience behavioral impacts, and thus the effect is discountable. The noise may change the animal's behavior—causing it to move to avoid physical injury or behavioral responses from noise exposure. Triggering an avoidance behavior is an effect on the species, but we believe this effect is insignificant as well. Pile driving cannot occur in areas identified as biologically important to these species (Section 2.1.1), thus, we do not expect exposure to noise to cause the animals to alter any important life functions, and we believe these highly mobile species will be able to relocate to areas of similar habitat outside of the construction zones.

No Effect

Pile installation by jetting, using an auger or drop punch to create a pilot hole, or installing I-beam boatlifts using a vibratory hammer will not result in physical injury (injury from exposure to peak pressure or cumulative sound exposure) or behavioral noise effects, because it will not create noise levels in excess of the respective thresholds for physical injury to, or behavioral responses in, sea turtles and ESA-listed fishes (Table 20). The methods used to determine the sound expected from these installation methods, and the final calculations, are provided in Appendix B.

Calculations for Physically Injurious and Behavioral Effects from Pile and Sheet Pile Installation

Tables 18-19 below provide a summary of the radii at which ESA-listed sea turtles and fish (smalltooth sawfish, scalloped hammerhead shark, sturgeon, and Nassau grouper) will experience physical peak pressure injury, physical injury from cumulative exposure to noise, or behavioral effects at given noise thresholds from the pile and sheet pile installation analyzed under this Opinion. These calculations are explained in more detail in Appendix B. As noted at the outset, of the types of pile and sheet pile installation analyzed in this Opinion, we would only expect single strike (peak pressure) injury from impact driving of metal piles or metal sheet piles; therefore, these activities are excluded from this Opinion as described in the PDCs for *In-water Noise from Pile and Sheet Pile Installation* (provided above and listed as not covered, category C).

Table 18. Impact Hammer Sound Source Levels and Impact Radius Distances

	Source Level (dB re 1 µPa[14])	Radius for Fish less than 2 grams	Radius for Fish over 2 grams	Radius for Sea Turtles
14-in wood pile and vinyl sheet Calculated 10 piles installed per day with 45 strikes per pile = 450 strikes per day				
Physical Injury (peak pressure)	195 dB Peak	0 m (1 ft)	0 m (1 ft)	0 m (1 ft)
Physical Injury (Cumulative exposure)	cumulative	1 pile = 4 m (12 ft) 5 piles = 11 m (36 ft) 10 piles = 17 m (56 ft)	1 pile = 2 m (7 ft) 5 piles = 6 m (20 ft) 10 piles = 9 m (30 ft)	1 pile = 2 m (7 ft) 5 piles = 6 m (20 ft) 10 piles = 9 m (30 ft)
Behavior (Root Mean Square [RMS])	185 dB RMS	215 m (705 ft)	215 m (705 ft)	46 m (151 ft)
24-in concrete pile Calculated 10 piles installed per day with 160 strikes per pile = 1,600 strikes per day				
Physical Injury (peak pressure)	200 dB Peak	0 m (1 ft)	0 m (1 ft)	0 m (1 ft)
Physical Injury (Cumulative exposure)	cumulative	1 pile = 9 m (28 ft) 5 piles = 25 m (83 ft) 10 piles = 40 m (131 ft)	1 pile = 5 m (16 ft) 5 piles = 14 m (46 ft) 10 piles = 22 m (72 ft)	1 pile = 5 m (16 ft) 5 piles = 14 m (46 ft) 10 piles = 22 m (72 ft)
Behavior (RMS)	185 dB	215 m (705 ft)	215 m (705 ft)	46 m (151 ft)
Two 12-in metal boat lift I-beam (H-pile) [15] Calculated 2 piles installed per day with 660 strikes per pile = 1,320 strikes per day				
Physical Injury (peak pressure)	205 dB Peak	1 m (3 ft)	1 m (3 ft)	1 m (3 ft)
Physical Injury (Cumulative exposure)	cumulative	1 pile = 22 m (72 ft) 2 piles = 35 m (115 ft)	1 pile = 12 m (39 ft) 2 piles = 19 m (62 ft)	1 pile = 12 m (39 ft) 2 piles = 19 m (62 ft)
Behavior (RMS)	190 dB RMS	465 m (1,526 ft)	465 m (1,526 ft)	100 m (328 ft)
24-in metal sheet pile Calculated 10 sheet piles installed per day with 660 strikes per pile = 6,600 strikes per day				
Physical Injury (peak pressure)	220 dB Peak	9 m (30 ft)	9 m (30 ft)	9 m (30 ft)
Physical Injury (Cumulative exposure)	cumulative	1 pile = 410 m (1,345 ft) 10 piles = 858 m (2,815 ft)	1 pile = 223 m (732 ft) 10 piles = 858 m (2,815 ft)	1 pile = 223 m (732 ft) 10 piles = 858 m (2,815 ft)
Behavior (RMS)	204 dB RMS	858 m (2,8215 ft)	858 m (2,8215 ft)	185 m (607 ft)

[14] dB re 1 µPa is a unit of measurement of sound in decibels relative to 1 micro-Pascal-squared second

[15] Noise levels not believed to be accurate based on the installation method used. Boatlift I-beams only penetrate loose sediment until they reach the top of, or first few inches of, hard substrate to stabilize the structure on the hard substrate versus penetrating it.

Table 19. Vibratory Hammer Sound Source Levels and Impact Radius Distances

	Source Level (dB re 1 µPa)	Radius for Fish ≥ 102 grams	Radius for Sea Turtles
36-in wood, concrete, vinyl, or metal piles Calculated installation of piles for 8 hours per day (no limit on the number of piles per day)			
Physical Injury (peak pressure)	195 dB Peak	0 m (0 ft)	0 m (0 ft)
Physical Injury (Cumulative exposure)	cumulative	0 m (0 ft)	0 m (0 ft)
Behavior (RMS)	185 dB RMS	215 m (705 ft)	46 m (151 ft)
Two 12-in metal boat lift I-beam (H-pile) [16] Calculated 2 piles installed per day for 30 minutes (1,800 seconds) per pile = 3,600 seconds per day			
Physical Injury (peak pressure)	165 dB Peak	0 m (0 ft)	0 m (0 ft)
Physical Injury (Cumulative exposure)	cumulative	0 m (0 ft)	0 m (0 ft)
Behavior (RMS)	150 dB RMS	0 m (0 ft)	0 m (0 ft)
24-in metal sheet pile Calculated installation of sheet piles for 8 hours per day (no limit on the number of sheet piles per day)			
Physical Injury (peak pressure)	192 dB Peak	0 m (0 ft)	0 m (0 ft)
Physical Injury (Cumulative exposure)	cumulative	0 m (0 ft)	0 m (0 ft)
Behavior (RMS)	178 dB RMS	74 m (243 ft)	16 m (52 ft)
We do not consider the noise effects of small fish for vibratory hammer, because the noise calculations are based on fish less than 0.6 grams and none of the ESA-listed fish in our action area are that small.			

[16] Noise levels not believed to be accurate based on the installation method used. Boatlift I-beams only penetrate loose sediment until they reach the top of, or first few inches of, hard substrate to stabilize the structure on the hard substrate versus penetrating it.

Table 20. NMFS Effects Determinations for In-water Construction Noise Analyzed under this Opinion to Sea Turtles and ESA-listed Fish

	Trench and fill	**Pilot hole (auger or drop punch)**	**Jetting**	**Vibratory**	**Impact hammer**
Wood pile 14-in diameter or less installed via impact hammer and 36-in or less for all other installation methods	NE	NE	NE	NLAA	NLAA
Concrete pile 24-in diameter/width or less (5 piles or less installed/day)	NE	NE	NE	NLAA	NLAA
Concrete pile 24-in diameter/width or less (6-10 piles installed/day)	NE	NE	NE	NLAA	NLAA
Metal pipe pile 36-in diameter or less	NE	NE	NE	NLAA	NC
2 metal boatlift I-beams	NE	NE	NE	NE	NC
Vinyl sheet pile – any size	NE	NE	NE	NLAA	NLAA
Concrete slab wall- any size (5 slabs or less installed/day)	NE	NE	NE	NLAA	NLAA
Concrete slab wall- any size (6-10 slabs installed/day)	NE	NE	NE	NLAA	NLAA
Metal sheet pile- any size	NE	NE	NE	NLAA	NC
NE = no effect; NLAA = may affect, not likely to adversely affect NC = not covered under this Opinion due to the potential effects to listed species					

2.2.1 Activity 1 (A1): Shoreline Stabilization

General Description

This category of activity covers activities related to shoreline stabilization, including the installation, repair (including all forms of maintenance), replacement, and removal of vertical seawalls and shoreline stabilization materials used to protect shorelines. These structures are typically installed from the land or from a shallow-draft barge. This Opinion does not cover the installation of jetties and groins or the placement of beach nourishment material. Living shoreline activities are analyzed separately under aquatic habitat enhancement, establishment, and restoration activities under Activity 7 in Section 2.2.7. Images of typical shoreline protection projects are provided below in Figure 9. For the purposes of this consultation, shoreline protection activities include installation and repair of vertical seawalls (including associated footers), and installation and repair of shoreline stabilization measures such as riprap, articulating blocks or mats, geotextile mats, and sand cement riprap. Vertical seawalls and shoreline stabilization measures are often combined to improve structural stability, such as placement of riprap material at the toe of a vertical seawall.

Vertical seawalls are constructed of vinyl, metal sheet pile, wood, or pre-fabricated concrete slabs. Vertical seawall installation can occur either by (1) using land-based equipment to trench, grade, or shape the shoreline (i.e., dredge the area) and set the seawall pieces in place, or (2) using barge-mounted equipment to place, jet, or hammer the materials into position. The seawall may be supported by installing batter or king piles by vibratory or impact hammer and/or deadmen anchors that hook underground behind the seawall stabilizing them to the uplands. Vertical seawalls are often protected from erosion and scour by placing another structure (e.g., seawall footers) or shoreline stabilization materials (e.g., riprap) immediately waterward of the seawall. Seawall footers are short/low level structures placed directly in front of a seawall to protect the bottom from erosion and scouring. The seawall footer is typically less than half the height of the seawall and can be installed in place of riprap to stabilize the structure. This Opinion covers repair and replacement of seawalls up to 18-in waterward of most existing seawalls, as defined in the PDCs for Activity 1. This is consistent with FDEP's *Exempt Activities* (Section 62-330.051).

In addition to vertical seawalls, shorelines may be stabilized or protected using riprap, articulating blocks or mats, geotextile mats, and sand cement riprap. These materials are typically placed from the land and may require minor excavation of the shoreline to properly place the materials. Work may also be completed from the water by barge-mounted equipment. Riprap is placed by trenching the location (i.e., dredging), placing filter fabric, and then placing riprap on top of the fabric. Other materials may be approved for shoreline stabilization, if coordinated according to the standards in the Project Specific Review in Section 2.3. NMFS will review the projects that propose to use other materials to ensure the materials and methods do not present an entanglement or entrapment risk to protected species and to ensure that the effects of using those materials are consistent with the effects of those materials analyzed here.

Shoreline protection projects may be used in to stabilize only a targeted area or portion of shoreline. Small shoreline protection projects include stabilizing areas around outfall structures, boat ramps, culverts, and other structures analyzed under this Opinion.

Figure 9. Example images of shoreline armoring and stabilization. The left image is a concrete slab seawall, the middle is a riprap shoreline, and the right is a vinyl seawall. (Images provided by the Florida Marine Contractors Association in 2014).

Project Design Criteria

PDCs specific to Activity 1 for Shoreline Stabilization:

A1.1. Activities covered by this Opinion include:

- A1.1.1. New shoreline stabilization: New shoreline stabilization projects cannot exceed 500 ft in length. New seawalls and footers cannot extend any further waterward than 1.5 ft (18 in) from MHW, unless necessary to align a new seawall with 1 or more adjacent seawalls.
  Repair or replacement of existing vertical seawalls: The repair, and replacement of seawalls and footers cannot extend any further waterward than 1.5 ft (18 in) from the wet face of the existing seawall or MHW, unless necessary to align with 1 or more adjacent seawalls. The repair or replacement of an existing seawall is not restricted to the 500 ft in length limit in PDC A1.1.1.
- A1.1.2. Shoreline stabilization materials may consist of riprap, articulating blocks or mats, and sand cement, geotextile/ filter fabric and mattresses. Installation of new shoreline stabilization materials where none previously existed may not extend more than 10 ft waterward of MHW (including the toe of the riprap). Riprap repair, and replacement may occur at its previous location, upland of, or within 1.5 ft (18 in) waterward of its previous location.
- A1.1.3. The Opinion does not cover removal of any length of seawall or other shoreline stabilization materials if such removal would result in an unstabilized shoreline.
- A1.1.4. The Opinion covers installation, repair, replacement, and removal of seawall footers.
- A1.1.5. This Opinion covers the removal/fill of upland cut boat ramps, slips, and basins to return the shoreline to the natural contour and/or to bring the shoreline into alignment with the adjacent property shorelines.

The following PDCs apply to all the activities described in PDC A1.1 above:

A1.2. Placement of backfill is limited to those situations where it is necessary to level the land behind seawalls or riprap. This includes backfill associated with installation of a seawall or riprap to remove/fill in an upland cut area (e.g., boat slip, boat ramp, boat basins) to return the shoreline to the original shape or to connect to adjacent seawalls to bring the shoreline into alignment with adjacent property shorelines.

A1.3. Shoreline stabilization materials must be placed by hand around red mangrove prop roots.

A1.4. Shoreline stabilization structures, other than vertical seawalls, shall be no steeper than a 2:1 Horizontal: Vertical slope for riprap, or the appropriate slope necessary to ensure shoreline stability while minimizing the total footprint when using materials other than riprap.

A1.5. Installation and/or repairs to groins, jetties, or other structures placed perpendicular to shore, and beach nourishment/renourishment are not covered in this Opinion. Breakwaters/living shorelines are covered as described in Activity 7.

A1.6. No placement of riprap below MHW is covered under this Opinion within the boundary of the FKNMS unless the FKNMS issues a NOAA permit or authorization that signifies the proposed activity is consistent with Title III of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended. Proof of approval from the FKNMS is required as part of the project level review submission, described in Section 2.3, below.

A1.7. Shoreline protection shall not occur on ocean beaches used for sea turtle nesting.

Additional PDCs for Activity 1 applicable in critical habitat:

In addition to the PDCs above, the project must be designed to meet the following PDCs if the project occurs in the critical habitat as described below.

A1.8. Smalltooth sawfish critical habitat: Installation of new shoreline stabilization materials in smalltooth sawfish critical habitat under this Opinion is limited to:

- A1.8.1. Placement of new shoreline stabilization materials (i.e. riprap, articulated concrete mats) in water depths deeper than -3 ft MLLW. No stabilization materials can be placed in waters between the MHWL and -3 ft MLLW.
- A1.8.2. Installation of new or repair/replacement seawalls within 1.5 ft waterward of the existing seawall or MHW.
- A1.8.3. Repair and replacement of shoreline stabilization materials (i.e., riprap, articulated concrete mats) within the same footprint of existing materials in depths between the MHWL and -3 ft MLLW. This means that these materials cannot result in the waterward extension or lateral expansion of materials beyond the previous footprint. Shoreline stabilization materials can be expanded in water depths deeper than -3 ft MLLW, as defined in PDC A1.1.3.
- A1.8.4. Removal/filling of man-made upland cut areas (e.g., upland cut boat basins or boat ramps) to return the shoreline to its original contour are allowed, even if it removes the shallow, euryhaline essential feature.
- A1.8.5. To be covered under this Opinion, activities cannot occur in areas identified as smalltooth sawfish limited exclusion zones, as defined in Section 2.1.1.1.

A1.9. Gulf sturgeon critical habitat: All new shoreline stabilization materials (e.g., riprap, articulating concrete mats) can only be placed between the shoreline and where the water reaches a depth of -6 ft MHW. Additional noise restrictions are required for pile and sheet pile installation in the Gulf sturgeon critical habitat migratory restriction zones defined in Section 2.1.1.2.

A1.10. *Acropora* critical habitat: To be covered under this Opinion, new or repair/replacement of shoreline protection cannot occur in *Acropora* critical habitat if the essential feature is present. Repair and replacement of shoreline protection within *Acropora* critical habitat is covered if it is within the existing footprint.

A1.11. Johnson's seagrass critical habitat: To be covered under this Opinion, installation of shoreline stabilization material (e.g., riprap and scour control materials, not vertical seawalls and footers) cannot occur if essential features are present. Repair and replacement of these materials (riprap and scour) is covered within the existing footprint. Vertical seawalls and footers can be installed, repaired, and replaced in Johnson's seagrass critical habitat even if the essential features are present, as long as the project is consistent with the applicable PDCs, including PDC A1.1.1 and A1.1.2 regarding overall length and waterward extension limit.

A1.12. U.S. Caribbean sea turtle critical habitat (hawksbill, leatherback, and the NA DPS of green sea turtle critical habitat): This Opinion does not apply to new structures in sea turtle critical habitat in the U.S. Caribbean. This Opinion does apply to repair and replacement of shoreline protection materials within U.S. Caribbean sea turtle critical habitat if the repair or replacement is within the existing footprint.

Assumptions

The USACE used the data collected from previous programmatic consultations to estimate how many shoreline stabilization projects it will authorize consistent with this Opinion over a 5-year period. Compared to previous Programmatic Opinions, the USACE was able to more accurately analyze data regarding shoreline stabilization activities and noted that the average size of the area impacted by shoreline stabilization projects differed between projects that occurred within smalltooth sawfish critical habitat (average seawall project resulted in 100.41 ft^2 of impacts to in-water areas) and outside of smalltooth sawfish critical habitat (average seawall project resulted in 291.59 ft^2 of impacts to in-water areas). We assume that shoreline stabilization projects in smalltooth sawfish have a smaller footprint because since we designated critical for the species in 2009, development in this area has been limited. For example, to avoid and minimize effects to the habitat, including the shallow, euryhaline water essential feature, seawalls may be designed to be smaller (not to extend out so far into the water) so as not to remove this feature entirely. In addition, placement of riprap along shorelines or in front of seawalls has been discouraged in these areas since the designation. Therefore, we will estimate the potential impacts of the expected shoreline stabilization activities within and outside of the geographic boundaries of smalltooth sawfish critical habitat using the data the USACE provided. The USACE also estimated that 27 projects would be covered in the next 5 years under this Opinion that would repair or replace a seawall that was longer than 500 lin ft. These 27 projects also may include riprap placement. All of these longer seawall repairs/replacements were estimated to occur outside of smalltooth sawfish critical habitat. Based on previously authorized seawall projects greater than 500 lin ft in length, the average repaired/replaced seawall length was 1,215 lin ft and covered 2,918.52 ft^2 of waterbottom (presumably from placement of the seawall waterward of the existing high water line or from the placement of riprap). We also assume that all of these 27 larger projects occur outside of critical habitat.

Thus, to analyze the effects of the shoreline stabilization projects, we looked the USACE's assumptions regarding the total number of shoreline stabilization activities to be covered under this Opinion per 5-year period and whether the projects would occur within or outside of smalltooth sawfish critical habitat. Based on this information, we determined the potential effects to species (see Tables 21) and critical habitat (see Table 23).

USACE anticipates that it will authorize 7,102 shoreline stabilization activities per 5-year period that would qualify for coverage under this Opinion (i.e., that meet the PDCs and other conditions of this Opinion). A breakdown of how many of these will occur in each critical habitat unit is provided in Table 8.

Potential Routes of Effect to Listed Species

In Section 2.2 above, we evaluated the routes of effect common to the 10 categories of activities covered under this Opinion on ESA-listed species identified in Table 5. Installing new or repairing/replacing shoreline stabilization involves all of the common routes of effect discussed above in the section entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion* (the numbers below correspond to the section numbers). The effects analysis for each of these routes of effects is provided above:

1. Direct Physical Effects from Construction Activities
2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction
5. Limiting Species' Movement and Access to Habitat
7. Noise

Please see Section 2.2 for our effects determinations.

In this section of the Opinion, we evaluate the potential effects to sea turtles, smalltooth sawfish, and sturgeon from the installation, repair, replacement, and removal of shoreline stabilization structures beyond the common routes of effect considered in Section 2.2. NMFS and USACE effects determinations are summarized for this category of activity in Table 21. Sea turtles, smalltooth sawfish, and sturgeon may be affected by the permanent loss of habitat from shoreline stabilization activities associated with Activity 1. We quantified the potential extent of habitat impacts in Table 22 based on (1) the assumptions about the average area of impact per project, included above, (2) the number and location of projects (inside or outside of smalltooth sawfish critical habitat) estimated by USACE (Table 8), and (3) the construction limitations contained in the PDCs.

Table 21. USACE and NMFS Determinations on the Effects of Shoreline Stabilization Activities (Activity 1) to ESA-listed Species listed in Table 5

Listed Species	USACE Determination	NMFS Determination
Sea Turtles	NLAA	NLAA
Sawfish	NLAA	NLAA
Sturgeon	NLAA	NLAA
Effects Determinations Explained in Section 2.2		
Johnson's seagrass	LAA	NE
Corals	NE	N/A
Whales	NE	NE
Nassau grouper	Not provided	NLAA
NE= no effect; NLAA= may affect, not likely to adversely affect; N/A= not applicable (if a project may affect ESA-listed corals, separate consultation is required). The effects analysis for Johnson's seagrass, corals, whales, and Nassau Grouper for all covered activities, including Activity 1, was provided at the beginning of Section 2.2. The USACE's original determination for Johnson's seagrass was based on the assumption that shoreline stabilization activities would affect the species. Under the PDCs, this Opinion does not apply to shoreline stabilization projects where Johnson's seagrass is within the project footprint (PDC AP.13).		

Table 22. Estimated Amount of Waterbottom Affected By Shoreline Stabilization Projects per 5-Year Period

Type and Location of seawall	Number of projects (n[17] = 7,102)	Estimated Average Area Affected per Project (ft^2)	Estimated Total Area Affected per 5-Year Period (ft^2)	Estimated Total Area Affected per 5-Year Period (ac)
Smalltooth sawfish critical habitat	1,012	100.41	101,614.92	2.33
Outside of smalltooth sawfish critical habitat	6,063	291.59	1,767,910.17	40.59
Outside of smalltooth sawfish critical habitat-repair/replace longer than 500 lin ft	27	2,918.52	78,800.04	1.81
Total	7,102		1,948,325.13	44.73

Over a 5-year period, 44.73 ac of shallow nearshore habitat may be permanently covered or removed by the installation, repair, replacement, or removal of shoreline stabilization structures. This estimate includes projects in Florida and the U.S. Caribbean.

- Sea turtles: Sea turtles may be affected by the placement of shoreline stabilization materials on top of 44.73 ac of shallow nearshore areas that may be used for foraging. However, we believe that the effect to sea turtles from the potential loss of nearshore foraging habitat is insignificant.
    - The waterbottom affected by Activity 1 could contain seagrasses, which are an important forage resource for green sea turtles. However, PDC AP.13 excludes shoreline stabilization projects from the Opinion where Johnson's seagrass is present and recommends that impacts to native, non-listed seagrasses be avoided and minimized to the extent practicable.
    - Limestone outcroppings and worm-rock reefs are important developmental habitat for juvenile green turtles. Therefore, under PDC AP.14, this Opinion does not apply to projects where hardbottom is found within the footprint.
    - Hawksbill sea turtles are most commonly associated with reef habitat and feed on sponges, algae, and other invertebrates. PDC AP.14 also limits this Opinion to projects that do not directly or indirectly affect listed corals, and excludes projects if non-listed

[17] n = the total number of projects as provided in Table 8.

corals and hardbottom habitats, which support sponges, algae, and other forage resources for hawksbill sea turtles, are within the project footprint.

- Shoreline stabilization activities may cover or remove nearshore areas inhabited by sea turtle prey species, including the crustaceans and mollusks that serve as prey for loggerhead and the fish, jellyfish, shrimp, and mollusks that serve as prey for Kemp's ridley sea turtles. These foraging areas are larger and more common throughout Florida and the U.S. Caribbean than the specific habitat types like seagrass beds, hard bottom, limestone outcroppings, and reefs that must be avoided under this Opinion. In addition, the 44.73 ac of impact is very small compared to the extensive areas available throughout Florida and the U.S. Caribbean that support sea turtle prey species. Sea turtles can travel long distances to forage. The projects covered under this Opinion for Activity 1 will be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and throughout the U.S. Caribbean), so sea turtles will likely be able to forage in nearby areas outside of active project sites.

Given the above, we believe the effect to sea turtles from the potential loss of nearshore foraging habitat is insignificant. In total, based on the routes of effect analyzed here and in Section 2.2, we determined that the shoreline stabilization activities under Activity 1 are not likely to adversely affect sea turtles.

- Smalltooth sawfish: Smalltooth sawfish may be affected by placement of shoreline stabilization materials on top of 44.73 ac of shallow nearshore areas, which they could use for foraging and refuge. As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sawfish would only be affected by projects occurring in Florida. For the first several years of their lives, juvenile smalltooth sawfish exhibit site fidelity to the areas in which they are pupped, typically in very shallow, nearshore waters where they can avoid predation by coastal shark species. In South Florida, sawfish have established distinct nursery areas where they utilize shallow, euryhaline habitat for foraging and red mangroves for refuge; these areas have been designated as critical habitat for the species. However, we believe that the effect on sawfish of the potential loss of nearshore foraging and refuge habitat associated with Activity 1 is insignificant. The PDCs limit this Opinion to shoreline protection activities occurring outside of smalltooth sawfish limited exclusion zones (PDC A1.8.1), which are areas research shows support higher levels of smalltooth sawfish pupping. Additionally, projects must be sited to avoid and minimize impacts to mangroves (AP.12), and mangrove removal for shoreline stabilization projects is not allowed under this Opinion for shoreline stabilization activities except for trimming and removal of mangroves above MHW that do not provide prop roots accessible to marine species (PDCs AP.12). Shoreline protection activities may also cover or remove nearshore areas inhabited by fish and crustaceans that serve as prey for smalltooth sawfish, and thus may affect areas used for smalltooth sawfish foraging. The area of impact (some amount less than 44.73 ac) is very small compared to the remaining large nearshore areas that support sawfish prey species. Sawfish can travel long distances to forage. The array of individual projects covered under this Opinion under Activity 1 that could affect smalltooth sawfish will be separated both temporally and spatially (along the entire coast of Florida), and sawfish can forage in nearby areas outside of active project sites.

Therefore, the effect on juvenile sawfish from the loss of small areas of shallow water forage habitat is expected to be so small as to be undetectable, and thus is insignificant. In total, based on the routes of effect analyzed here and in Section 2.2, we determined that the shoreline protection activities under Activity 1 are not likely to adversely affect smalltooth sawfish.

- Sturgeon: Sturgeon may be affected by placement of shoreline stabilization materials on top of 44.73 ac of shallow nearshore areas that may be used for foraging. As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sturgeon would only be affected by projects occurring in Florida. Shoreline stabilization projects may cover and bury nearshore bottom substrates containing sturgeon prey species, such as benthic worms and insects, as well as crustaceans and mollusks. The effect on sturgeon of the potential loss of nearshore foraging habitat is insignificant. Sturgeon are opportunistic feeders that forage over large areas. Gulf sturgeon select foraging habitat based on substrate composition and depth, rather than prey density, abundance, or diversity. During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft (2-4 m) deep that are characterized by low-relief sand substrate (Fox et al. 2002). Hence, Gulf sturgeon, and likely shortnose and Atlantic sturgeon, often occupy waters deeper than those typically affected by shoreline protection activities (including both seawalls and riprap placement) that occur along shoreline (i.e., in the vicinity of the MHWL). Within important foraging areas (i.e., Gulf sturgeon critical habitat) depth limitations in PDC A1.9 exclude projects from coverage under this Opinion that would place riprap in the preferred foraging depth range of sturgeon. The area of impact (some amount less than 44.73 ac) is very small compared to the remaining large areas that support sturgeon prey species. The array of individual projects covered under this Opinion for Activity 1 will be separated both temporally and spatially (along the entire coast of Florida), and sturgeon can forage in nearby areas outside of active project sites.

  Therefore, the effect on sturgeon from the losses of small areas of shallow water forage habitat is expected to be so small as to be undetectable, and thus is insignificant. In total, based on the routes of effect analyzed here and in Section 2.2, we determined that the shoreline stabilization activities under Activity 1 are not likely to adversely affect sturgeon.

Potential Routes of Effect to Critical Habitat

In this section of the Opinion, we evaluate the potential effects to smalltooth sawfish critical habitat, Gulf sturgeon critical habitat, and Johnson's seagrass critical habitat from shoreline stabilization activities under Activity 1. The estimated impacts to each critical habitat unit and NMFS and USACE effects determinations for this category of activity are summarized in Table 23 with calculations of the estimated impacts provided in Table 24.

Table 23. USACE and NMFS Determinations on the Effects of Shoreline Stabilization Activities (Activity 1) to Designated Critical Habitat

Designated Critical Habitat	USACE Determination	NMFS Determination
Smalltooth sawfish	LAA	LAA
Gulf sturgeon	NLAA	NLAA
Johnson's seagrass	NLAA	LAA
Loggerhead	NE	NE
Effects Determinations Explained in Section 2.2		
Acropora	NE	NE
North Atlantic right whale	NE	NE
Atlantic sturgeon	Not provided	NE
The effects analysis for loggerhead, *Acropora*, North Atlantic right whale, and Atlantic sturgeon critical habitat was provided at the beginning of Section 2.2.		

Table 24. Estimated Amount of Waterbottom Affected By Shoreline Stabilization Projects in Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat per 5-Year Period

Type of seawall	Number of projects	Estimated Average Area Affected per Project (ft^2)	Estimated Total Area Affected per 5-Year Period (ft^2)	Estimated Total Area Affected per 5-Year Period (ac)
Smalltooth sawfish critical habitat	1,012	100.41	101,614.92	2.33
Gulf sturgeon critical habitat	165	291.59	48,112.35	1.10
Johnson's seagrass critical habitat	306	291.59	89,226.54	2.05

Potential Routes of Effect to Smalltooth Sawfish Critical Habitat

The USACE anticipates it may authorize 1,102 shoreline stabilization activities that qualify for coverage under this Opinion in a 5-year period in smalltooth sawfish critical habitat. We estimate that 101,614.92 ft^2 (2.33 ac) of waterbottom area within smalltooth sawfish critical habitat will be covered by the placement these structures (Table 24). This Opinion only covers shoreline protection activities under Activity 1 that occur outside of sawfish limited exclusion zones (PDC A1.8.5), and the estimate of the amount of waterbottom affected in smalltooth sawfish critical habitat accounts for that. Red mangroves are 1 of the essential features of sawfish critical habitat. PDC AP.12 limits red mangrove removal under the Opinion to specific instances not including removal of red mangrove for shoreline stabilization activities, and removal above the MHWL provided that red mangrove prop roots are accessible to marine species are not removed. PDC A1.3 also protects red mangroves by requiring hand-placement of shoreline stabilization materials around red mangrove prop roots, avoiding harm to red mangroves from shoreline stabilization activities. Therefore, there will be no effect to the essential feature of red mangroves in sawfish critical habitat.

We believe shoreline stabilization activities are likely to adversely affect the shallow, euryhaline essential feature from the placement of materials in shallow, nearshore waters calculated in Table 24 above. PDC A1.8 limits impacts to the shallow, euryhaline essential feature by limiting the installation or repair of vertical seawalls to no more than 1.5 ft waterward of the existing seawall or the MHWL and prohibits new riprap and other stabilization materials from placement within shallow, euryhaline habitats (i.e., within from waters between the MHWL and -3 ft MLLW).

Combined, new and repair/replacement projects anticipated per 5-year period are estimated to permanently remove 101,614.92 ft² (2.33 ac) of shallow, euryhaline habitat within sawfish critical habitat (see Table 24). We believe the potential loss of shallow, euryhaline habitat due to shoreline stabilization projects under Activity 1 is likely to adversely affect critical habitat and is evaluated in Section 5.

Potential Routes of Effect to Gulf Sturgeon Critical Habitat

USACE anticipates that 165 shoreline stabilization activities may be covered under this Opinion per 5-year period within the geographic boundary of Gulf sturgeon critical habitat under this Opinion.

Combined, we anticipate that new and repair/replacement projects covered under this Opinion including the placement of seawalls and riprap will permanently remove or alter 48,112.35 ft² (1.1 ac) of estuarine habitats within Gulf sturgeon critical habitat per 5-year period (see Table 24). Although we do not know to what extent these areas contain the PCEs of Gulf sturgeon critical habitat, we evaluate the potential effects to the PCEs below assuming these areas contain the first 3 PCEs (abundant prey items, water quality, sediment quality), and evaluate the effect to the fourth PCE (safe and unobstructed migratory pathways) based on best assumptions below.

1. <u>Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages</u>. Shoreline protection projects may cover and bury nearshore bottom substrates containing sturgeon prey species. But we expect the effects to this PCE will be insignificant since the estimated 1.1 ac of impact is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat that we estimate support sturgeon prey species. Further, not all of the 1.1 ac of habitat lost to shoreline stabilization support prey items or serve as preferred foraging habitat. Gulf sturgeon are suction feeders that tend to forage further offshore, in calm marine and estuarine waters that support their macroinvertebrate prey including brachiopods, mollusks, worms, and crustaceans (Mason and Clugston 1993). During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). In addition, within Gulf sturgeon critical habitat, depth limitations in PDC A1.9 exclude projects involving the placement of riprap in the preferred foraging depth range of sturgeon from coverage under the Opinion (this Opinion only covers riprap placement projects in waters shallower than -6 MHW). Although other

shoreline stabilization activities, such as seawall installation or repair, may occur within Gulf sturgeon critical habitat, not all such projects will occur in the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. Localized and temporary reductions in water quality through increased turbidity may result from the installation, repair, replacement, or removal of shoreline stabilization structures; however, we believe that the effects to this PCE will be insignificant. PDC AP.10 of the PDCs for *In-Water Activities* requires monitoring and controlling turbidity throughout the duration of all projects. Turbidity curtains will be required for most projects. When the curtains are deployed, turbidity will be contained within the active portion of the project site, and we expect any small amounts of turbidity that may escape to have an insignificant effect on water quality. In a few instances, the USACE project manager has the ability to waive the turbidity curtain requirement. These instances include projects that are so small that turbidity is expected to be minimal, such as the placement of a single pile, placement of a scientific survey device, or removal of marine debris. Another instance where turbidity curtains may not be used is in areas with high wave energy where securing turbidity curtains would not be feasible, thereby potentially increasing the risk of them becoming loose and entangling animals or damaging nearby habitat. In high-energy areas, turbidity would dissipate quickly and would therefore not be a problem. In both of the instances where turbidity curtains will not be used (i.e., for projects that are so small turbidity is expected to be minimal and for high-energy areas where turbidity will dissipate very quickly), changes in water quality is not a concern.

3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages. The placement of shoreline stabilization materials, such as seawalls, riprap, cement, and geotextile fabric, can affect sediment quality. The placement of shoreline stabilization materials converts sandy substrate, capable of supporting Gulf sturgeon prey, to hard man-made materials that do not support prey species. However, we believe the effects to this PCE will be insignificant since the estimated 1.1 ac of impact is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat with sediments that we estimate support sturgeon prey species and Gulf sturgeon foraging. Further, not all of the 1.1 ac of habitat lost to shoreline stabilization has the sediment quality needed to support Gulf sturgeon prey or serve as preferred foraging habitat. During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Within Gulf sturgeon critical habitat, depth limitations in PDC A1.9 exclude projects involving the placement of riprap in the preferred foraging depth range of sturgeon (this Opinion only covers riprap placement projects in waters shallower than -6 MHW). Although other shoreline stabilization activities, such as seawall installation or repair, may occur within Gulf sturgeon critical habitat, not all will occur in the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats. Shoreline stabilization activities could obstruct migratory pathways for spawning if they blocked areas between estuaries and rivers. Migratory pathways could also be obstructed by shoreline stabilization activities in Gulf sturgeon critical habitat if they prevented movement within estuarine and marine areas used for foraging. However, we believe that there will be no effect to this PCE. The mouth of Gulf sturgeon spawning rivers and narrow inlets are identified in Section 2.1.1.2 as Gulf sturgeon critical habitat migratory restriction zones. To prevent Gulf sturgeon from being deterred from entering or exiting a spawning river, PDC A1.9 limits construction activities in Gulf sturgeon critical habitat, requiring new shoreline stabilization materials to be placed between the shoreline and -6ft MHW, and requires compliance with the noise limitations in the Gulf sturgeon critical habitat migratory restriction zones. Shoreline stabilization projects occurring outside of Gulf sturgeon critical habitat migratory restriction zones will occur immediately contiguous with and parallel to shorelines and will not restrict the movement of sturgeon.

Because the effects to the PCEs of abundant prey items, water quality, and sediment quality will be insignificant and because we believe there will be no effect to safe and unobstructed migratory pathways, we believe that shoreline stabilization activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat.

Potential Routes of Effect to Johnson's Seagrass Critical Habitat
The USACE anticipates that 306 shoreline stabilization activities may be covered under this Opinion per 5-year period in Johnson's seagrass critical habitat. The Opinion does not cover installation of new riprap, scour material, and materials other than vertical seawalls and footers occurring in Johnson's seagrass critical habitat if the essential features listed in Table 7 are present, but repair and replacement of these materials is covered within the existing footprint (PDC A1.11). This PDC limits the placement of new riprap, scour, and other stabilizing material; seawalls and footers may be installed, repaired, or removed in Johnson's seagrass critical habitat when the essential features are present, consistent with the other PDCs, including PDC A1.1.1 and A1.1.2). Combined, new and repair/replacement projects are anticipated to permanently remove 89,226.54 ft² (2.05 ac) of nearshore habitat (Table 24). We do not know if these areas contain the features of Johnson's seagrass critical habitat; however, for the purpose of this consultation, we will assume that the features may be present. Therefore, shoreline stabilization projects in Activity 1 are likely to adversely affect critical habitat and those effects are evaluated in Section 5.

2.2.2 Activity 2 (A2): Pile-Supported Structures and Anchored Buoys

General Description
Pile-supported structures include docks, marinas, minor structures, chickees (i.e., over-water camping platforms), ATONs, and private aids-to-navigation (PATONs) including pile-supported signs or anchored floating buoys. Activity 2 includes the installation, repair (e.g., maintenance), replacement, and removal of these structures. Minor structures typically include mooring piles, dolphin piles (not to exceed a cluster of 4), boatlifts, hoists, davits, davit pads, fenders, fender piles, mooring whips and cleats. Pile supports may be made of wood, metal, concrete, and composite materials, and may be installed by jetting, auguring, vibratory hammer, and impact

hammer. Docks/piers can be designed in various configurations. T-shaped docks consist of a long walkway to a terminal platform(s) extending to either side, and L-shaped docks are similar but with a terminal extending to only one side. Marginal docks run parallel with the shoreline either directly attached to the shore or by constructing a short walkway perpendicular to the shore connecting to a longer dock constructed parallel with the shore. Floating vessel platforms include solid floating docks or platforms that are typically attached to permanent piles. Example images of these structures are shown below in Figures 10-12.

Figure 10. Examples of dock shapes, including T-shaped and L-shaped docks (©2014 Google).


Figure 11. Pile-supported Structures. Example of a marginal dock on the left, boatlift with I-beam in the middle, and a chickee on the right. (The left and middle photos were provided by the Florida Marine Contractors Association and right photo from www.cnn.com.).

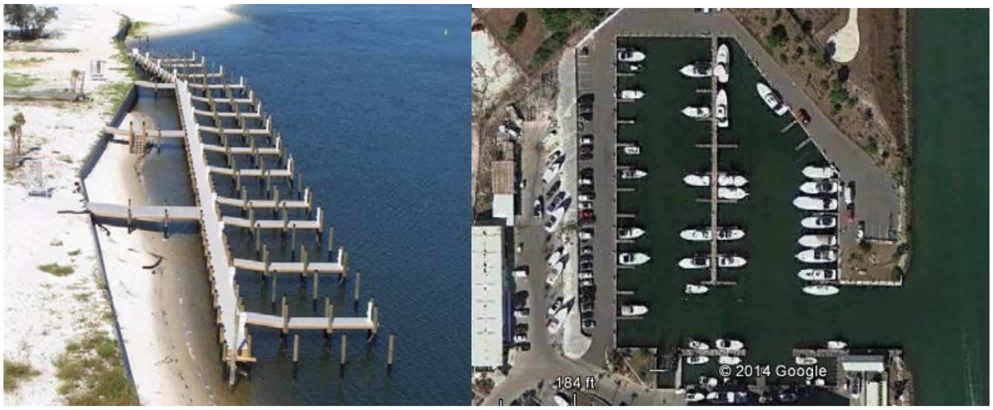

Figure 12. Sample Marina Images. The left image shows an example of an open water marina (provided by the Florida Marine Contractors Association), while the right image shows an example of marina contained within an upland cut basin (©2014 Google).

Marinas occur in a variety of configurations and locations and can be designed for a variety of uses (e.g., commercial marina for boat sales, public marina, yacht club, fishing charters, commercial fishing) such as those shown in Figure 12. For the purposes of this Opinion, we also consider multi-family docking facilities as marinas (e.g., condo complexes, trailer parks, subdivisions that the home owners association owns the docks). Construction of new marina and multi-family facilities, reconfiguration and expansion of existing facilities, repair and replacement of deteriorating structures, and removal of existing structures are included in this activity.

Mooring fields are designated in-water areas where vessels can attach to anchored buoys. These areas are designed to allow boaters to moor in deeper water than is typically feasible at a marina. Vessel operators then access shore from dinghies.

Project Design Criteria

PDCs Specific to Activity 2 - Pile-Supported Structures and Anchored Buoys:

A2.1. Activities covered by this Opinion include the installation, repair, replacement, and removal of structures as described below:

A2.1.1. The pile-supported and anchored structures included in this Opinion are: docks and piers, boatlifts, mooring piles and dolphin piles associated with docks/piers; ATONs and PATONs; floating docks; pile-supported chickees (i.e., small, back-country, over-water, pile-supported, primitive camping shelters); boardwalks (as long as they are designed and clearly marked to prohibit fishing and vessel mooring); mooring fields and buoys; and other minor pile-supported structures. This does not include structures that support large commercial vessels including ferries, tankers, and cargo ships such as ferry terminals and large ports.

A2.1.2. Pile-supported docks/piers for a single-family residential lot are limited to 4 slips for motorized vessels. Slips for non-motorized vessels (e.g., kayak, canoe, and paddleboard) and associated launching areas do not count toward the total slip number.

A2.1.3. Pile-supported structures for marinas, multi-family facilities (e.g., condo complexes, trailer parks, subdivisions when the homeowners association owns and controls the in-water structures). Docks and piers for multi-family residential properties (e.g., condos, trailer parks, apartment complexes), and marinas are limited to a maximum of 50 total slips (i.e., combination of wet and dry slips for existing plus proposed slips).

A2.1.4. Anchored buoys and temporary pile-supported structures associated with marine events. Upon completion of the event, these structures must be removed and, to the maximum extent practical, the site must be restored to pre-construction elevations. Water depths in the area of marine events must be deep enough to support at least 5 ft of water depth under the keel of a vessel and between the keel of a vessel and ESA-listed coral colonies when transiting to the mooring areas. There is no limit on the number of vessel slips allowed for temporary structures associated marine events such as boat shows.

A2.1.5. Mooring fields are limited to a maximum of 50 motorized vessels (there is no limit on the number of non-motorized vessels).

A2.1.6. All pile-supported structures constructed must comply with PDC 2.17 for *Docks or Other Minor Structures Constructed in Florida Under this Opinion (see below*).

The following PDCs apply to all the activities described in PDC A2.1 above:

A2.2. For commercial, multi-family, or public facilities, and marine events, signs must be posted in a visible location(s), alerting users of listed species in the area susceptible to vessel strikes and hook-and-line captures. The most current version of the signs that must be downloaded and sign installation guidance are available at: (http://sero.nmfs.noaa.gov/protected_resources/section_7/protected_species_educational_signs/index.html). The signs required to be posted by area are stated below:

A2.2.1. All projects in Florida shall use the Save Sea Turtle, Sawfish, and Dolphin sign. These signs shall include contact information to the sea turtle and marine mammal stranding networks and smalltooth sawfish encounter database.

A2.2.2. Projects within the North Atlantic right whale educational sign zone (as defined in Section 2.1.1.4) shall post the Help Protect North Atlantic Right Whales sign.

A2.2.3. On the east coast of Florida, projects located within the St. John's River and those occurring north of the St. Johns River to the Florida-Georgia line shall post the Report Sturgeon sign. On the west coast of Florida, projects occurring from the Cedar Key, Florida north to the Florida-Alabama line.

A2.2.4. We are still developing the signs to be used in the U.S. Caribbean. Once developed, those signs will be included at the website above.

A2.3. For commercial, multi-family, or public facilities, monofilament recycling bins must be provided at the docking facility to reduce the risk of turtle or sawfish entanglement in, or ingestion of, marine debris. Monofilament recycling bins must:

A2.3.1. Be constructed and labeled according to the instructions provided at http://mrrp.myfwc.com.

A2.3.2. Be maintained in working order and emptied frequently (according to http://mrrp.myfwc.com standards) so that they do not overflow.

A2.4. For any dock project (new construction, repair, or replacement) at a private residence located within 11 nautical miles of North Atlantic right whale critical habitat (as measured in a radius from the center of the nearest inlet to open ocean and described in Section 2.1.1.4), the property owner will be provided a handout with their USACE permit describing the presence of North Atlantic right whales in the area and the Federal regulations governing the approach to North Atlantic right whales (Appendix C).

A2.5. ATONs and PATONs must be approved by and installed in accordance with the requirements of the USCG (see 33 CFR, chapter I, subchapter C, part 66 and RHA Section 10 and any other pertinent requirements).

A2.6. Chickees must be less than 500 ft^2 and support no more than 2 slips.

A2.7. No activities associated with municipal or commercial fishing piers are covered under this Opinion.

A2.8. Docks installed within visible distance of ocean beaches are required to comply with turtle-friendly lighting, if lighting is necessary to the project. Turtle-friendly lighting is explained and examples are provided on the Florida Fish and Wildlife Conservation Commission website: http://myfwc.com/wildlifehabitats/managed/sea-turtles/lighting/

A2.9. Project construction will take place from uplands or from floating equipment (e.g., barge); prop or wheel-washing is prohibited.

Additional PDCs for Activity 2 applicable in critical habitat:

In addition to the PDCs above, the project must be designed to meet the following PDCs if the project occurs in the critical habitat as described below.

A2.10. *Acropora* critical habitat and the U.S. Caribbean: This Opinion does not cover new and expanded pile-supported structures in *Acropora* critical habitat where the essential features are present. The distance from ATONs to ESA-listed corals and *Acropora* critical habitat shall ensure there are no impacts to the corals or the essential feature of *Acropora* critical habitat from the movement of buoys and tackle. The appropriate distance shall be based on the size of the anchor chain or other tackle to be installed to secure the buoy to its anchor, particularly when the design of the ATON does not prohibit contact of tackle with the marine bottom. In all cases, buoy tackle will include flotation to ensure there is no contact between the anchor chain or line and the marine bottom.

A2.11. Gulf sturgeon critical habitat: Additional noise restrictions are required for pile and sheet pile installation in the Gulf sturgeon critical habitat migratory restriction zones defined in Section 2.1.1.2. The noise restrictions are described in that section.

A2.12. Smalltooth sawfish critical habitat: This Opinion does not cover activities occurring in areas identified as smalltooth sawfish limited exclusion zones defined in Section 2.1.1.1.

A2.13. North Atlantic right whale critical habitat: This Opinion does not cover installation of anchored ATONs and permanent buoys in North Atlantic right whale critical habitat; temporary buoys for marine events are allowed in North Atlantic right whale critical habitat.

A2.14. Johnson’s seagrass critical habitat: This Opinion does not cover new marinas or multi-family facilities in Johnson’s seagrass critical habitat. Repair, replacement, and reconfiguration of existing marinas or multi-family facilities may be covered if it (1) occurs within same overall footprint (out to the perimeter of the facility, including the outer limits of the structure and permitted mooring locations), (2) does not increase the total aerial extent (i.e., area of coverage from the dock structures) of the existing facility, and (3) does not affect Johnson’s seagrass. Mooring fields are allowed in Johnson’s seagrass critical habitat and within the range of Johnson’s seagrass so long as they occur in waters deeper than -13 ft (-4 m).

A2.15. NWA DPS of loggerhead sea turtle critical habitat: ATONs (pile-supported and anchored buoys) are allowed in nearshore reproductive habitat of the NWA DPS of loggerhead sea turtles under this Opinion. No other pile-supported structures are allowed in nearshore reproductive habitat under this Opinion.

A2.16. U.S. Caribbean sea turtle critical habitat (hawksbill, leatherback, and the NA DPS of green sea turtle critical habitat): ATONs (pile-supported and anchored buoys) are allowed near sea turtle nesting beaches under this Opinion. No other pile-supported structures are allowed near sea turtle nesting beaches under this Opinion.

A2.17. PDCs for Docks or Other Minor Structures

These PDCs address the anticipated dock construction scenarios expected within Florida and the U.S. Caribbean and provide NMFS PRD's construction guidelines for projects occurring (1) within Johnson's seagrass critical habitat; (2) within the range of Johnson's seagrass[18], but outside of Johnson's seagrass critical habitat; and (3) outside of both the range and critical habitat for Johnson's seagrass. These scenarios consider whether a seagrass survey was conducted for projects within the range of Johnson's seagrass or located in Johnson's seagrass critical habitat. Surveys must be completed no earlier than 1 year before submitting the application to the action agency for project authorization. There is no seasonal restriction for Johnson's seagrass surveys; however, Johnson's seagrass is found within the range of other seagrass species that exhibit a seasonal pattern of growth and distribution. For comparison, NMFS Habitat Conservation Division's recommended sampling window for non-listed species is June 1 to September 30.

Dock Construction Scenarios

	Within Johnson's seagrass critical habitat	**Within the Range of Johnson's seagrass (outside of critical habitat)**	**In the U.S. Caribbean and Florida (outside of the range and critical habitat of Johnson's seagrass)**
Dock replacement in the exact footprint (i.e., same location/configuration/ size) as the previous dock with…			
No native seagrass under dock	A	A	A
Johnson's seagrass under dock	B	B	N/A
Native seagrass, other than Johnson's seagrass, under the dock	B	A	A
No current seagrass survey	B	B	A
New docks or dock expansions with…			
No native seagrasses within property limits	B	A	A
Johnson's seagrass within property limits	B	B	N/A
Native seagrass, other than Johnson's seagrass, within property limits	B	A	A
No current seagrass survey	B	B	A

A= No additional PDCs

[18] The range of Johnson's seagrass is defined as Turkey Creek/Palm Bay south to central Biscayne Bay in the lagoon systems on the east coast of Florida

B= Dock must meet PDCs below
N/A = not applicable; Johnson's seagrass could not occur under the dock because the dock project is outside the range of Johnson's seagrass

Dock PDCs for Scenario B in the table above:

1. To avoid and minimize impacts to Johnson's seagrass and native, non-listed seagrasses to the maximum extent practicable:
   - The dock must be positioned to avoid and minimize effects to Johnson's seagrass
   - Over any area that contains Johnson's seagrass or native, non-listed seagrasses, the dock shall be oriented in a north-south orientation to the maximum extent that is practicable to allow maximum sunlight under the structure.
   - If practicable, terminal platforms shall be placed in deep water, waterward of Johnson's seagrass beds or native, non-listed seagrasses beds or in an area devoid of Johnson's seagrass or native, non-listed seagrasses.
   - Piles must be spaced a minimum of 10 ft apart in any area that contains Johnson's seagrass to minimize direct impacts.
   - Piles shall be installed in a manner that will not result in the formation of sedimentary deposits (e.g., donuts or halos) around the newly installed pilings.
   - No covered boat lifts are allowed over any Johnson's seagrass.

2. Decking options: Deck surfaces (parallel with the water) that are located waterward of the MHWL must be constructed of grated materials or plank construction or a combination of the both methods (e.g. plank decking on the walkway and grated decking on the terminal platform). These decking options are described below:

   Grated decking:
   - Height requirement: The surface of the structure, including the dock walkway (the over-water narrow portion connecting the terminal platform to the shore and any over-water ramp required for access) and the dock, must be a minimum of 3 ft above MHW when constructed with grated decking.
   - Size limitations: The dock walkway is limited to a width of 4 ft. The terminal platform is limited to a total area of 160 ft^2. Marginal docks are limited to a width of 5 ft. The 5 ft width restriction is measured from wet side of the seawall. For example, if a seawall cap is 3 feet overwater then the dock would be limited to 2 feet.
   - Material description: Decking materials shaped in the form of grids, grates, lattices, etc., to allow the passage of light through the open spaces. These materials must provide a minimum of 43% open space.

   Plank decking:
   - Height requirement: The surface of the structure, including the dock walkway (the over-water narrow portion connecting the terminal platform to the shore and any over-water ramp required for access) and the dock, must be a minimum of 5 ft above MHW when constructed of plank decking.
   - Size limitations: The dock walkway is limited to a width of 4 ft. The terminal platform is limited to a total area of 120 ft^2. Marginal docks are limited to a width of 5 ft.
   - Material description: Deck boards may be constructed of any material. Deck boards

must be installed to provide a minimum of a 0.5-in gap between individual deck boards

Assumptions
As with shoreline stabilization structures, the USACE reviewed projects covered under recent Programmatic Opinions to estimate impacts anticipated from pile-supported structures covered under this Opinion. The USACE provided the specifics regarding Activity 2, including:

- Number of minor structures (supporting 4 slips or less) and major structures projects (supporting 5-50 slips).

- Number of new construction and repair/replacement activities.

- Number and type (minor vs. major) projects located inside or outside of Johnson's seagrass critical habitat.
  - The distinction between projects occurring inside and outside of Johnson's seagrass critical habitat is important for 2 reasons. First, dock construction projects may adversely affect Johnson's seagrass critical habitat. Second, in projects meeting NMFS and USACE guidance entitled *Key for Construction Conditions for Docks or Other Minor Structures Constructed in or Over Johnson's Seagrass (Halophila johnsonii)*, the size and number of piles is smaller in Johnson's seagrass critical habitat to minimize effects to the essential features of Johnson's seagrass critical habitat.

- Assessment of how many dock projects are expected to occur within Johnson's seagrass critical habitat that will occur over Johnson's seagrass.
  - Approximately 10% of all dock projects are anticipated to occur within Johnson's seagrass critical habitat and over existing Johnson's seagrass. The average project of this type is estimated to shade 450 ft^2 of waterbottom that could contain Johnson's seagrass.

- Assessment of the number of dock projects anticipated to result in the removal of red mangroves within smalltooth sawfish critical habitat.
  - Although mangrove removal is allowed to install a dock walkway, the USACE is required to first avoid and minimize mangrove impacts. It is anticipated that very few docks built in smalltooth sawfish critical habitat will require the removal of red mangroves to place the dock due to the general requirement to avoid and minimize mangrove removal, either by siting the walkway to avoid mangroves entirely or to minimize the effects to only trimming. The USACE believes that only 7 dock projects in the last 5 years required mangrove removal and they anticipate mangrove removal will occur for less than 10 projects in the next 5 years.

USACE anticipates that 33,574 pile-supported structure and anchored buoy activities that qualify for coverage under this Opinion (i.e., that meet the PDCs and other conditions of this Opinion) will occur per 5-year period, 33,083 outside of Johnson's seagrass critical habitat and 491 in Johnson's seagrass critical habitat. A breakdown of how many of these will occur in each critical habitat unit is provided in Table 8.

Thus, to analyze the effects of the pile-supported structures and anchored buoys, we looked the USACE's assumptions regarding (1) the total number of shoreline protection activities to be covered under this Opinion per 5-year period; (2) whether the projects would be new construction or repair/replacement; and (3) whether the projects would occur within or outside of Johnson's seagrass critical habitat. Based on this information, we determined the potential effects to species (Table 25) and critical habitat (Table 28).

Potential Routes of Effect to Listed Species

In Section 2.2 above, we evaluated routes of effect common to the 10 categories of activities covered under this Opinion on ESA-listed species identified in Table 5. Installing new or repairing/replacing pile-supported structures would result in the following common routes of effect discussed above in the section entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion* (the numbers below correspond to the section numbers). The effects analysis for each of these routes of effects is provided in those sections:

1. Direct Physical Effects from Construction Activities
2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction
6. Vessel Strikes
7. Noise

In this section of the Opinion, we evaluate the potential effects to sea turtles, smalltooth sawfish, and sturgeon from the installation, repair, replacement, and removal of pile-supported structures and anchored buoys that were not considered in Section 2.2. NMFS and USACE effects determinations are summarized for this category of activity in Table 25.

Sea turtles, smalltooth sawfish, sturgeon, and Johnson' seagrass may be affected by the permanent loss of habitat from the placement of piles and anchors associated with Activity 2. We quantified the potential extent of these direct impacts based on (1) the assumptions about the percent of projects that are new or repair/replacement and the number of piles required to support the structure, (2) the number and location of projects (inside and outside of Johnson's seagrass critical habitat) estimated by USACE (Tables 8), and (3) the construction limitations contained in the PDCs. In Tables 26 and 27 below, we determined the "total number of projects" by multiplying the total number of projects occurring outside of Johnson's seagrass critical habitat and within Johnson's seagrass critical habitat (Table 8) by the estimated percent of each project type to determine how many of each project type (e.g., new boatlifts, new large structures) is anticipated per 5-year period. The "total number of projects" was then multiplied by the "total number of new piles" and the "size of the piles" anticipated at that structure to determine the "total estimated amount of waterbottom affected." The impact from anchored buoys is expected to be small in size since anchors are typically not large and since we expect a small number of these projects as the use of anchored buoys are often limited to minor projects associated with marine events. Historically, the USACE has not tracked anchored projects and assumes the number of these projects is low, so we assume that the potential amount of waterbottom affected by anchored buoys is sufficiently captured in the estimated area we estimate will be affected by piles-supported structures.

For all of these calculations, we assumed that all piles used were square. We understand that piles may be square or round and that the area of impact from a round pile would be less than that of a square pile; however, since we are unsure which shape will be used, we will use the larger impact area of square piles acknowledging this may be a slight over estimate. We also assumed that all piles were 12-in by 12-in (average pile size) since some projects types did not state the pile size and some provided a range.

Table 25. USACE and NMFS Determinations on the Effects of Pile-Supported Structures and Anchored Buoys (Activity 2) to ESA-listed Species listed in Table 5

Listed Species	USACE Determination	NMFS Determination
Sea Turtles	NLAA	NLAA
Sawfish	NLAA	NLAA
Sturgeon	NLAA	NLAA
Johnson's seagrass	LAA	LAA
Effects Determinations Explained in Section 2.2		
Corals	NE	N/A
Whales	NE	NE
Nassau Grouper	Not provided	NLAA
NE= no effect; NLAA= may affect, not likely to adversely affect; N/A= not applicable (if a project may affect ESA-listed corals, separate consultation is required). The effects analysis for corals, whales, and Nassau Grouper was provided at the beginning of Section 2.2.		

Table 26. Estimated Amount of Waterbottom Affected by Pile-Supported Structures and Anchored Buoys Occurring Outside of Johnson's Seagrass Critical per 5-Year Period

Project Type	**Percent**	**Total Number of projects (n = 33,083)**	**Total Number of New Piles/ Structures**	**Size of Piles (ft^2)**	**Total Estimated Amount of Waterbottom Affected (ft^2)**	**Total Estimated Amount of Waterbottom Affected (ac)**
New boatlifts	38%	12,571.54[19]	4	1	50,286.16	1.15
New minor dock	26.50%	8,767.00	35	1	306,844.83	7.04
New ATONS, anchored buoys, and single-pile structures	3.50%	1,157.91	1	1	1,157.91	0.03
Repair/replacement of minor structures	12%	3,969.96	0	N/A	0.00	0.00
New major structures (supporting up to 50 slips)	9%	2,977.47	388	1	1,155,258.36	26.52
Repair/replacement of major structures	11%	3,639.13	0	N/A	0.00	0.00
Total	100%	33,083*			1,513,547.25	34.75

[19] In this table and all future similar tables in the Opinion, we calculate the number of projects by multiplying the percent of projects by the total. We do not round the number of projects here because we are trying to estimate the total area affected based on a series of assumptions and rounding at each step may increase the final number. As we implement the Opinion, we will track the total number of projects and the total area affected.

Table 27. Estimated Amount of Waterbottom Affected by Pile-Supported Structures and Anchored Buoys Occurring Within Johnson's Seagrass Critical Habitat per 5-Year Period

Project Type	Percent	Total Number of projects (n = 491)	Total Number of New Piles/ Structures	Size of Piles (ft^2)	Total Estimated Amount of Waterbottom Affected (ft^2)	Total Estimated Amount of Waterbottom Affected (ac)
New boatlifts	35.50%	174.31	4	1	696.65	0.02
New minor dock	36.30%	178.23	20	1	3,564.66	0.08
New ATONS, anchored buoys, and single-pile structures	5.20%	25.53	1	1	25.51	0.00[20]
Repair/replacement of minor structures	14.00%	68.74	0	N/A	0	0.00
New major structures (supporting up to 50 slips)	Per PDC A2.14, the Opinion does not cover new marina or multi-family facilities (new major structures) in Johnson's seagrass critical habitat					
Repair/replacement of major structures	9.00%	44.19	0	N/A	0	0.00
Total	100.00%	491			4,287.41	0.10

Over a 5-year period, 34.85 ac of waterbottom area may be permanently covered or removed by the installation of new pile-supported structures and anchored buoys covered under this Opinion (34.75 ac [total from Table 26] + 0.1 ac [total from Table 27] = 34.85 ac). This estimate includes projects in Florida and the U.S. Caribbean. Repair and replacement of pile-supported structures are not expected to result in habitat losses because the number of piles is not expected to increase.

- Sea Turtles: Sea turtles may be affected by the placement of piles and anchors on top of 34.85 ac of waterbottom area that may be used as forage habitat for sea turtles. However, the effect on sea turtles of the potential loss of foraging habitat is insignificant.
  - The waterbottom affected by Activity 2 could contain seagrasses, which are an important forage resource for green sea turtles. However, PDC AP.13 excludes pile-supported structure projects from this Opinion where Johnson's seagrass is present, except for pile-supported structures that meet the PDCs for Docks or Other Minor Structures (PDC A2.17), and recommends that impacts to native, non-listed seagrasses be avoided and minimized to the extent practicable. Although some shading of seagrasses is allowed

[20] 25.51 ft^2 is 0.0006 ac. We are rounding to 2 figures, hence we assume 0,00 ac will be affected.

from pile-supported structures as defined by the PDC A2.17, and shading may have small impacts on seagrass coverage, recruitment, and growth, we believe the minimal impacts to seagrass resources from shading will have an insignificant effect on sea turtles through reduction in forage resources.

- Limestone outcroppings and worm-rock reefs that are important developmental habitat for juvenile green turtles. Therefore, under PDC AP.14, this Opinion does not apply to projects where hardbottom is found within the project footprint.
- Hawksbill sea turtles are most commonly associated with reef habitat and feed on sponges, algae, and other invertebrates. PDC AP.14 also limits this Opinion to projects that do not directly or indirectly affect listed corals, and excludes projects if non-listed corals and hardbottom habitats, which support sponges, algae, and other forage resources for hawksbill sea turtles, are within the project footprint.
- New pile-supported structures and anchored buoys may cover or remove areas inhabited by sea turtle prey species, including the crustaceans and mollusks that serve as prey for loggerhead and the fish, jellyfish, shrimp, and mollusks that serve as prey for Kemp's ridley sea turtles. These foraging areas are larger and more common throughout Florida and the U.S. Caribbean than the specific habitat types like seagrass beds, hard bottom, limestone outcroppings, and reefs that must be avoided under this Opinion. In addition, the 34.84 ac of impact is very small compared to the extensive areas available throughout Florida and the U.S. Caribbean that support sea turtle prey species. Sea turtles can travel long distances to forage. The array of individual projects covered under Activity 2 will be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and throughout the U.S. Caribbean), so sea turtles will likely be able to forage in nearby areas outside of active project sites.

Given the above, effect to sea turtles from the potential loss of nearshore foraging habitat is insignificant. In total, based on the routes of effect analyzed here (insignificant effect on sea turtles from impacts to foraging habitat) and in Section 2.2, we determined that pile-supported structures and anchored buoys covered under this Opinion under Activity 2 are not likely to adversely affect sea turtles.

- <u>Smalltooth sawfish:</u> Smalltooth sawfish may be affected by the placement of piles and anchors on 34.85 ac of waterbottom area, which they could use for foraging and refuge. As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sawfish would only be affected by projects occurring in Florida, and in greater concentrations in smalltooth sawfish critical habitat. For the first several years of their lives, juvenile smalltooth sawfish exhibit site fidelity to the areas in which they are pupped, typically in very shallow, nearshore waters where they can avoid predation by coastal shark species. In South Florida, sawfish have established distinct nursery areas where they utilize shallow, euryhaline habitat and red mangroves for refuge; these areas have been designated as critical habitat for the species. However, we believe the effect on sawfish of the potential loss of foraging and refuge habitat associated with Activity 2 is insignificant. The PDCs limit activities in smalltooth sawfish critical habitat and exclude pile-supported structures and anchored buoys projects (activities under Activity 2) occurring smalltooth sawfish limited exclusion zones (PDC A2.12), which are areas research shows support higher levels of smalltooth sawfish pupping. In addition, under PDC AP.12, projects must be sited to avoid and minimize impacts to mangroves, and mangrove removal is strictly limited. Pertinent to Activity 2, PDC AP.12 limits mangrove removal associated with dock installation to no more than 4 lin ft of mangrove shoreline to place a dock walkway or up to 8 lin ft for an ADA-compliant public dock. PDC AP.12 also allows removal above MHW provided that red mangrove prop roots that are accessible to marine species are not removed. The USACE believes that very few docks will require the removal of red mangroves because docks can typically be sited to avoid red mangrove impacts, as required by PDC AP.12.

USACE estimates that 10 docks of the 4,125 docks in smalltooth sawfish critical habitat (or 0.24%) could require red mangrove removal in in the next 5-year period. If we assumed that 1% (rounding up from 0.24%) of all pile-supported structures in smalltooth sawfish critical habitat would require red mangrove removal, approximately 412.5 projects would require red mangrove removal (4,125 total projects in smalltooth sawfish critical habitat from Table 8 x 1%= 412.5). If all of these projects would require 4-ft wide walkways, 1,650 lin ft (412.5 projects x 4 lin ft) of red mangroves would be removed. If all the docks were to require the largest walkway dimensions of 8-ft wide to accommodate ADA compliant walkways, a maximum of 3,300lin ft (412.5 projects x 8 lin ft) of red mangrove removal would occur. Therefore, we estimate that between 1,650 and 3,330 lin ft of mangrove shoreline in critical habitat may be removed for the placement of docks in Florida by activities that may be covered under this Opinion per 5-year period. Even at the upper limit associated with 8-ft walkways, the anticipated loss of mangrove shorelines is very small compared to the amount of mangrove shoreline remaining in critical habitat and throughout Florida. As is noted above, PDC A2.12 excludes pile-supported structures and anchored buoys projects occurring in smalltooth sawfish limited exclusion zones. Additionally, the array of individual projects covered under this Opinion for Activity 2 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sawfish can forage and seek refuge in nearby areas outside of active project sites. Therefore, we believe the effect on smalltooth sawfish from the potential loss of foraging and refuge habitat is insignificant. Based on the routes of effect analyzed here and the routes of effect addressed in Section 2.2, we determined that pile-supported structures and anchored buoys covered under this Opinion for Activity 2 are not likely to adversely affect smalltooth sawfish.

- <u>Sturgeon:</u> Sturgeon may be affected by the placement of piles and anchors on 34.85 ac of waterbottom area that may be used as foraging habitat. As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sturgeon would only be affected by projects occurring in Florida. Piles and anchors may cover and bury bottom substrates containing sturgeon prey species, such as benthic worms and insects, as well as crustaceans and mollusks. However, the effect on sturgeon of the potential loss of foraging habitat is insignificant. Sturgeon are opportunistic feeders that forage over large areas. Gulf sturgeon select foraging habitat based on substrate composition and depth, rather than prey density, abundance, or diversity. During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Hence, Gulf sturgeon, and likely shortnose and Atlantic sturgeon, often occupy waters deeper than those affected by at least smaller docks located closer to shore. Even still, the area of impact (some amount less than 34.85 ac) is very small compared to the areas approximately 1.5 million ac of available marine and estuarine critical habitat that we estimate support sturgeon prey species. The array of individual projects covered under this Opinion for Activity 2 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sturgeon can forage in nearby areas outside of active project sites. Based on the routes of effect analyzed here and the routes of effect addressed in Section 2.2, we determined that pile-supported structures and anchored buoys analyzed under Activity 2 are not likely to adversely affect sturgeon.

- Johnson's seagrass: We believe there will be no effect to Johnson's seagrass from mooring fields. Mooring fields in the range of Johnson's seagrass are limited to waters deeper than 13 ft (PDC A2.14). Studies show that Johnson's seagrass occurs in waters shallower than 10-13 ft (3-4 m) (NMFS 2007a). Water depths greater than 13 ft are not believed to provide the water transparency necessary for enough sunlight to reach the sea floor to support Johnson's seagrass growth. Therefore, mooring fields in waters too deep to support the growth of Johnson's seagrass are not expected to affect Johnson's seagrass.

  We believe pile-supported structures in areas that support Johnson's seagrass may affect Johnson's seagrass via shading, however we believe the effect will be insignificant. All docks built throughout the range of the species (which includes all Johnson's seagrass critical habitat) will be required to adhere to the PDCs including PDC A2.17, which describes the allowable decking height and construction materials for overwater structures. These guidelines are designed to reduce the effects of shading by maximizing light transmission under the structures. They require new docks or dock expansions within Johnson's seagrass critical habitat to be constructed of either grated decking or plank decking meeting specific criteria. Within the range of the species, but outside of critical habitat, those new structures must be constructed of grated or plank decking unless there are no native seagrasses within the property limits or there is native seagrass, other than Johnson's seagrass, within those limits. With grated decking, the surface of the structure must be elevated to a minimum of 3 ft above MHW. Grated decking is decking constructed of a grid or other pattern that provides a minimum of 43% open space. In addition, the size of the dock walkway and the terminal platform, and the size of the marginal dock, are limited to reduce the overall size of the overwater structure and further reduce the area shaded. With plank decking, deck boards must be spaced ½ in apart and the surface of the structure must be elevated to a minimum of 5 ft above MHW. As with grated docks, the size of the walkway and the terminal platform, as well as the size of the marginal dock, also are limited.

  We developed these PDCs based on studies that indicate both dock height and deck type influence seagrass survival. A 2008 study, found no statistical difference in density of Johnson's seagrass under grated decking compared to adjacent sites and reference areas (Landry et al. 2008). However, this pattern did not hold true for all seagrass species as most others were statistically reduced under grated decks when compared to the adjacent sites (Landry et al. 2008). Another study considered light availability and dock height and found "a significant positive correlation between dock height and light availability in the seagrass canopy in the shaded areas beneath the dock walkway" (i.e., the higher the dock, and the more space between the dock and MHW, the more light was able to reach the seagrass (Shafer et al. 2008)). Results showed a reduction in the frequency of occurrence of most seagrass species, including Johnson's seagrass, under docks that were not fully built to the deck height requirements of the dock construction guidelines (Shafer et al. 2008). Yet, Shafer et al. (2008) stated that their data "…demonstrate that *H. johnsonii* is capable of growing under the low light conditions found in the shaded areas beneath dock walkways." Therefore, we believe new or expanded docks built to these guidelines will continue to support Johnson's seagrass and provide adequate light availability for its growth because Johnson's seagrass is more tolerant to low light conditions than other seagrasses in the area (NMFS 2002). As a result, we believe that docks built in accordance with PDC A2.17 will have only insignificant effects on Johnson's seagrass. Dock replacement in the same footprint and of the same size as the existing structure will not increase shading in the area and will have no effect on the species.

Likewise, any vessel moored at the pile-supported structures in areas supporting Johnson's seagrass could shade the waterbottom and affect the species. However, as noted above, we believe installation, repair, and replacement of pile-supported will not contribute to an increase the number of registered vessels in the State of Florida or in counties adjacent Johnson's seagrass critical habitat (see Section 2.2, *Construction Related Effects for All Categories of Activities Analyzed under this Opinion* Item 6, Vessel Strikes), and that it is extremely unlikely that the proposed action will increase the number of vessels moored in areas supporting Johnson's seagrass. Thus it is extremely unlikely that these projects will affect Johnson's seagrass through vessel shading. In addition, the population of Johnson's seagrass has remained stable and even expanded north despite the continued repair, replacement, and construction of docks and the vessels associated with them in southeast Florida. Therefore, the effect of vessel shading is discountable.

In addition, we believe that placement of the piles in areas supporting Johnson's seagrass may affect the species. We evaluate the potential effects to Johnson's seagrass from the placement of piles in areas that support Johnson's seagrass based on information provided by USACE regarding the number of projects occurring within Johnson's seagrass critical habitat (491) and the percent of those projects that might occur in areas supporting the species. We recognize that Johnson's seagrass may occur throughout its range, which extends beyond the limits of its critical habitat. However, due to data limitations, we do not know how many docks have been constructed outside of critical habitat, but within the range of the species. Based on USACE's experience with permitting activities within the range of Johnson's seagrass, the USACE believes that 10% of the 491 projects that will occur in Johnson's seagrass critical habitat may be constructed in areas that support Johnson's seagrasses. As we calculated in Table 27, above, we believe the piles associated with the 491 structures expected in Johnson's seagrass critical habitat may be placed on up to 3,989.56 ft^2 (0.1 ac) of waterbottom. If we assume that 10% of these projects will be placed in areas that support Johnson's seagrass, and that placement in an area supporting Johnson's seagrass will affect the species, the projects may affect up to 398.96 ft^2 of Johnson's seagrass (3,989.56 ft^2 x 10% = 398.956 ft^2). The effect to this amount of Johnson's seagrass from pile installation is analyzed in Section 5. Our approach could overestimate the effects to Johnson's seagrass. Although the USACE expects 491 projects in Johnson's seagrass critical habitat, 23% (or about 113) of those projects will be repair or replacement projects that we do not expect to affect the waterbottom or Johnson's seagrass because these projects generally do not involve additional piles in the water. However, we think including the repair and replacement projects (a potential overestimate) will offset the potential underestimate from the data limitations that prevent us from quantifying the effects of those docks located outside critical habitat, but within the species' range, that may also affect the species.

The effects to the essential features of Johnson's seagrass critical habitat are analyzed separately below.

Potential Routes of Effect to Critical Habitat

In this section of the Opinion, we evaluate the potential effects to smalltooth sawfish critical habitat, Gulf sturgeon critical habitat, and Johnson's seagrass critical habitat from installation, repair, replacement, and removal of pile-supported structures and anchored buoys covered under this Opinion. The estimated impacts to each critical habitat unit and NMFS and USACE effects determinations for this category of activity are summarized in Table 28.

Table 28. USACE and NMFS Determinations on the Effects of Pile-Supported Structures and Anchored Buoys (Activity2) to Designated Critical Habitats

<table>
<tr><th>Project Location</th><th>Number of Projects</th><th>USACE Determination</th><th>NMFS Determination</th></tr>
<tr><td>Sawfish critical habitat</td><td>4,125</td><td>LAA</td><td>LAA</td></tr>
<tr><td>Gulf sturgeon critical habitat</td><td>724</td><td>NLAA</td><td>NLAA</td></tr>
<tr><td>Johnson's seagrass critical habitat</td><td>491</td><td>LAA</td><td>LAA</td></tr>
<tr><td>Loggerhead critical habitat</td><td rowspan="4">The effects analysis for these critical habitat units was provided at the beginning of Section 2.2</td><td>NE</td><td>NE</td></tr>
<tr><td>Acropora critical habitat</td><td>NE</td><td>NE</td></tr>
<tr><td>North Atlantic right whale critical habitat</td><td>NE</td><td>NE</td></tr>
<tr><td>Atlantic sturgeon critical habitat</td><td>Not provided</td><td>NE</td></tr>
</table>

Potential Routes of Effect to Smalltooth Sawfish Critical Habitat

The USACE anticipates it may authorize 4,125 pile-supported structures that qualify for coverage under this Opinion in a 5-year period in smalltooth sawfish critical habitat. We estimate that 172,322 ft² (3.96 ac) of waterbottom area within smalltooth sawfish critical habitat will be covered by the placement of pile-supported structure and anchored buoy activities (Table 29).

Table 29. Estimated Amount of Waterbottom Affected by Pile-Supported Structures and Anchored Buoys Occurring Within Smalltooth Sawfish Critical Habitat per 5-Year Period

Project Type	Percent	Number of project (n = 4,125)	Number of New Piles	Size of Piles (ft²)	Total Estimated Waterbottom Affected by Piles per 5-year (ft²)	Total Estimated Waterbottom Affected by Piles per 5-year (ac)
New boatlifts	38%	1,567.50	4	1	6,270	0.14
New minor dock	26.50%	1,093.13	20	1	21,863	0.50
New ATONS and single-pile structures	3.50%	144.38	1	1	144	0.00[21]
Repair/ replacement of minor structures	12%	495.00	0[22]	N/A	0	0
New major structures (supporting up to 50 slips)	9%	371.25	388	1	144,045	3.31
Repair/ replacement of major structures	11%	453.75	0	N/A	0	0
Total	100%	4,125			172,322	3.96
N/A = not applicable; these projects are repair/replacements that do not have new impacts.						

[21] 144 ft^2 is approximately 0.003 ac, which rounded to 2 decimal places is 0.00 ac.

[22] We assume repair and replacement structures are of the same size and do not result in additional piles on the waterbottom.

We believe the installation of the pile-supported structures and anchored buoys are not likely to adversely affect the shallow (less than -3 ft MLLW), euryhaline water essential feature of critical habitat. Installing piles or anchoring buoys will have no effect on the salinity (i.e., euryhaline component of the essential feature) of the surrounding waters. While some piles and anchored buoys will be installed within the shallow component of the essential feature, we believe any effects to the critical habitat will be insignificant. The placement of a few piles or anchored buoys will not change the overall depth in the area or restrict sawfish foraging, refuge, or movement in the area. The habitat will continue to provide for predator avoidance and habitat for prey, thus facilitating the recruitment of juveniles into the adult population. The Opinion does not cover projects under Activity 2 if they occur in sawfish limited exclusion zones (PDC A2.12). Therefore, we assume that all projects will occur outside of these sensitive areas. We believe the red mangrove essential feature will be adversely affected by this category of activity. While the PDCs for *Mangroves, Seagrasses, Corals and Hardbottom for All Projects* (PDC AP.12) require that pile-supported structures be located to minimize to the loss of mangroves, the PDCs do allow the removal of up to 4 lin ft of mangrove shoreline to accommodate the installation of walkways for residential docks and up to 8 lin ft for ADA compliant public dock walkways.

The USACE believes that only 10 dock projects covered under this Opinion will require the removal of red mangroves in smalltooth sawfish critical habitat in the next 5-year period. If we assume that all of these projects would be 8-lin ft wide to accommodate ADA compliant walkways (worst-case scenario), that would result in the potential removal of 80 lin ft of mangroves. The potential loss of 80-lin ft of the red mangrove essential feature may adversely affect critical habitat and the effects to smalltooth sawfish critical habitat are evaluated in Section 5.

Potential Routes of Effect to Gulf Sturgeon Critical Habitat

The USACE anticipates that 724 pile-supported structures may be covered under this Opinion per 5-year period in Gulf sturgeon critical habitat using this Opinion. We estimate that 30,245.1 ft^2 (0.7 ac) of waterbottom area in Gulf sturgeon critical habitat will be covered by pile and buoy placement (Table30). Although we do not know to what extent these areas contain the PCEs of Gulf sturgeon critical habitat, we evaluate the potential effects to the PCEs below assuming these areas contain the first 3 PCEs (abundant prey items, water quality, sediment quality), and evaluate the effect to the fourth PCE (safe and unobstructed migratory pathways) based on best assumptions below.

Table 30. Estimated Amount of Waterbottom Affected by Pile-Supported Structures and Anchored Buoys Occurring Within Gulf Sturgeon Critical Habitat per 5-Year Period

Project Type	Percent	Number of projects (n = 724)	Number of New Piles	Size of Piles (ft²)	Total Estimated Amount of Waterbottom Affected by Piles per 5-year (ft²)	Total Estimated Amount of Waterbottom Affected by Piles per 5-year (ac)
New boatlifts	38%	275.12	4	1	1100.48	0.03
New minor dock	26.50%	191.86	20	1	3837.2	0.09
New ATONS and single-pile structures	3.50%	25.34	1	1	25.34	0.00[23]
Repair/ replacement of minor structures	12%	86.88	0[24]	N/A	0	0.00
New major structures (supporting up to 50 slips)	9%	65.16	388.00	1	25,282.08	0.58
Repair/ replacement of major structures	11%	79.64	0	N/A	0	0.00
Total	100%	724			30,245.10	0.70
N/A = not applicable; these projects are repair/replacements that do not have new impacts.						

[23] 25.34 ft^2 is approximately 0.0006 ac, which rounded to 2 decimal places is 0.00.

[24] We assume repair and replacement structures are of the same size and do not result in additional piles on the waterbottom.

1. Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages. Pile-supported structures and anchored buoys may cover and bury bottom substrates containing sturgeon prey species. However, we believe that the effects to this PCE will be insignificant since the estimated 0.7 ac of impact is very small compared to the approximately 1.5 million ac of available marine and estuarine habitat that we estimate support sturgeon prey species within Gulf sturgeon critical habitat. Further, not all of the 0.7 ac of habitat covered or buried may support prey items or serve as preferred foraging habitat. Gulf sturgeon are suction feeders that tend to forage further offshore, in calmer marine and estuarine waters that support their macroinvertebrate prey including brachiopods, mollusks, worms, and crustaceans (Mason and Clugston 1993). During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Though many of the smaller docks will occur within Gulf sturgeon critical habitat, not all will occur in the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. Localized and temporary reductions in water quality through increased turbidity may result from the installation, repair, replacement, or removal of pile-supported structures and anchored buoys; however, we believe the effects to this PCE will be insignificant. PDC AP.10 of the PDCs for *In-Water Activities* requires turbidity to be monitored and controlled throughout the duration of all projects. Turbidity curtains will be required for most projects. When the curtains are deployed, turbidity will be contained within the active portion of the project site, and we expect any small amounts of turbidity that may escape to have an insignificant effect on water quality. In a few instances, the USACE project manager has the ability to waive the turbidity curtain requirement. These instances include projects that are so small that turbidity is expected to be minimal, such as the placement of a single pile, placement of a scientific survey device, or removal of marine debris. Another instance where turbidity curtains may not be used is in areas with high wave energy where securing turbidity curtains would not be feasible, thereby potentially increasing the risk of them becoming loose and entangling animals or damaging nearby habitat. In high energy areas, turbidity would dissipate quickly and would therefore not be a problem. Therefore, we believe that even minor or temporary turbidity generated will have insignificant effects on the water quality feature. Effects to temperate, salinity, pH, hardness, oxygen content and other water quality parameters are not expected to result from pile-supported structure installation, repair, and removal.

3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages. The placement of piles and buoys can affect sediment quality. The placement of these materials may remove or cover sandy substrate capable of supporting Gulf sturgeon prey. However, we believe the effects to this PCE will be insignificant because the removal of 0.7 ac of area that may contain suitable sediment quality is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat that we estimate has sediments that support sturgeon prey species

and Gulf sturgeon foraging. Further, not all of the 0.7 ac of habitat lost from piles and buoys placement may have the sediment quality needed to support Gulf sturgeon prey or serve as preferred foraging habitat. During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Though some piles and buoys may occur within Gulf sturgeon critical habitat, not all will occur in the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats. Pile-supported structures and anchored buoys could obstruct migratory pathways for spawning if they blocked areas between estuaries and rivers. Migratory pathways could also be obstructed by these activities in Gulf sturgeon critical habitat if they prevented movement within estuarine and marine areas used for foraging. However, given the PDCs and exclusion zones, we believe there will be no effect to this PCE. The mouth of Gulf sturgeon spawning rivers and narrow inlets are identified in Section 2.1.1.2 as Gulf sturgeon critical habitat migratory restriction zones. To prevent interference with Gulf sturgeon entering or exiting a spawning river, PDC A2.11 contains noise limitations for construction activities in Gulf sturgeon critical habitat, in the Gulf sturgeon critical habitat migratory restriction zones. Outside of the narrow areas that we have defined as Gulf sturgeon critical habitat migratory restriction zones, pile-supported structures and anchored buoy will not create a barrier that would restrict the movement of sturgeon. Therefore, we believe there will be no effect to migratory pathways.

Because the effects to the PCEs of abundant prey items, water quality, and sediment quality will be insignificant and there will be no effect to safe and unobstructed migratory pathways, we believe that pile-supported structure and anchored buoy activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat.

Potential Routes of Effect to Johnson's Seagrass Critical Habitat

We believe there will be no effect to Johnson's seagrass critical habitat from mooring fields. Mooring fields in the range of Johnson's seagrass are limited to waters deeper than -13 ft (PDC A2.14). Studies show that Johnson's seagrass occurs in waters shallower than -10 to -13 ft (-3 to -4 m) (NMFS 2007a). Water deeper than -13 ft is not believed to provide the water transparency necessary for enough sunlight to reach the sea floor to support Johnson's seagrass growth. Therefore, no effect is expected from mooring fields in deeper waters too deep to support the growth of Johnson's seagrass.

Johnson's seagrass critical habitat may be affected by pile-supported structures and anchored buoys (outside of mooring fields). Table 7 describes the Johnson's seagrass critical habitat essential features, and of those, the following may be affected (1) water quality, (2) stable, unconsolidated sediments that are free from physical disturbance, and (3) water transparency, as discussed below:

1. Water quality. We believe the effects to water quality will be insignificant since turbidity curtains will be used to contain turbidity during construction, and disturbed sediments are expected to settle out by the completion of the individual project. In a few instances, the

USACE project manager has the ability to waive the turbidity curtain requirement. These instances include projects that are so small that turbidity is expected to be minimal, such as the placement of a single pile, placement of a scientific survey device, or removal of marine debris. Another instance where turbidity curtains may not be used is in areas with high wave energy where securing turbidity curtains would not be feasible, thereby potentially increasing the risk of them becoming loose and entangling animals or damaging nearby habitat. In high energy areas, turbidity would dissipate quickly and would therefore not be a problem. Therefore, we believe that even minor or temporary turbidity generated will have insignificant effects on the water quality feature.

2. Stable, unconsolidated sediments that are free from physical disturbance. Based on the assumptions and calculations in Table 27, we estimate that 3,989.56 ft² (0.1 ac) of waterbottom area in Johnson's seagrass critical habitat will be affected (covered) from the placement of piles and buoys. The direct impact to 0.1 ac of habitat from pile placement is likely to adversely affect the stable, unconsolidated sediment essential feature. This effect on the stable, unconsolidated sediments essential feature is evaluated in Section 5.

3. Water transparency. The water transparency essential feature is described in the final rule designating Johnson's seagrass critical habitat (65 FR 17786). As described in the rule, the feature supports conservation of the species by ensuring it has sufficient light for photosynthesis. In particular, we explained that seagrass diminishes in turbid areas or in colored waters where reduced light limits photosynthesis, and thus sought to protect water of a sufficient transparency to allow sufficient light transmission to support species abundance and distribution. We noted a few potential causes of decreased water transparency, including suspended sediments, water color, and chlorophylls, and we explained that the essential features, including water transparency, may require special management (a factor in designating critical habitat) because of dock, marina, and bridge construction and shading from these structures. We also explained that docking facilities contribute to loss of Johnson's seagrass through shading. Putting this information together, NMFS has evaluated actions that could reduce the amount of sunlight reaching the bottom in Johnson's seagrass critical habitat as affecting the water transparency essential feature. Thus, below, we evaluate if shading from the placement of pile-supported structures and vessels moored at these structures reduces the amount of light able to reach the bottom to an extent that it affects the abundance and distribution of the species and affects the water transparency essential feature.

    - New and expanded docks: To reduce the effects of shading from docks, PDC A2.17 requires that all new docks or dock expansions built in Johnson's seagrass critical habitat be constructed of decking that allows light transmission under the dock. These guidelines are designed to reduce the effects of shading on seagrass growth. To maximize light transmission under the structure, the docks must either be constructed of grated decking that is elevated to a minimum of 3 ft above MHW and that provides a minimum of 43% open space, or of plank decking spaced ½ in apart and elevated to a minimum of 5 ft above MHW. As discussed above for Johnson's seagrass effects from shading, Johnson's seagrass was found to persist under docks constructed of grated decking with no statistical difference in density compared to reference sites (Landry et al. 2008). Another study considered light availability and dock height and found “a significant positive correlation between dock height and light availability in the seagrass canopy in the shaded areas beneath the dock walkway” (i.e., the higher the dock, and the more space between the dock and MHW, the more light was able to reach the seagrass (Shafer et al. 2008)). Results showed a reduction in the frequency of occurrence of most seagrass species, including Johnson’s seagrass, under docks that were not fully built to the deck height requirements of the dock construction guidelines (Shafer et al. 2008). Yet, Shafer et al. (2008) stated that their data “…demonstrate that *H. johnsonii* is capable of growing under the low light conditions found in the shaded areas beneath dock walkways.” Therefore, we believe the addition of new or expanded docks built to these guidelines that provide either grated decking (allowing a minimum of 43% open space to allow light through the deck surface) or dock heights of at least 5 ft (that is elevated sufficiently to allow sunlight under the structure during the majority of the day) will continue to provide adequate light availability for Johnson’s seagrass growth, and support the water transparency essential feature. As a result, we believe docks built in compliance with these guidelines will have an insignificant effect on the water transparency essential feature.

- <u>Repair and replacement of existing docks</u>: Under PDC A2.17, all repairs to existing docks rebuilt with the same size/area must be built with grated or plank decking that allows light transmission except for replacement docks of the same size/same footprint where no seagrasses (either Johnson’s or non-ESA listed seagrasses) are identified under the existing structure. These replacements can use any type of decking material, deck spacing, and deck height and are not subject to the grated or plank decking requirements described above. We do not believe these replacement projects will result in any additional shading beyond the shading from the existing structures, and thus will not contribute additional effects to the water transparency essential feature. Therefore, we believe the replacement of docks in the same footprint will have no effect on the water transparency essential feature.

- <u>Vessels stored at docks</u>: Vessels moored at overwater structures can shade the waterbottom and thus can affect the water transparency essential feature of Johnson’s seagrass critical habitat. In this Opinion, we reevaluated the number of vessels registered in Florida and specifically in counties adjacent to Johnson’s seagrass critical habitat (Section 2.2, Vessel Strikes). Our analysis showed that the number of registered vessels in Johnson’s seagrass critical habitat and throughout Florida has remained statistically unchanged over the last 10 years. Although the USACE continues to permit the installation, repair, and replacement of docks and marinas, the number of vessels registered in Florida and Johnson’s seagrass critical habitat area has not changed. We assume that this is because (1) most old vessels are ultimately replaced with new vessels; (2) many new docks and marinas likely replace older structures so a permit to construct a new structure does not necessarily mean the new structure will support new vessels; and (3) vessels stored at 1 location may be relocated to a new located, but are not new vessels to the state of Florida or specific area like Johnson’s seagrass critical habitat. Also, new residential docks may be built that do not support vessel dockage or storage. Although it is possible that a vessel may be relocated from dry storage to a newly permitted wet slip, overall, we do not believe the amount of vessel shading is changing within Johnson's seagrass critical habitat. Therefore, we believe there will be no new or additional effect to the water transparency essential feature from shading from vessels moored at overwater structures authorized under Activity 2.

Therefore, of the essential features of Johnson's seagrass that may be affected by Activity 2, we conclude the water quality and water transparency essential features are not likely to be adversely affected. The stable, unconsolidated sediments essential feature is likely to be adversely affected and the effects to that feature are evaluated in Section 5.

2.2.3 Activity 3 (A3): Maintenance, Minor, and Muck Dredging

General Description
This Opinion is limited to maintenance, minor, and muck dredging as described below.

Maintenance Dredging
For this Opinion, we define maintenance dredging as the dredging of an area previously dredged under a permit by the USACE at the site of the previously authorized dredging, to the same depth and within the same footprint, but under a new authorization. Maintenance dredging may be necessary around docks to moor vessels, around boat ramps, and around other structures necessary to maintain adequate depth for vessel movement. Dredged canals require regular maintenance dredging to maintain the original width and depth. Canals tend to shoal in overtime either slowly from daily water movement or suddenly from stochastic events such as hurricanes. We have classified canals into 3 categories for the purpose of evaluating maintenance dredging:

1. Federal channels- Major waterways authorized and maintained by the federal government to accommodate vessel traffic, including the Intracoastal Waterway (ICW), Atlantic Intracoastal Waterway (AIWW), Gulf Intracoastal Waterway (GIWW), shipping channels, and main channels in harbor and ports. These federal channels are often maintained by larger equipment including hopper dredges. Maintenance dredging of federal channels is not covered under this Opinion because dredging of large navigational channels like the ICW involves large areas and volumes of dredged material that are beyond the scope of this Opinion. ESA consultation for many federally maintained navigational channels is addressed through other consultations such as SARBO (NMFS 1997) and GRBO (NMFS 2007b). Minor dredging in areas adjacent to federal channels is covered under this Opinion (e.g., dredging around a dock at a private residence located along the ICW), as long as the dredging is outside of the federally maintained center channel.

2. Open-water canals- These are mid-size channels that connect federal channels to confined channels, such as residential canals.

3. Confined channels- These are channels confined on both sides by land and include residential canals (e.g., Cape Coral canals) and smaller rivers that do not support significant vessel traffic.

Though the top width of open-water canals and confined channels varies by location, the width that canals are maintenance dredged is typically limited to 30 ft wide at the top of the cut and 20 ft wide at the bottom or the cut, as shown in Figure 13 below.

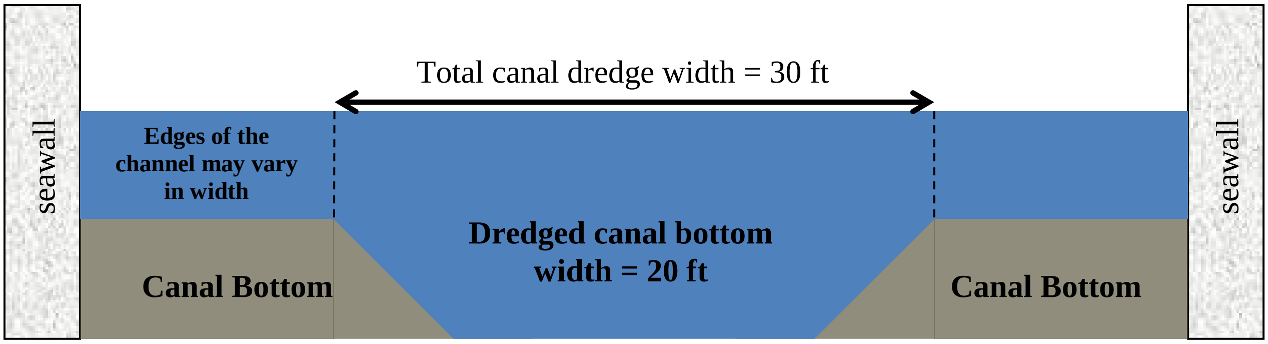

Figure 13. Canal dredging footprint drawing.
This diagram shows the standard 20-ft bottom dredging footprint and 5-ft side slopes for a total of a 30-ft-wide dredging footprint within a confined channel armored on both sides by seawalls. Note that the sides of the channels remain shallow and only the center of the canal is dredged for vessel navigation through the canal.

Minor Dredging
For this Opinion, we define minor dredging as any newly-authorized dredging (other than maintenance dredging) that is limited in size and depth according to the PDCs for Activity 3. Minor dredging may be required to accommodate vessel movement in an area or may be related to another activity such as for the installation of seawalls or outfall structures. Minor dredging may also include treasure hunting and salvage operations that use blowers, propeller deflectors, and suctioning devices.

Muck Dredging for Water Quality Enhancement
For this Opinion, we define muck dredging as any dredging that involves the removal of muck sediments alone. Muck sediments are defined as accumulated organic material typically found in areas with poor water quality. Equipment used for muck dredging can include hydraulic vacuum dredge, bucket dredge, or other similar dredging equipment. Muck dredging is used to improve the water quality or for restoration projects and is not intended to increase water depths to support vessel mooring. Muck dredging is limited to the PDCs listed below.

General Description of Dredging Methods
Mechanical Dredging
Mechanical dredges are characterized by the use of some form of bucket or clamshell that excavates material by scooping it from the bottom and then raising the bottom material and placing it onto a waiting barge or directly into a placement/disposal area (Figure 14). Mechanical dredges work best in consolidated, or hard-packed, substrate and can be used to clear rocks and debris. Dredging buckets have difficulty retaining loose, fine substrate, which can be washed from the bucket as it is raised through the water column. Special buckets have been designed for controlling the flow of water and material from buckets and are used when dredging contaminated sediments to minimize the spread of contamination. Mechanical dredges are rugged and can work in tightly confined areas. They vary in size from small equipment mounted on shallow-draft barges with limited bucket size (i.e., with capacities as small as 1 cubic yard) to larger equipment arrays mounted on a large barges with bucket capacities up to ten or more cubic

yards), towed to the dredging site and secured in place by anchors or spuds. They are often used in harbors, around docks and piers, and in relatively protected channels, but are not suited for areas of high traffic or rough seas.

Dipper dredges and clamshell dredges, named for the scooping buckets they employ, are the 2 most common types of mechanical dredges (Figure 14). A bucket dredge begins the digging operation by dropping the bucket in an open position from a point above the sediment. The bucket falls through the water and penetrates into the bottom material. The sides of the bucket are then closed and material is sheared from the bottom and contained in the bucket compartment. The bucket is raised above the water surface, swung to a point over the barge, and then released into the barge by opening the sides of the bucket. Usually, 2 or more disposal barges are used in conjunction with the mechanical dredge. While 1 barge is being filled, another is being towed to the dumpsite by a tug and emptied. If a diked disposal area is used, the material must be unloaded using mechanical or hydraulic equipment. Using numerous barges, work can proceed continuously, only interrupted by changing dump barges or moving the dredge. This makes mechanical dredges particularly well suited for dredging projects where the disposal site is many miles away. The dipper dredge is essentially a power shovel mounted on a barge. It can dig hard materials and has all the advantages of the bucket dredge, except for its deep digging and sea state capabilities. Similar to the bucket dredge operation, the dipper dredge places material into a barge, which is towed to a disposal area (USACE 1993).


Figure 14. Mechanical dredge (clamshell bucket and barge).

Hydraulic Dredging

Hydraulic dredging (also referred to as cutterhead or pipeline dredging) is characterized by the use of a pump to dredge sediment and the transportation of the dredged material slurry and water to identified discharge areas (Figure 15). The ratio of water to sediment within the slurry mixture is controlled to maximize efficiency. The main types of hydraulic dredges are pipeline and hopper dredges.

Pipeline dredges are designed to handle a wide range of materials including clay, hardpan, silts, sands, gravel, and some types of rock formations without blasting. They are used for new work and maintenance in projects where suitable placement/disposal areas are nearby and operate in an almost continuous dredging cycle resulting in maximum production, economy, and efficiency. Pipeline dredges are capable of dredging in shallow or deep water and have accurate bottom and side slope cutting capabilities. Limitations of pipeline dredges include relative lack of mobility, long mobilization and demobilization times, inability to work in high wave action and currents, and they are impractical in high traffic areas.

Pipeline dredges are rarely self-propelled, and typically must be transported to and from the dredge site by barge or tow. Pipeline dredge size is based on the inside diameter of the discharge pipe which commonly ranges from 6-36 in. They require an extensive array of support equipment including the pipeline (floating, shore, and submerged), boats (crew, work, survey), barges, and pipe handling equipment. Most pipeline dredges have a cutterhead on the suction end. A cutterhead is a mechanical device that has rotating teeth to break up or loosen the bottom material so that it can be sucked through the dredge. Some cutterheads are rugged enough to break up rock for removal (Figure 15).

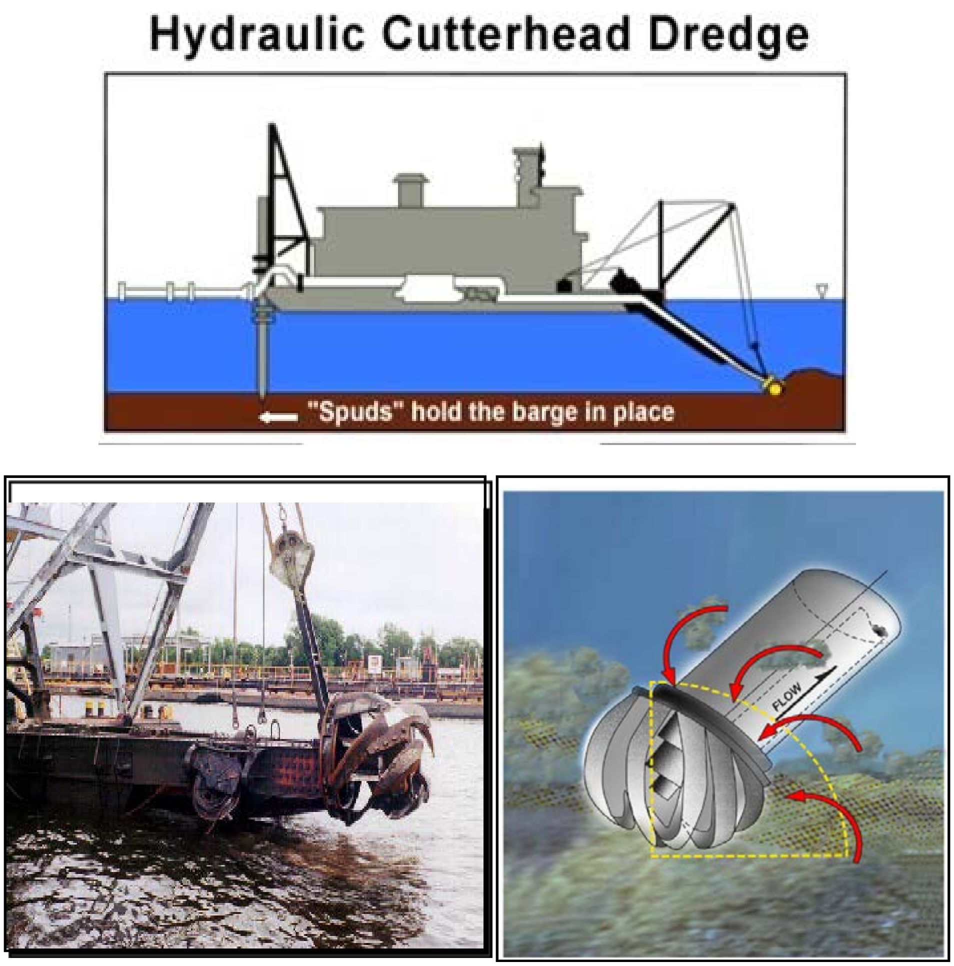

Figure 15. Cutterhead pipeline dredge schematic and representative close-up photographs (provided by USACE).

During the dredging operation, a cutterhead suction barge is held in position by 2 spuds at the stern of the dredge, only 1 of which can be on the bottom while the dredge swings. There are 2 swing anchors some distance from either side of the dredge, which are connected by wire rope to the swing winches. The dredge swings port and starboard alternately, passing the cutter through the bottom material until the proper depth is achieved. The dredge advances by “walking” itself forward on the spuds. This is accomplished by swinging the dredge to the port, using the port spud an appropriate distance, then the starboard spud is dropped and the port spud is raised. The dredge is then swung an equal distance to the starboard, the port spud is dropped, and the starboard spud is raised.

Cutterhead pipeline dredges work best in large areas with deep shoals, where the cutterhead is buried in the bottom. A cutterhead removes dredged material through an intake pipe and then pushes it out the discharge pipeline directly to the placement/disposal site. Most, but not all, pipeline dredging operations involve upland placement/disposal of the dredged material. Therefore, the discharge end of the pipeline is connected to a shore pipe. When effective pumping distances to the placement/disposal site become too long, a booster pump is added to the pipeline to increase the efficiency of the dredging operation.

Transportation Methodology

Dredged material is typically transported by barge and then transferred to a land-based dump truck for disposal in upland locations. In some instances, the material is barged to an approved water location or beneficial use site. Methods of transporting dredged material to disposal sites include self-propelled transport via barges or towing of loaded barges to disposal sites via tugboats. Tugboats may be used to move immobile equipment into place as well as tow loaded barges to the disposal sites. Dredged material may also be transported by pipeline as described above under hydraulic dredging.

Disposal Locations

Dredged material can be disposed of in a USACE verified upland disposal sites, USACE-permitted beneficial reuse sites, existing/authorized Dredged Material Management Areas, or U.S. Environmental Protection Agency (EPA)-designated ocean dredged material disposal sites. Beneficial reuse sites are often areas of eroding shorelines and marshes or seagrass restoration areas where dredged material is used to return the area to a water depth that supports seagrasses. The disposal location is dependent of the type of material dredged, the proximity to the dredging locations, and permitting requirements. Beneficial reuse sites and ocean disposal sites used for projects covered under this Opinion must have undergone Section 7 consultation (either individual or programmatic) to evaluate the potential effects of disposal on ESA-listed species and critical habitat. Some beneficial reuse sites, such as living shorelines, are covered under Activity 7 of this Opinion. Beach renourishment placement is also considered a beneficial use of dredged material.

Project Design Criteria

PDCs specific to Activity 3 (maintenance, minor, and muck dredging):

A3.1. Activities covered by this Opinion include:

- A3.1.1. Maintenance dredging of existing areas such as canals, channels, basins, berths, marinas, boat slips, and areas around intake and discharge structures. Maintenance dredging will be limited to the depth and width previously authorized by the USACE or other regulatory authority such as FDEP or water management districts. There is no size limit for maintenance dredging so long as it meets the previously authorized depth and width. If the previous authorized depth is unknown, dredging is limited to -7.0 ft MLW including any advanced maintenance or overdredge.

A3.1.2. Minor dredging (non-maintenance) dredging as follows:

A3.1.2.1. For dredging to accommodate vessel mooring at boat slips around docks and marinas, the size is limited to the minimum necessary to accommodate vessel mooring, not to exceed 5,000 ft^2. The maximum allowed dredging depth (including overdredge) cannot exceed the depth of the adjacent navigational channel (i.e., controlling depth) or a maximum depth of -7 ft MLW. For projects located adjacent to federal channels (not within the dredged navigational channel), the dredging depth can exceed -7 ft MLW so long as it does not exceed the controlling depth of the federal channel.

A3.1.2.2. For treasure hunting and salvage operations that use blowers, propeller deflectors, and suctioning devices, the size is limited to a total of 5,000 ft^2 and is limited to sandy areas only.

A3.1.2.3. Minor dredging does not include dredging to create new navigational channels.

A3.1.2.4. Minor dredging includes dredging to accommodate the placement of shoreline stabilization, outfall structures; boat ramps; upland cut boat ramps and basins; temporary platforms, fill, and cofferdams; and placement of erosion and scour control-measures. This type of dredging is usually required to embed materials and/or to allow smooth transition of the work to the natural surrounding elevation.

A3.1.3. Muck Dredging, or removing accumulated organic to restore natural habitats and for water quality enhancement, as follows:

A3.1.3.1. Muck dredging cannot be used to increase water depths to support navigation, access, or vessel mooring.

A3.1.3.2. Dredging depths are limited to only that necessary to remove the muck layer down to natural sediments.

The following PDCs apply to all the activities described in PDC A3.1 above:

A3.2. This Opinion does not cover hopper dredging.

A3.3. With respect to the dredged material, all dredged material must be placed in an USACE-verified upland disposal site, EPA or USACE-designated open water disposal site, USACE Dredged Material Management Area, or USACE-approved beneficial use sites for mitigation or restoration, as long as it meets PDC A3.3.1-A3.3.3 below.

A3.3.1. The disposal sites shall employ erosion control measures such as upland erosion control, such as filtration or berms, or in-water turbidity curtains.

A3.3.2. Handling and storage of dredged material must be completed in a manner that prevents sedimentation, erosion, and turbidity during dewatering, overflow, transferring, and storage of the dredged material. For example, the overwater transfer of dredge material should either contain the dredged material and any water to prevent sedimentation or employ other methods, such as turbidity curtains in the marine environment, to ensure that any turbidity generated as the water is returned to the marine environment is contained. If the applicant conducts sediment testing voluntarily or in compliance with other law, and such testing indicates high levels of contaminants in the sediments to be dredged, water from dewatering should not be released back into the marine environment.

A3.3.3. This Opinion does not cover the use of in-water disposal sites (e.g., beneficial use sites or ocean disposal sites) unless the use of the in-water disposal sites has previously undergone ESA-Section 7 consultation with NMFS for disposal of material at these locations. If the applicant is seeking disposal in an in-water disposal location not previously consulted on by NMFS, then the entire project (both dredging and disposal) must be consulted on separately and is not covered under this Opinion.

A3.3.4. This Opinion applies to upland disposal of beach quality sand on beaches if placed above the existing MHW, if the grain size analysis indicates that the dredged sand is compatible with the existing beach sand, and if the sand placement does not change the existing waterward extension of the beach. Placement of beach sand on nesting beaches above MHW that may affect ESA-listed species is under the jurisdiction of the USFWS.

A3.4. This Opinion does not cover dredging within the mapped and authorized federal navigational channels (e.g., ICW, AIWW, GIWW, or harbors [e.g., Port Canaveral]). Dredging outside of the mapped channel in the surrounding waters is covered.

Additional PDCs for Activity 3 applicable in critical habitat:

In addition to the PDCs above, the project must be designed to meet the following PDCs if the project occurs in the critical habitat as described below.

A3.5. Smalltooth sawfish critical habitat:

A3.5.1. Maintenance dredging of canals in smalltooth sawfish critical habitat is covered under this Opinion as long as it is within the previously authorized dredge footprint and to the previously USACE authorized depth.

A3.5.2. For minor dredging: If only the shallow euryhaline (MHWL to -3 ft MLLW) water essential feature is present (i.e., no red mangroves), dredged depths are limited to a maximum depth of -3 ft MLLW. If red mangroves are present, dredging, excavation, or disposal is not allowed within 5 ft of all red mangrove prop roots.

A3.5.3. Muck dredging, as defined in PDC A3.1.3, is not allowed in shallow, euryhaline habitat (MHWL to -3 ft MLLW)

A3.5.4. Dredging and disposal activities are not allowed in areas identified as smalltooth sawfish limited exclusion zones, defined in Section 2.1.1.1.

A3.6. Gulf sturgeon critical habitat: No treasure hunting or muck dredging is allowed in Gulf sturgeon critical habitat at any time of year. No maintenance or minor dredging is allowed in Gulf sturgeon critical habitat between September and March, when sturgeon are likely to be present in these areas. When allowed, maintenance and minor dredging activities shall be conducted according to the PDCs above for all dredging activities.

A3.7. *Acropora* critical habitat and the U.S. Caribbean: This Opinion does not cover dredging (maintenance, minor, or muck) and disposal in *Acropora* critical habitat where the essential features are present or within the U.S. Caribbean. This Opinion does not cover projects requiring penetrating or removing underlying hard substrate (e.g., bedrock, hardbottom) using any methods including blasting or fracturing. Treasure hunting is not allowed in *Acropora* critical habitat or the U.S. Caribbean.

A3.8. Johnson's seagrass critical habitat: Treasure hunting is not allowed in waters less than 12 ft (4 m) deep. Muck dredging is not allowed if the essential features are present. All other dredging is covered if conducted according to the PDCs above for all dredging activities.

A3.9. U.S. Caribbean sea turtle critical habitat (hawksbill, leatherback, and the NA DPS of green sea turtle critical habitat) and loggerhead sea turtle critical habitat: Dredging consistent with the PDCs above can occur in these critical habitat areas.

Assumptions

Maintenance dredging: Estimating the areal extent of areas affected by maintenance dredging is difficult because the USACE tracks dredging and disposal by volume, in cubic yards. Currently the USACE only has limited data on the area of impact. The USACE estimates that the average maintenance dredging is 5 ac per project. However, this could vary widely since maintenance dredging is not limited by area (meaning we have not set a limit on the amount of dredging in a particular location), but instead is limited to the previously authorized footprint and depth.
Maintenance dredging in smalltooth sawfish critical habitat: Maintenance dredging of navigational canals within smalltooth sawfish critical habitat is performed by the West Coast Inland Navigational District (WCIND) as the local sponsor used by the USACE to perform and manage dredging in this area. WCIND provided NMFS with GIS data regarding all of the maintenance dredging of navigational canals within the smalltooth sawfish critical habitat for the CHEU. This data was based on studies under the Florida Sea Grant (Antonini et al. 2000; Fann et al. 2002; Swett et al. 2012; Swett et al. 2000a; Swett et al. 2000b; Swett et al. 2002; Swett et al. 2000c). According to the WCIND studies, if they deepened all of the canals that have areas that are currently less than -3 ft MLLW, this would result in the potential loss of 12,742,560 ft^2 (292.53 ac) of the shallow, euryhaline essential feature. Though it is unlikely that all of the canals in smalltooth sawfish critical habitat will be maintenance dredged per 5-year period, we consider what the cumulative effect would be from removing the essential feature in these areas.

Maintenance dredging in Johnson's seagrass critical habitat: According to the USACE, these projects can range from larger projects that maintenance dredge long stretches of navigational channels, which may affect up to 12,000 ft^2, to smaller projects that maintenance dredge around a boat slips and smaller structures, which may affect only a couple hundred square feet. Based on their records, the USACE estimates that the average maintenance dredging project is approximately 1,200 ft^2.

Maintenance dredging and Johnson's seagrass: The USACE has very few records of maintenance dredging projects that resulted in the loss of Johnson's seagrass. However, based on their records, the USACE estimate maintenance dredging could result in a maximum loss of 4,356 ft^2 (0.1 ac) of Johnson's seagrass per year or 21,780 ft^2 (0.5 ac) per 5-year period.

Minor new dredging: The PDCs limit the size and depth of minor new dredging. The USACE estimates that the average minor dredging project will be 2,500 ft^2. The difference for minor versus maintenance dredging is that maintenance dredging is by definition limited to previously dredged areas and will not result in impacts outside of previously disturbed areas.

Muck dredging: The size and depth of muck dredging is limited to the amount necessary to return the area to the natural depth contour by removing accumulated organic material. The USACE has not previously differentiated muck dredging from other types of dredging in their tracking systems so they do not know how many or how big muck dredging projects will be that are covered under this Opinion. Muck dredging was differentiated for this Opinion because more restoration type projects have been described as muck dredging lately. Because the dredging does not ultimately change the natural depth feature of an area, we classified it differently from maintenance and minor dredging and applied different PDC requirements. The USACE assumes that muck dredging makes up only a small fraction (5%) of all dredging projects because of its very specific nature to remove accumulated sediments that contribute to poor water quality that would only occur in specific areas with poor tidal flushing. These projects can be highly variable in size depending on site conditions. Projects could range from only the terminus of a channel that may be less than 1 ac or could be a large section of a stagnant channel or bay that could be 50 ac or more. For example, the Monroe County Canal Management Master Plan (AMEC Environment & Infrastructure 2013) estimates that muck dredging in canals in the Florida Keys will remove approximately 2.6 ac of material per canal while muck dredging projects in the Indian River Lagoon have been proposed that are approximately 1,000 ac. The USACE believes that larger projects will be rare and that on average, they will impact 25 ac. Due to the range of potential sizes of these types of projects, the PDCs have specific restrictions in critical habitat and sensitive areas.

Estimated areal extent (area) of maintenance, minor, and muck dredging activities is used, in combination with the estimated number of projects anticipated both in and outside of critical habitat (Table 8) to determine the potential effects from this category of activity. USACE anticipates that 1,320 dredging projects will be covered under this Opinion per 5-year period of which 74% will be maintenance dredging, 21% will be new minor dredging, and 5% will be muck dredging.

Thus, to analyze the effects of dredging activities, we looked at the USACE's assumptions regarding (1) the total number of maintenance, minor, and muck dredging activities to be covered under this Opinion per 5-year period; and (2) the anticipated size of the dredging areas based on dredging type and location. Based on this information, we determined the potential effects to species (Tables 31) and critical habitat (Table 33).

Potential Routes of Effect to Listed Species

In Section 2.2 above, we evaluated routes of effect common to the 10 categories of activities covered under this Opinion on ESA-listed species identified in Table 5. Installing new or repairing/replacing boat ramp projects would result in the following common routes of effect discussed above in the section entitled *Construction Related Effects for All Categories of*

Activities Analyzed under this Opinion (the numbers below correspond to the section numbers). The effects analysis for each of these routes of effects is provided in those sections:

1. Direct Physical Effects from Construction Activities
2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction

In this section of the Opinion, we evaluate the potential effects to sea turtles, smalltooth sawfish, and sturgeon from maintenance, minor, and muck dredging that was not considered in Section 2.2. NMFS and USACE effects determinations are summarized for this category of activity in Table 31. Sea turtles, smalltooth sawfish, sturgeon, and Johnson's seagrass may be affected by the permanent loss of habitat from dredging. We quantified the potential extent of habitat impacts based on (1) the assumptions, (2) the number and type of projects estimated by USACE (Table 8), and (3) the limitations defined by the PDCs. Table 32 provides the estimated amount of waterbottom affected by dredging activities. This was calculated for each of the 3 "types of dredging" activities (i.e., maintenance, minor, and muck). The USAE provided the estimated total number of projects that will be covered per 5-year period (1,320 projects) and the percent of dredging expected to be in each of the 3 dredging categories. With this information, we calculated the "total number of projects." This was then multiplied by the "estimated average dredged area per project" to determine the "total area dredged."

Table 31. USACE and NMFS Determinations on the Effects of Dredging Activities (Activity 3) to ESA-listed Species listed in Table 5

Listed Species	USACE Determination	NMFS Determination
Sea Turtles	NLAA	NLAA
Sawfish	NLAA	NLAA
Sturgeon	NLAA	NLAA
Johnson's seagrass	LAA	LAA
Effects Determinations Explained in Section 2.2		
Corals	NE	N/A
Whales	NE	NE
Nassau grouper	Not provided	NE
NE= no effect; NLAA= may affect, not likely to adversely affect; N/A= not applicable (if a project may affect ESA-listed corals, separate consultation is required). The effects analysis for corals, whales, and Nassau Grouper was provided at the beginning of Section 2.2.		

Table 32. Estimated Amount of Waterbottom Affected by Dredging Activities Per 5-Year Period.

Type of Dredging	Percent of Projects	Total Number of Projects (n = 1,320)	Estimated Average Area Dredged per Project (ac)	Total Area Dredged (ac)
Maintenance	74%	976.80	5	4,884.00
Minor	21%	277.20	0.06	16.63
Muck	5%	66.00	25	1,650.00
Total		1,320		6,550.63

Over a 5-year period, 6,550.63 ac of waterbottom area may be permanently altered or removed by the dredging activities. This estimate includes projects in both Florida and the U.S. Caribbean. For the 3 types of dredging, the total area dredged can have different effects on foraging and refuge habitat, as summarized below and explained in more detail for each species.

- Minor dredging: The 16.63 ac impacted by minor dredging represents new, permanent changes to waterbottom, resulting in the potential loss of foraging and refuge habitat.

- Maintenance dredging: The 4,884 ac of estimated maintenance dredging per 5-year period is limited to the same footprint as the already dredged areas, most of which are navigational channels. Previously dredged channels continue to shoal in due to natural wave action and require regular maintenance. Depending on the maintenance dredging interval/ timeframe, these areas can recruit with seagrasses and other benthic resources between dredging cycles. Due to the continued need to maintenance dredge channels to maintain navigational access, the process of them continuing to shoal in, and the continued recruiting of seagrasses and other prey resources back into the channel, we consider maintenance dredging to be a temporary impact.

- Muck dredging: The estimated 1,650 ac of muck dredging are limited to restoring areas to the previous depth in an attempt to improve water quality and likely habitat for species by removing accumulated sediments. We consider this to improve foraging and refuge habitat.

Also, the impacts to waterbottom area are unlikely to be concentrated as the array of individual projects covered under this Opinion under Activity 3 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and the U.S Caribbean).

- <u>Sea Turtles:</u> Sea turtles may be affected by the loss of 6,550.63 ac of waterbottom areas due to dredging as these areas could be used for foraging and potentially refuge. Of the 6,550.63 ac impacted, 1,650 ac will be muck dredged. The areas to be muck dredged are covered in accumulated organic material and thus would not support foraging resources due to the poor sediment and water quality in these areas. Therefore we do not believe muck dredging will affect sea turtles by affecting their forage resources, except to improve the habitat in this area that may eventually recruit foraging resources for sea turtles in the future.

We believe the effect on sea turtles from the potential loss of foraging and refuge habitat from maintenance and minor dredging is insignificant. As discussed above, maintenance dredging will temporarily affect 4,884 ac of previously dredged areas that may not serve as high quality foraging and refuge habitat and resources that may have recruited back into the previously dredged channel will continue to be removed by maintenance dredging and reestablish again based on the dredging interval. Minor dredging 16.63 ac of new areas, may also affect foraging resources. The temporary effects from maintenance dredging and the permanent effects from minor dredging areas to sea turtle foraging resources are discussed below:

- The waterbottom affected by Activity 3 could contain seagrasses, which are an important forage resource for green sea turtles. However, PDC AP.13 limits effects to Johnson's seagrass from maintenance dredging (PDC AP.13 limits to a maximum removal of 0.1 ac per year). In addition, PDC AP.13 recommends that impacts to native, non-listed seagrasses be avoided and minimized to the extent practicable.
- Limestone outcroppings and worm-rock reefs are important developmental habitat for juvenile green turtles. Therefore, under PDC AP.14, this Opinion does not apply to projects where hardbottom is found within the footprint.
- Hawksbill sea turtles are most commonly associated with reef habitat and feed on sponges, algae, and other invertebrates. PDC AP.14 also limits this Opinion to projects that do not directly and indirectly affects listed corals, and excludes projects if non-listed corals and hardbottom habitat, which support sponges, algae, and other forage resources for hawksbill sea turtles, are within the project footprint.
- Dredging activities may remove areas inhabited by sea turtle prey species, including the crustaceans and mollusks that serve as prey for loggerhead and the fish, jellyfish, shrimp, and mollusks that serve as prey for Kemp's ridley sea turtles. These effects are temporary as seagrasses and macroalgae will likely regrow in these areas. In addition, these foraging areas are larger and more common throughout Florida and the U.S. Caribbean than the specific habitat types like seagrass beds, hard bottom, limestone outcroppings, and reefs that must be avoided under this Opinion. The area of impact is small compared to the remaining large nearshore areas that support sea turtle prey species, and sea turtles can travel long distances to forage. Thus, we believe that loggerhead and Kemp's ridley sea turtles will be able to find foraging resources outside of the area affected by the projects.
- Sea turtles may also use channels to thermal regulate by entering deeper channels in the summer to avoid warmer surface waters and entering deeper water in the winter where waters may be warmer than winter surface temperatures. The inability to access these channels during dredging would be temporary and dredging would not occur throughout the entire reach of a channel at the same time allowing other channel areas to thermal regulate.

Given the above, we believe the effect to sea turtles from the potential loss of foraging and refuge habitat is insignificant. In total, based on the routes of effect analyzed here and in

Section 2.2, we determined that the dredging activities under Activity 3 are not likely to adversely affect sea turtles.

- Smalltooth sawfish: Smalltooth sawfish may be affected by the loss of 6,550.63 ac of waterbottom area due to dredging, which could be used for foraging and refuge. However, of the estimated 6,550.63 ac of dredging, 1,650 ac of muck dredging will be in areas of accumulated organic material that also was not likely used by sawfish for forage and refuge activities. Since smalltooth sawfish are bottom dwelling species, movement through a layer of accumulated sediments would likely be difficult and the areas to be dredged likely would lack foraging resources because of the low sediment and water quality. Therefore, we believe muck dredging will not affect smalltooth sawfish by affecting their forage resources.

  We believe the effect on sawfish of the potential loss of nearshore foraging and refuge habitat from maintenance and minor dredging is insignificant. Maintenance dredging will affect 4,884 ac of waterbottom. As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sawfish would only be affected by projects occurring in Florida. The areas to be dredged are not likely to provide quality habitat for smalltooth (e.g., maintenance dredging canals, marinas, around outfall structures). For the first several years of their lives, juvenile smalltooth sawfish exhibit site fidelity to the areas in which they are pupped, typically in very shallow, nearshore waters where they can avoid predation by coastal shark species. In South Florida, sawfish have established distinct nursery areas where they utilize shallow, euryhaline habitat and red mangroves for refuge; these areas have been designated as critical habitat for the species. The PDCs limit activities in smalltooth sawfish critical habitat and prohibit activities in the limited exclusion zones (PDC A3.5). Smalltooth sawfish seek refuge and forage among red mangroves, and PDC AP.12 states that mangrove removal covered under this Opinion is limited to certain dock and outfall structure installation and does not include removal of mangroves for dredging activities. In addition, PDC AP.12 allows removal above the MHWL provided that red mangrove prop roots that are accessible to marine species are not removed. Dredging may remove nearshore areas inhabited by fish and crustaceans that serve as prey for smalltooth sawfish. The area of impact (some amount less than 4,884) is small compared to the other nearshore areas that support sawfish prey species. Sawfish can travel long distances to forage. The array of individual projects covered under this Opinion for Activity 3 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sawfish can forage in nearby areas outside of active project sites. Therefore, we believe the effect on smalltooth sawfish from impacts to foraging and refuge resources from minor and maintenance dredging will be insignificant. Based on the routes of effect analyzed here and in Section 2.2, we determined that dredging activities under Activity 3 are not likely to adversely affect smalltooth sawfish.

- Sturgeon: Sturgeon may be affected by dredging of 6,550.63 ac of waterbottom area that may be used for foraging. However, of the estimated 6,550.63 ac of waterbottom to be dredged, the 1,650 ac to be muck dredged will be in areas of accumulated organic material that also will not likely be used by sturgeon for foraging activities. Since sturgeon are bottom dwelling species, movement through a layer of accumulated sediments would likely be difficult and we expect these areas would lack foraging resources because of the low sediment and water quality. Thus, we do not believe muck dredging will affect sturgeon by affecting their forage resources.

We believe the effect on sturgeon of the potential loss of foraging habitat from minor and maintenance dredging is insignificant. The 4,884 ac to be maintenance dredged are in areas that are not likely to provide high quality habitat for sturgeon (e.g., maintenance dredging canals, marinas, around outfall structures). As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sturgeon would only be affected by projects occurring in Florida. The PDCs allow dredging within areas utilized by Gulf sturgeon, including critical habitat. However, the PDCs preclude dredging in the estuaries and bays within Gulf sturgeon critical habitat between September and March, when sturgeon are likely to be present in these areas (PDC A3.6). When sturgeon return from spawning rivers, the dredging could affect the availability of foraging resources; however, we believe the effect on sturgeon will be insignificant because sturgeon are opportunistic feeders that forage over large areas and will be able to locate prey beyond the small minor dredging footprints and maintenance of existing channels. Also, effects foraging resources from dredging are temporary since benthic invertebrate populations in dredged areas have been observed to recover in 3-24 months after dredging (Culter and Mahadevan 1982; Saloman et al. 1982; Wilber et al. 2007).

Atlantic and shortnose sturgeon are limited in Florida to the St. Marys River and the St. Johns River. This Opinion does not apply to projects in the St. Marys River (Section 2.1.1.3), where Atlantic sturgeon spawn. Neither Atlantic nor shortnose sturgeon are known to spawn in the St. Johns River, so dredging in this river will not affect sturgeon spawning or migrating to foraging areas after leaving spawning rivers in Florida.

The array of individual projects covered under this Opinion for Activity 3 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sturgeon can forage in nearby areas outside of active project sites. Therefore, we believe the effect on sturgeon from impacts to foraging resources from minor and maintenance dredging will be insignificant. Based on the routes of effect analyzed here and in Section 2.2, we determined that dredging activities under Activity 3 are not likely to adversely affect sturgeon.

- Johnson's seagrass: Johnson's seagrass may be affected by dredging activities evaluated in this Opinion. The USACE estimates that maintenance dredging could result in a maximum loss of 4,356 ft^2 (0.1 ac) of Johnson's seagrass per year or 21,780 ft^2 (0.5 ac) per 5-year period. PDC AP.13 limits removal of Johnson's seagrass to a maximum of 0.1 ac per year for all maintenance dredging activities that USACE may authorize under this Opinion. Although the impacts are limited by the PDCs, maintenance dredging activities evaluated in this Opinion is likely to adversely affect Johnson's seagrass. The loss of Johnson's seagrass from maintenance dredging is evaluated in Section 5.

  PDC AP.13 does not allow impacts to Johnson's seagrass from muck dredging or minor dredging so we believe there will be no effect to the species from these types of dredging. In particular, PDC AP.13 does not allow these activities to occur where Johnson's seagrass is within the project footprint.

Potential Routes of Effect to Critical Habitat
In this section of the Opinion, we evaluate the potential effects to smalltooth sawfish critical habitat, Gulf sturgeon critical habitat, and Johnson's seagrass critical habitat from dredging activities. Table 7 describes the specific features of critical habitat evaluated in this Opinion. The estimated impacts to each critical habitat unit (Table 34) and NMFS and USACE effects determinations for this category of activity are summarized in Table 33.

Table 33. USACE and NMFS Determinations on the Effect of Dredging Activities (Activity 3) on Designated Critical Habitat

Project Location	**USACE Determination**	**NMFS Determination**
Sawfish critical habitat	NLAA	NLAA
Gulf sturgeon critical habitat	NLAA	NLAA
Johnson's seagrass critical habitat	LAA	LAA
Effects Determinations Explained in Section 2.2		
Loggerhead critical habitat	NE	NE
Acropora critical habitat	NE	NE
North Atlantic right whale critical habitat	NE	NE
Atlantic sturgeon critical habitat	Not provided	NE
The effects analysis for loggerhead, *Acropora*, North Atlantic right whale, and Atlantic sturgeon critical habitat was provided at the beginning of Section 2.2.		

Table 34. Total Waterbottom Affected by Dredging Projects within Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat

Type of Dredging	Percent of Projects	Total Number of Projects per Critical Habitat	Estimated Average Area Dredged per Project	Total Area Dredged (ft^2)	Total Area Dredged (ac)
Smalltooth sawfish critical habitat (n = 150)					
Maintenance	74%	111.00	WCIND determined all maintenance = 12,742,560 ft^2	12,742,560.00	292.53
Minor	21%	31.50	2,500	78,750.00	1.81
Muck	5%	7.50	1,089,000	8,167,500.00	187.50
Total	100%	150		20,988,810.00	481.84
Gulf sturgeon critical habitat (n = 51)					
Maintenance	74%	37.74	217,800	8,219,772.00	188.70
Minor	26%	13.26	2,500	33,150.00	0.76
Muck	PDC A3.6 does not cover muck dredging in Gulf sturgeon critical habitat				
Total	100%	51		8,252,922.00	189.46
Johnson's seagrass critical habitat (n = 31)					
Maintenance	74%	22.94	1,200.00	27,528.00	0.63
Minor	21%	6.51	2,500.00	16,275.00	0.37
Muck	5%	1.55	1,089,000	1,687,950.00	38.75
Total	100%	31		1,731,753.00	39.75

Potential Routes of Effect to Smalltooth Sawfish Critical Habitat

We believe that there will be no effect to the red mangrove essential feature of smalltooth sawfish critical habitat from any dredging covered under Activity 3. USACE anticipates that 150 dredging activities may be covered under this Opinion per 5-year period in smalltooth sawfish critical habitat. The PDCs for *Mangroves, Seagrasses, Corals and Hardbottom for All Projects* (PDC AP.12) prohibit the removal of mangroves, including red mangroves which are an essential feature of smalltooth sawfish critical habitat, from any dredging project (i.e., mangrove removal is limited to other, non-dredging projects, and removal above the MHWL provided that red mangrove prop roots that are accessible to marine species are not removed). In addition, PDC A3.5.2 states that for minor dredging, if red mangroves are present, dredging, excavation, or disposal is not allowed within 5 ft of all red mangrove prop roots.

We believe there will be no effect to the shallow, euryhaline essential feature of smalltooth sawfish critical habitat from the estimated 292.53 ac of waterbottom area in smalltooth sawfish critical habitat to be maintenance dredged (Table 34). Maintenance dredging under this Opinion is limited to the areas in smalltooth sawfish critical habitat that have been previously dredged and is limited to the previously authorized depth and footprint (PDC A3.5.1). As stated in the Smalltooth Sawfish Critical Habitat Rule (NMFS 2009), maintained channels or marinas are not included in the designated critical habitat. Because the maintenance dredging to be covered under this Opinion only includes maintenance of previously dredged channels, we do not anticipate any effects to smalltooth sawfish critical habitat.

We believe minor dredging of 1.81 ac of waterbottom area in smalltooth sawfish critical habitat (Table 34) will have no effect on the shallow, euryhaline essential feature of smalltooth sawfish critical habitat. PDC A3.5.2 limits minor dredging to areas already deeper than -3 ft MLLW or areas shallower than -3 ft MLLW that are dredged to maintain the 0-3 ft shallow, euryhaline essential feature. For example, an area that is currently- 4 ft deep can be deepened to -6 ft deep or an area that is currently -1 ft deep can be deepened to -3 ft MLLW, without removing the shallow, euryhaline essential feature. Therefore, minor dredging will not remove the shallow, euryhaline essential feature, and changes in depth between the MHWL and -3 ft MLLW will not affect this essential feature.

Muck dredging is not allowed in shallow, euryhaline habitat (PDC A3.5.3) and PDC AP.12 does not allow removal of red mangroves in association with any dredging activities, including muck dredging. Therefore, the estimated 187.5 ac of muck dredging that could occur in smalltooth sawfish critical habitat will not affect the essential features of smalltooth sawfish critical habitat.

Potential Routes of Effect to Gulf sturgeon Critical Habitat

We believe that maintenance and minor dredging activities may affect, but are not likely to adversely affect Gulf sturgeon critical habitat. PDC A3.6 prohibits muck dredging in Gulf sturgeon critical habitat; therefore, these types of dredging will have no effect on critical habitat. USACE anticipates that approximately 51 maintenance and minor dredging activities may be covered under this Opinion per 5-year period in Gulf sturgeon critical habitat. Although we do not know to what extent these areas contain the PCEs of Gulf sturgeon critical habitat, we evaluate the potential effects to the PCEs below assuming these areas contain the first 3 PCEs (abundant prey items, water quality, sediment quality), and evaluate the effect to the fourth PCE (safe and unobstructed migratory pathways) based on best assumptions below.

1. <u>Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages</u>. Dredging may remove substrates containing sturgeon prey items. However, we believe the effects to this PCE will be insignificant since the estimated 189.46 ac (Table 34) of impact from the combination of maintenance (188.7 ac) and minor (0.76 ac) dredging is small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat that we estimate support sturgeon prey species. Dredged material removal will temporarily affect the prey abundance (e.g., crustaceans on the benthic surface and infaunal polychaetes within the dredging footprint). As discussed above, these effects are primarily short-term in nature, consisting of a temporary loss of benthic

invertebrate populations in the dredged areas. Observed rates of benthic community recovery after dredging range from 3-24 months (Culter and Mahadevan 1982; Saloman et al. 1982; Wilber et al. 2007). The relatively species-poor benthic assemblages associated with low salinity estuarine sediments can recover in periods of time ranging from a few months to approximately 1 year, while the more diverse communities of high salinity estuarine sediments may require a year or longer. Therefore, we believe the effects to this PCE will be insignificant.

2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. Localized and temporary reductions in water quality through increased turbidity may result from dredging; however, the effects to this PCE will be insignificant. PDC AP.10 of the PDCs for *In-Water Activities* requires monitoring and controlling turbidity throughout the duration of all projects. Turbidity curtains will be required for most projects. When the curtains are deployed, turbidity will be contained within the active portion of the project site, and we expect any small amounts of turbidity that may escape to have an insignificant effect on water quality. In a few instances, the USACE project manager has the ability to waive the turbidity curtain requirement. An instance where turbidity curtains may be waived is in areas with high wave energy where securing turbidity curtains would not be feasible, thereby potentially increasing the risk of them becoming loose and entangling animals or damaging nearby habitat. In high energy areas, turbidity would dissipate quickly and would therefore effects from turbidity would be minimal, if any. Also, by limiting the dredging depths to no greater than the controlling depth of the adjacent channel for minor dredging and to the previously authorized depth for maintenance dredging, we believe these projects will not affect the hydrology and overall water quality in the area. Therefore, we believe the effects to this PCE will be insignificant.

3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages. Dredging can affect sediment quality; however, the effects to this PCE will be insignificant. The materials that will be dredged from a project area are likely to be the same as those remaining in the dredge footprint; therefore, no permanent alteration of habitat composition occurs within this area. Because similar habitat is expected to be present pre- and post-dredging, it is anticipated that the benthic biota in the dredging areas will have the ability to recover and re-colonize. Therefore, we believe the effects to this PCE will be insignificant.

4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats. Dredging activities could obstruct migratory pathways for spawning if they blocked areas between estuaries and rivers. Migratory pathways could also be obstructed by dredging activities in Gulf sturgeon critical habitat if they prevented movement within estuarine and marine areas used for foraging; however, we believe there will be no effect to this PCE. PDC A3.6 prohibits dredging anywhere in Gulf sturgeon critical habitat between September and March, when sturgeon are likely to be present in the migratory pathways.

Because the effects to the PCEs of abundant prey items, water quality, and sediment quality will be insignificant and there will be no effect to safe and unobstructed migratory pathways, we believe that maintenance and minor dredging activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat.

Potential Routes of Effect to Johnson's Seagrass Critical Habitat
We believe minor dredging may affect the essential features of Johnson's seagrass critical habitat. USACE anticipates that 31 dredging activities may be covered under this Opinion per 5-year period in Johnson's seagrass critical habitat. We estimate that 39.75 ac of waterbottom may be dredged in Johnson's seagrass critical habitat.

We believe maintenance dredging 0.63 ac per 5-year period (Table 34) will have no effect to the essential features of Johnson's seagrass critical habitat. Maintenance dredging in areas that have been previously disturbed lack of the stable, unconsolidated sediment that is free from physical disturbance essential feature. Since Johnson's seagrass critical habitat must support all of the essential features to be considered functional critical habitat, these areas are not considered critical habitat. Therefore, maintenance dredging of these areas is expected to have no effect on Johnson's seagrass critical habitat.

We believe minor dredging of 0.37 ac is likely to adversely affect Johnson's seagrass critical habitat by permanently removing the essential features. The loss of 0.37 ac of Johnson's seagrass critical habitat from minor dredging (Table 34) is evaluated in Section 5.

We believe muck dredging of 38.75 ac will have no effect to the essential features of critical habitat. PDC A3.8 prohibits muck dredging where the essential features are present. Areas to be muck dredged within the geographic boundary of Johnson's seagrass have accumulated organic material that is so thick that it no long supports seagrass growth. Thus, it lacks the essential features of stable, unconsolidated sediments that are free from physical disturbance and/or adequate water quality. Removal of the accumulated material back to the original depth and sediments is intended to improve habitat by returning these areas back to their natural state that may then ultimately support seagrasses in the future, and thus could restore the feature.

2.2.4 Activity 4 (A4): Water-Management Outfall Structures and Associated Endwalls

General Description
This category of activity includes the installation, repair (including all forms of maintenance), replacement, and removal of water-management outfall structures. These structures are typically placed by trenching or excavating a conduit or discharge pipe from the stormwater system or mosquito ditch to an open water body for discharge or by installing a culvert to connect 2 water bodies to improve water circulation and water quality or restore hydrology. All work is typically completed using mechanical equipment from the uplands. Some discharge pipes or culverts are fitted with manatee grates or blocked by piles or bars (Figure 16), which are spaced a maximum of 8 in apart, depending on the size of the discharge pipe or culvert, to ensure that manatees do not enter these pipes or culverts and become trapped. All water discharged from outfall structures must meet all of the state and federal water current quality standards to protect the waterbody to which it is discharged. In addition, all outfall structures for stormwater-

management systems, including replacements, in *Acropora* critical habitat and Johnson's seagrass critical habitat must meet current state and federal water quality standards and contain an in-line treatment structure to reduce water velocities, sedimentation, nutrients, and pollutants discharged from the outfall structure into marine waters. Methods for meeting these standards may include nutrient baffle structures, filters, natural bio filters, and low impact development such as infiltration basins and trenches or vegetative swales. These additional water quality requirements for outfall structures in *Acropora* or Johnson's seagrass critical habitat do not apply to installation of manatee grates on existing culverts or maintenance of the head wall or other shoreline stabilization activities associated with the outfall.
Scour control measures are often used to prevent localized scour and erosion at discharge structures. These measures may include geotextile mats, riprap, or other materials to stabilize the immediate discharge area. The use of these materials is covered under the shoreline stabilization category of activity (Activity 1).

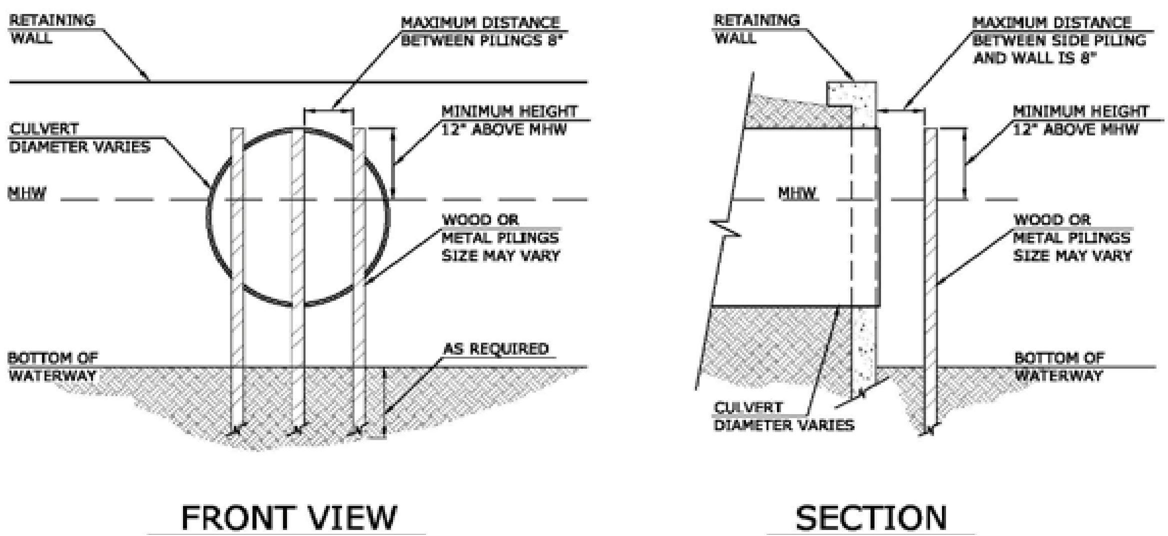

Figure 16. Sample drawing of an outfall pipe with a manatee grate. Manatee grates are typically attached to the pipe, but in this case, piles are placed in front of the pipe.

Project Design Criteria

PDCs specific to Activity for Water-Management Outfall Structures and Associated Endwalls:

A4.1. Activities covered by this Opinion include:

- 4.1.1 Installation, repair, replacement, extension, and removal of existing metal or concrete pipes, culverts, or other drainage conveyance structures that discharge storm water, surface water, or connect existing water bodies.
- 4.1.2 Installation of new outfall structures to connect 2 existing water bodies to improve water flow and quality or restore hydrology.
- 4.1.3 Installation of metal manatee grates. Grates are installed for manatee protection on all culverts that are between 8-in and 8-ft of diameter.

The following PDCs apply to all the activities described in PDC A4.1 above:

A4.2. This Opinion only covers water-management outfall structures when the effluent from the outfall is authorized, conditionally authorized, specifically exempted, or in compliance with the National Pollutant Discharge Elimination System Program (CWA section 402 or state water quality permit and any implementing regulations). The construction of intake structures is not covered unless it is directly associated with a USACE authorized outfall structure.

A4.3. All outfall discharge shall be designed and implemented to prevent erosion and scour.

Additional PDCs for Activity 4 applicable in critical habitat:

In addition to the PDCs above, the project must be designed to meet the following PDCs if the project occurs in the critical habitat as described below.

A4.4. *Acropora* critical habitat, Johnson's seagrass critical habitat, and throughout the U.S. Caribbean (whether in critical habitat units or not): All outfall structures for stormwater-management systems, including replacements and repairs, in these areas must be designed as follows:

- A4.4.1. Structures that result in water discharge into nearshore waters must not be part of a combined-sewer system (sanitary and storm sewers that are connected).
- A4.4.2. Meet current state and federal water quality standards.
- A4.4.3. In addition to any requirements contained in state and federal water quality standards, outfall structures shall be designed to include a treatment structure that reduces water velocities, sedimentation, nutrients, and pollutants discharged from the outfall structure into marine waters to protect surrounding seagrasses or corals. These methods may include nutrient baffle structures, control structures with sediment forebays, filters, natural bio filters, velocity baffles at outfall, and low impact development such as infiltration basins, rain gardens, and trenches or vegetative swales. These requirements do not apply to installation of manatee grates on existing culverts or maintenance of the head wall or other shoreline stabilization activities associated with the outfall.

A4.5. Smalltooth sawfish critical habitat: This Opinion does not cover activities in areas identified as smalltooth sawfish limited exclusion zones, as defined in Section 2.1.1.1.

A4.6. Gulf sturgeon critical habitat: Additional noise restrictions are required for pile and sheet pile installation in the Gulf sturgeon critical habitat migratory restriction zones defined in Section 2.1.1.2.

A4.7. U.S. Caribbean sea turtle critical habitat (hawksbill, leatherback, and the NA DPS of green sea turtle critical habitat): This Opinion does not apply to water management outfall structures proposed in U.S. Caribbean sea turtle critical habitat.

Assumptions

The USACE estimates that 100 ft^2 of habitat may be affected by each water-management outfall project. According to information provided in the *Monroe County Canal Management Plan* (AMEC Environment & Infrastructure 2013), culverts are anticipated to be used between man-made canals in the Florida Keys to improve water quality or restore hydrology. Due to the prevalence of mangroves throughout Florida, the placement of some of the culverts could result in the loss of mangroves along the shoreline even after designing the location to avoid and minimize the loss of mangroves. Therefore, the PDCs limit the removal of mangroves for when installing culverts to improve water quality or restore hydrology between 2 waterbodies to no more than 20 lin ft of mangroves along the shoreline per culvert opening (PDC AP.12). This is the amount that the *Monroe County Canal Management Plan* estimated may be required to be removed to install these culverts. The USACE estimates that no more than 10% of projects will result in the removal of mangroves.

Thus, to analyze the effects of the water-management outfall activities, we looked at the USACE's assumptions regarding (1) the total number of water-management outfall activities to be authorized per 5-year period that meet the requirements of the Opinion; and (2) if the installation of the structure would result in the removal of mangroves. Based on this information, we determined the potential effects to species (Table 35) and critical habitat (Table 37).

Potential Routes of Effect to Listed Species

In Section 2.2 above, we evaluated routes of effect common to the 10 categories of activities covered under this Opinion on ESA-listed species identified in Table 5. Installing new or repairing/replacing water-management outfall projects would result in 5 of the common routes of effect discussed above in the section entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion* (the numbers below correspond to the section numbers). The effects analysis for each of these routes of effects is provided in those sections:

1. Direct Physical Effects from Construction Activities
2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction
7. Noise

In this section of the Opinion, we evaluate the potential effects to sea turtles, smalltooth sawfish, and sturgeon from the installation, maintenance, repair, replacement, and removal of water-management outfall structures and associated endwalls that were not considered in Section 2.2. NMFS and USACE's effects determinations are summarized for this category of activity in Table 35. Sea turtles, smalltooth sawfish, and sturgeon may be affected by the permanent loss of habitat from the placement of materials along the shoreline. We quantified the potential extent of habitat impacts based on (1) the assumptions, (2) the number and location of projects estimated by USACE, and (3) the construction limitations defined by the PDCs. Estimated amount of waterbottom and shoreline area affected by water-management outfalls structures was calculated in Table 36 by multiplying the estimated "total number of projects" by the "average area of loss per project" to get the total amount of waterbottom and shoreline area affected by the placement of structures. Table 36 also provides the estimated total mangrove loss expected by multiplying the USACE's estimate of a 20 lin ft of mangrove loss per project involving the placement of culverts necessary to improve water quality or restore hydrology between 2 water bodies (also restricted to 20 lin ft by PDC AP.12) by the 10% of the 129 estimated project per year expected to have mangrove impacts.

Table 35. USACE and NMFS Determinations on the Effects of Water-Management Outfall Structures and Associated Endwall Activities (Activity 4) to ESA-listed Species Listed in Table 5

Listed Species	USACE Determination	NMFS Determination
Sea Turtles	NLAA	NLAA
Sawfish	NLAA	NLAA
Sturgeon	NLAA	NLAA
Effects Determinations Explained in Section 2.2		
Johnson's seagrass	NE	NE
Corals	NE	N/A
Whales	NE	NE
Nassau grouper	Not provided	NLAA
NE= no effect; NLAA= may affect, not likely to adversely affect; N/A= not applicable (if a project may affect ESA-listed corals, separate consultation is required). The effects analysis for Johnson's seagrass, corals, whales, and Nassau Grouper was provided at the beginning of Section 2.2.		

Table 36. Estimated Amount of Waterbottom and Shoreline Areas and Mangrove Shoreline Affected by Water-Management Outfall Structures and Associated Endwall Projects per 5-Year Period.

Total Number of Projects	Average Area Affected Per Project	Total Area Affected
Waterbottom and shoreline area		
129	100 ft²	12,870 ft² (0.3 ac)
Mangrove Loss		
12.9 (10 % of the 129 projects)	20 lin ft	258 lin ft

Potential Routes of Effect to Sea Turtles, Smalltooth Sawfish, and Sturgeon
We calculated the combined estimated amount of both (1) waterbottom and shoreline areas and (2) mangrove shoreline area affected per project from all water-management outfall structures and endwall projects per 5-year period. We do not know how many projects will be new construction vs repair, replacement, and removal of water-management outfall structures and associated endwall projects. New projects will affect more waterbottom than repair or replacement projects, which will likely be in the same footprint and will not affect additional resources. Given the limited data available, to ensure that we have evaluated the potential worst-case scenario for impacts to these areas, we will assume that all of the projects are new and that each project will result in the average loss of 100 ft² of waterbottom and shoreline area (see assumptions above). Impacts to mangroves from the placement of culverts between 2 waterbodies are limited to no more than 20 lin ft of removal per project (PDC AP.12). In addition, the USACE believes that only 10% of projects will require the removal of mangroves since projects will first be sited to minimize and avoid mangroves (PDC AP.12).

Combined over a 5-year period, the placement of water-management outfall structures and endwall projects are estimated to cover and remove 12,870 ft² (0.3 ac) of waterbottom and shoreline areas and an estimated 258 lin ft of mangrove shoreline (Table 36). We acknowledge that that the estimated loss from water-management outfall structures is likely an overestimate since we assumed all projects are new construction (i.e., not repair, replace, or removal, which as noted above, we do not expect to affect additional resources). This loss is unlikely to be concentrated as the array of individual projects covered under Activity 4 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and the U.S. Caribbean).

- Sea Turtles: Sea turtles may be affected by the placement of structures on top of 0.3 ac of waterbottom and shoreline areas. However, the effect on sea turtles of the potential loss of nearshore foraging habitat is insignificant.
  - The area affected by Activity 4 could contain seagrasses, which are an important forage resource for green sea turtles. However, PDC AP.13 excludes all projects from the Opinion where Johnson's seagrass is present and recommends that impacts to native, non-listed seagrasses be avoided and minimized to the extent practicable.
  - Limestone outcroppings and worm-rock reefs are important developmental habitat for juvenile green turtles. Therefore, under PDC AP.14, this Opinion does not apply to projects where hardbottom is found within the project footprint.

- o Hawksbill sea turtles are most commonly associated with reef habitat and feed on sponges, algae, and other invertebrates. PDC AP.14 also limits this Opinion to projects that do not directly or indirectly affect listed corals, and excludes projects if non-listed corals and hardbottom habitat, which support sponges, algae, and other forage resources for hawksbill sea turtles, are within the project footprint.
- o Outfall structure activities may cover or remove nearshore areas inhabited by sea turtle prey species, including the crustaceans and mollusks that serve as prey for loggerhead and the fish, jellyfish, shrimp, and mollusks that serve as prey for Kemp's ridley sea turtles. These foraging areas are larger and more common throughout Florida and the U.S. Caribbean than the specific habitat types like seagrass beds, hard bottom, limestone outcroppings, and reefs that must be avoided under this Opinion. In addition, the 0.3 ac of impact is very small compared to the remaining large nearshore areas that support sea turtle prey species, and sea turtles can travel long distances to forage. The projects covered under Activity 4 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and the U.S. Caribbean), and sea turtles can forage in nearby areas outside of active project sites.

Given the above, the effect to sea turtles from the potential loss of foraging habitat is insignificant. In total, based on the routes of effect analyzed here and in Section 2.2, we determined that the outfall structure and associated endwall activities under Activity 4 are not likely to adversely affect sea turtles.

- Smalltooth sawfish: Smalltooth sawfish may be affected by the placement of structures on top of 0.3 ac of waterbottom and shoreline areas and the loss of 202 lin ft of mangrove shoreline, both of which could be used for foraging and refuge. As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sawfish would only be affected by projects occurring in Florida. However, the effect on sawfish of the potential loss of nearshore foraging and refuge habitat is insignificant. For the first several years of their lives, juvenile smalltooth sawfish exhibit site fidelity to the areas in which they are pupped, typically in very shallow, nearshore waters where they can avoid predation by coastal shark species. In South Florida, sawfish have established distinct nursery areas where they utilize shallow, euryhaline habitat and red mangroves for refuge; these areas have been designated as critical habitat for the species. The PDCs limits this Opinion to outfall projects occurring outside of smalltooth sawfish limited exclusion zones (PDC A4.5), which are areas that research shows support higher levels of smalltooth sawfish pupping. Projects must be sited to avoid and minimize impacts to mangroves, and mangrove removal associated with placing a culvert between 2 waterbodies to improve water quality or restore hydrology is limited to 20 lin ft per project by PDC AP.12 for a total estimated loss of 258 lin ft. This is a small area of mangrove shoreline reduction when compared to all the mangrove shoreline within the action area and likely undetectable to smalltooth sawfish. As is shown in Figure 16, installing the outfall structure and associated endwalls may also cover or bury nearshore areas by the placement of structures along the shoreline in areas potentially inhabited by fish and crustaceans that serve as prey for smalltooth sawfish. The area of impact (some amount less than 0.3 ac) is very small compared to the remaining large nearshore areas that support sawfish prey species. Sawfish can travel long distances to forage. The projects covered under Activity 4 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sawfish can forage in nearby areas outside of active project sites. Thus, we believe the effect on sawfish of the potential loss of nearshore foraging and refuge habitat is insignificant. Based on the routes of effect analyzed here and in Section 2.2, we determined that the water-management outfall structures and associated endwall activities under Activity 4 are not likely to adversely affect smalltooth sawfish.

- Sturgeon: Sturgeon may be affected by the placement of structures on top of 0.3 ac waterbottom and shoreline areas, which could be used for foraging. As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sturgeon would only be affected by projects occurring in Florida. However, the effect on sturgeon of the potential loss of these nearshore foraging habitat is insignificant. As is shown in Figure 16, installing the outfall structure and associated endwall may cover and bury nearshore bottom substrates from the placement of these structures along the shoreline. The covered areas may contain sturgeon prey species, such as benthic worms and insects, as well as crustaceans and mollusks. However, sturgeon are opportunistic feeders that forage over large areas. Gulf sturgeon select foraging habitat based on substrate composition and depth, rather than prey density, abundance, or diversity. During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Hence, Gulf sturgeon, and likely shortnose and Atlantic sturgeon, often occupy waters deeper than those typically affected by water-management outfall structures and endwall projects occurring in the vicinity of the MHWL. The area of impact (some amount less than 0.3 ac) is very small compared to the remaining large areas that support sturgeon prey species. The projects covered under Activity 4 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sturgeon can forage in nearby areas outside of active project sites. Based on the routes of effect analyzed here and in Section 2.2, we determined that the water-management outfall structure and endwall projects under Activity 4 are not likely to adversely affect sturgeon.

Potential Routes of Effect to Critical Habitat

In this section of the Opinion, we evaluate the potential effects to smalltooth sawfish critical habitat, Gulf sturgeon critical habitat, and Johnson's seagrass critical habitat from water - management outfall structures and associated endwall projects covered under this Opinion. The NMFS and USACE effects determinations for this category of activity are summarized in Table 37.

Table 37. USACE and NMFS Determinations on the Effects of Water-Management and Endwall Activities (Activity 4) on Designated Critical Habitat

Designated Critical Habitat	USACE Determination	NMFS Determination
Smalltooth sawfish critical habitat	LAA	LAA
Gulf sturgeon critical habitat	NLAA	NLAA
Johnson's seagrass critical habitat	LAA	LAA
Effects Determinations Explained in Section 2.2		
Loggerhead critical habitat	NE	NE
Acropora critical habitat	NE	NE
North Atlantic right whale critical habitat	NE	NE
Atlantic sturgeon critical habitat	Not provided	NE
The effects analysis for loggerhead, *Acropora*, North Atlantic right whale, and Atlantic sturgeon critical habitat was provided at the beginning of Section 2.2.		

The estimated amount of waterbottom/ shoreline areas and mangrove shoreline affected by these structures is calculated in Table 38 by multiplying the estimated number of projects expected per 5-year period (total number of projects from Table 8) by the estimated 100 ft² of area waterbottom and of shoreline affected to determine the "total amount of waterbottom within critical habitat affected." Below, we discuss whether and how affecting this area may affect the essential features of critical habitat. In addition, in the section addressing effects to smalltooth sawfish critical habitat, we estimate red mangrove loss.

Table 38. Estimated Amount of Waterbottom and Shoreline Areas Affected by Water-Management Outfall Structures and Associated Endwall Projects in Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat

Project Location	Number of Projects (Table 8)	Total Waterbottom Area Within Critical Habitat Affected (ft²)	Total Waterbottom Area Within Critical Habitat Affected (ac)
Smalltooth sawfish critical habitat	19	1,900	0.04
Gulf sturgeon critical habitat	24	2,400	0.06
Johnson's seagrass critical habitat	7	700	0.02

Potential Routes of Effect to Smalltooth Sawfish Critical Habitat

We believe that water-management outfall activities may affect smalltooth sawfish critical habitat. USACE anticipates that it may authorize 19 water-management outfall activities that meet the requirements of this Opinion per 5-year period in smalltooth sawfish critical habitat. The USACE estimates that 10% of the all water-management outfall and associated endwall

projects (see assumptions above) will result in the removal of mangrove shoreline. Since we do not know if some or all of the mangrove removal for the placement of culverts necessary to improve water quality or restore hydrology between 2 water bodies will occur in our outside of smalltooth sawfish critical habitat, we calculated a minimum and maximum removal of this essential feature. If 10% of the 19 estimated projects in smalltooth sawfish critical habitat resulted in the 20 lin ft of mangrove removal, this would result in a total estimated loss of up to 38 lin ft (20 lin ft x 1.9 projects). This would be the minimum estimated removal of the red mangrove essential feature. However, if all of the projects involving mangrove removal occurred in smalltooth sawfish critical habitat (10% of all 129 projects, shown in Table 36 above), that would result in the removal of 258 lin ft of mangrove shoreline (20 lin ft x 12.9 projects = 258 lin ft). This would represent a maximum estimated removal and is likely an over-estimate since it is unlikely all the mangrove removal projects would occur in smalltooth sawfish critical habitat. However, since red mangrove removal is likely to have the greatest effect in smalltooth sawfish critical habitat, we will analyze the effects of this activity if all mangrove removal occurred inside smalltooth sawfish critical habitat and affected red mangroves. We acknowledge this is likely an overestimate, but will err on the side of the species when evaluating the effects to this essential feature. This loss of the essential feature is likely to adversely affect critical habitat and is evaluated further in Section 5.
In Table 38, we estimated that the placement of water-management outfall structures in smalltooth sawfish critical habitat may affect up to 1,900 ft^2 (0.04 ac) of waterbottom and shoreline areas. We assume these affected areas are shallow, euryhaline habitat, which is likely to adversely affect the essential feature. Therefore, the potential loss of red mangroves and shallow, euryhaline habitat is likely to adversely affect critical habitat and evaluated in Section 5.

Potential Routes of Effect to Gulf sturgeon Critical Habitat
We believe that water-management outfall activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat, as described below. USACE anticipates that 24 water-management outfall activities may be authorized per 5-year period in Gulf sturgeon critical habitat that rely on this Opinion, resulting in the placement of structures on top of 2,400 ft^2 (0.06 ac) of waterbottom and shoreline areas in Gulf sturgeon critical habitat (Table 38). Although we do not know to what extent these areas contain the PCEs of Gulf sturgeon critical habitat, we evaluate the potential effects to the PCEs below assuming these areas contain the first 3 PCEs (abundant prey items, water quality, sediment quality), and evaluate the effect to the fourth PCE (safe and unobstructed migratory pathways) based on best assumptions below.

1. <u>Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages</u>. Installing water-management outfall and associated endwall structures, including the manatee grates, may cover and bury nearshore bottom substrates containing sturgeon prey species. However, we believe the effects to this PCE will be insignificant since the placement of structures on an estimated 0.06 ac of waterbottom and shoreline areas is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat that we estimate supports sturgeon prey species. Further, not all of the 0.06 ac of habitat lost is expected to support prey items or serve as preferred foraging habitat. Gulf sturgeon are suction feeders that tend to forage in calm marine and estuarine waters that support their macroinvertebrate prey including brachiopods,

mollusks, worms, and crustaceans (Mason and Clugston 1993). During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5 and 13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Since water-management and associated endwall projects occur along the shoreline, installation or repair of these structures may not occur in areas with the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. Localized and temporary reductions in water quality through increased turbidity may result from the installation, maintenance, repair, or removal of water-management outfall structures and associated endwall projects; however, the effects to this PCE will be insignificant. PDC AP.10 of the PDCs for *In-Water Activities* requires monitoring and controlling turbidity throughout the duration of all projects. Turbidity curtains will be required for most projects. When the curtains are deployed, turbidity will be contained within the active portion of the project site, and we expect any small amounts of turbidity that may escape to have an insignificant effect on water quality. In a few instances, the USACE project manager has the ability to waive the turbidity curtain requirement as described in PDC AP.10. These instances include projects that are so small that turbidity is expected to be minimal, such as the placement of a single pile, placement of a scientific survey device, or removal of marine debris. Another instance where turbidity curtains may be waived is in areas with high wave energy where securing turbidity curtains would not be feasible, thereby potentially increasing the risk of them becoming loose and entangling animals or damaging nearby habitat. In high wave energy areas, turbidity would dissipate quickly and would therefore not be a problem. In both of the instances where turbidity curtains will not be used (i.e., for projects that are so small turbidity is expected to be minimal and for high energy areas where turbidity will dissipate very quickly), we believe effects from turbidity on water quality would be insignificant.

3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages. The placement of water-management outfall structures and associated endwall projects, can affect sediment quality. The placement of these materials converts sandy substrate, capable of supporting Gulf sturgeon prey, to hard man-made materials that do not support prey species. However, we believe the effects to this PCE will be insignificant since the placement of structures on top of an estimated 0.06 ac waterbottom and shoreline areas is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat with sediments that we estimate supports sturgeon prey species and Gulf sturgeon foraging. Further, not all of the 0.06 ac of habitat lost will have the sediment quality needed to support Gulf sturgeon prey or serve as preferred foraging habitat. During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5 and13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Water-management structures and associated endwall projects are expected to occur along the shoreline in hence may not occur in the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats. Water-management outfall structures and associated endwall activities could obstruct migratory pathways for spawning if they blocked areas between estuaries and rivers. Migratory pathways could also be obstructed in Gulf sturgeon critical habitat if they prevented movement within estuarine and marine areas used for foraging. However, we believe there would be no effect to this PCE. The mouth of Gulf sturgeon spawning rivers and narrow inlets are identified in Section 2.1.1.2 as Gulf sturgeon critical habitat migratory restriction zones. To prevent Gulf sturgeon from being deterred from entering or exiting a spawning river, PDC A4.6 requires compliance with the noise restrictions for pile and sheet pile installation in Gulf sturgeon critical habitat and the Gulf sturgeon critical habitat migratory restriction zones. Outfall structure and associated endwall projects occurring in areas outside of Gulf sturgeon critical habitat migratory restriction zones will occur immediately contiguous with and parallel to shorelines and will not restrict the movement of sturgeon.

Because the effects to the PCEs of abundant prey items, water quality, and sediment quality will be insignificant and there will be no effect to safe and unobstructed migratory pathways, we believe that water-management outfall structure and associated endwall projects activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat.

Potential Routes of Effect to Johnson's Seagrass Critical Habitat

We believe that water-management outfall activities may affect Johnson's seagrass critical habitat. USACE anticipates that it may authorize 7 water-management outfall activities that meet the requirements of this Opinion per 5-year period in Johnson's seagrass critical habitat (Table 38). We assume the affected areas contain the following essential features of Johnson's seagrass critical habitat, water quality, and stable, unconsolidated sediments that are free from physical disturbance, and assess the potential impacts to those features.

1. Water quality. Water discharged from these water-management outfall structures may affect water quality. The PDCs state that all outfall structures for stormwater-management systems, including replacements, in Johnson's seagrass critical habitat must meet current state and federal water quality standards (PDC A4.2) and must also contain an in-line treatment structure to reduce water velocities, sedimentation, nutrients, and pollutants discharged from the outfall structure into marine waters (PDC A4.4). These methods may include nutrient baffle structures, filters, natural bio filters, and low impact development such as infiltration basins and trenches or vegetative swales. The additional protective measures are required in Johnson's seagrass critical habitat to reduce water quality impacts to seagrasses. Therefore, we believe this activity will result in insignificant effects to the Johnson's seagrass water quality essential feature.

2. Stable, unconsolidated sediments that are free from physical disturbance. Placement of these structures will permanently remove areas of the stable, unconsolidated sediment essential feature. The USACE estimates the placement of water-management outfall structure on top of 100 ft² or less of waterbottom and shoreline areas in Johnson's seagrass critical habitat per project (see assumptions above) and we assume that the USACE may authorize 7 of these activities per 5-year period, resulting the potential loss of a total of 700 ft² (0.02 ac) of

Johnson's seagrass critical habitat (Table 38). This loss is likely to adversely affect Johnson's seagrass critical habitat and is evaluated in Section 5.

2.2.5 Activity 5 (A5): Scientific Survey Devices

General Description

This category of activity includes the installation, repair (including all forms of maintenance), replacement, and removal of scientific survey devices include scientific measuring devices such as staff gages, tide and current gages, meteorological stations, water recording and biological observation devices, water quality testing and improvement devices, and vibracore devices. Since these devices are used in scientific research, those using the devices may rely on new survey methods or new scientific experiments when deploying and using the devices that are not discussed here. It is likely that any new devices or methods of using them will have similar effects to those considered in this Opinion. Hence, the Opinion may cover other types of scientific survey devices if they are approved according to the procedures outlined in the Project Review requirements in Section 2.3. According to USACE, scientific survey devices are typically removed in less than 24 months. Many survey devices are installed with anchored buoys, vinyl poles, or single piles installed by hand or jetted in place from a barge. This type of installation can typically be completed in 1-2 days.

Project Design Criteria

PDCs specific to Activity 5 for Scientific Survey Devices:

A5.1. This Opinion covers the installation, repair, and removal of scientific survey devices, including any related equipment and anchors, for up to 24 months if those devices are intended to measure and/or record scientific data in tidal waters, such as staff gages, weirs, tide and current gages, meteorological stations, water recording and biological observation devices, water quality testing and improvement devices, vibracore samplings, and similar structures.

A5.2. The scientific survey device, including any related equipment and anchors, shall not block access of species to an area. For example, the structures shall not prevent movement in or out of a river or channel.

A5.3. No later than 24 months after initial installation or upon completion of data acquisition, whichever comes first, the measuring device and any other structure or fills associated with that device (e.g., anchors, buoys, lines) must be removed and the site must be restored to pre-construction conditions.

A5.4. The scientific survey device, including any related equipment and anchors, shall be inspected and any required maintenance performed at least twice a year and following storm events that may have moved or dislodged the structure to ensure that equipment and anchors are still in place and have not moved to areas containing ESA-listed corals.

Assumptions

The USACE believes that activities in this category will be temporarily placed on 1 ft^2 to 50 ft^2 of waterbottom area, with an average of 20 ft^2 per project. The affected waterbottom includes

those areas upon which materials, anchors, lines, or any other equipment used for scientific surveys is placed. USACE anticipates that 89 temporary scientific survey activities will be covered under this Opinion per 5-year period (Table 8).
Thus, to analyze the effects of scientific survey projects, we looked at the USACE's assumptions regarding (1) the total number of scientific activities to be authorized per 5-year period; and the estimated size of the impacts from this activity. Based on this information, we determined the potential effects to species (Table 39) and critical habitat (Table 41).

Potential Routes of Effect to Listed Species
In Section 2.2 above, we evaluated routes of effect common to the 10 categories of activities covered under this Opinion on ESA-listed species identified in Table 5. Installing scientific survey device projects would result in the following common routes of effect discussed above in the section entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion* (the numbers below correspond to the section numbers). The effects analysis for each of these routes of effects is provided in those sections:

1. Direct Physical Effects from Construction Activities
2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction
7. Noise

In this section of the Opinion, we evaluate the potential effects to sea turtles, smalltooth sawfish, and sturgeon from the impacts associated with the temporary placement of scientific survey devices that were not considered in Section 2.2. NMFS and USACE effects determinations are summarized for this category of activity in Table 39. Sea turtles, smalltooth sawfish, and sturgeon may be affected by the temporary placement of structures on top of waterbottom areas, which may serve as habitat, during the up to 24 months (PDC A5.3) that scientific survey devices are in place. We quantified the potential extent of impacts based on (1) the assumptions, (2) the number and location of projects estimated by USACE (Table 8), and (3) the construction limitations defined by the PDCs. Scientific survey devices can account for a large array of activities that scientists develop to test and track changes in the marine environment. Since we do not know the exact items that will be used, the PDCs are designed to limit effects to species and habitat by limiting the duration the devices may be used and by requiring the devices to be deployed in a manner that does not block species access to resources. The USACE assumes the materials placed for these activities will be small in size ranging from 1 ft^2 to 50 ft^2, with an average impact of 20 ft^2 per project. In Table 40, we determined the minimum and maximum impacts possible from this temporary activity by multiplying the estimated number of projects by the minimum (1 ft^2), maximum (50 ft^2) and average (20 ft^2) amount of expected impacts.

Table 39. USACE and NMFS Determinations on the Effects of Scientific Survey Device Activities (Activity 5) to ESA-listed Species Listed in Table 5

Listed Species	USACE Determination	NMFS Determination
Sea Turtles	NLAA	NLAA
Sawfish	NLAA	NLAA
Sturgeon	NLAA	NLAA
Effects Determinations Explained in Section 2.2		
Johnson's seagrass	NE	NE
Corals	NE	N/A
Whales	NE	NE
Nassau Grouper	Not provided	NLAA
NE= no effect; NLAA= may affect, not likely to adversely affect; N/A= not applicable (if a project may affect ESA-listed corals, separate consultation is required). The effects analysis for Johnson's seagrass, corals, whales, and Nassau grouper was provided at the beginning of Section 2.2.		

Table 40. Estimated Number of Scientific Survey Activities and the Associated Temporary Habitat Impacts over a 5-Year Period.

Number of Projects	Minimum estimated impact of 1 ft² per project (ft²)	Maximum estimated impact of 50 ft² per project (ft²)	Average estimated impact of 20 ft² per project (ft²)	Average estimated impact (ac)
89	89	4,450	1,780	0.04

Over a 5-year period, sea turtles, sawfish, and sturgeon could be affected by the temporary placement of scientific survey devices on top of between 89 and 4,450 ft² (estimated average temporary loss of 1,780 ft² [0.04 ac])of waterbottom area, which may serve as foraging or refuge habitat. This estimate includes projects in both Florida and the U.S. Caribbean.
This temporary placement of structures on waterbottom areas is unlikely to be concentrated as the array of individual projects covered under Activity 5 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and the U.S. Caribbean). Due to the limited time these devices will be in use (24 months as required by PDC A5.3) and the limited size of impact (based on the assumptions), scientific survey devices may be used in critical habitat units. In addition, certain types of scientific survey devices may be attached to a pile or anchor system. Those projects must follow the noise requirements for pile installation contained in the PDCs for *In-Water Noise from Pile and Sheet Pile Installation* (PDC AP.2), as applicable, as well as the requirements for anchor lines designed to prevent entanglement contained in the PDCs for *In-Water Activities*, specifically PDC AP.11.

- Sea turtles: Sea turtles may be affected by the temporary placement of structures on between 89 and 4,450 ft² of waterbottom area, which could be used as foraging habitat. However, the effect on sea turtles of the potential loss of foraging habitat is insignificant since each of these scientific survey devices will only temporarily occupy a small space each (1-50 ft^2). In addition,

- The waterbottom affected by Activity 5 could contain seagrasses, which are an important forage resource for green sea turtles. However, PDC AP.13 excludes projects scientific survey device projects where Johnson's seagrass is present within the project footprint and recommends that impacts to native, non-listed seagrasses be avoided and minimized to the extent practicable.
- Limestone outcroppings and worm-rock reefs are important developmental habitat for juvenile green turtles. Therefore, under PDC AP.14, this Opinion does not apply to projects where hardbottom is found within the project footprint.
- Hawksbill sea turtles are most commonly associated with reef habitat and feed on sponges, algae, and other invertebrates. PDC AP.14 also limits this Opinion to projects that do not directly or indirectly affect ESA-listed coral and excludes projects if non-listed corals and hardbottom habitat, which support sponges, algae, and other forage resources for hawksbill sea turtles, are within the project footprint.
- Scientific survey device activities may temporarily cover areas inhabited by sea turtle prey species, including the crustaceans and mollusks that serve as prey for loggerhead and the fish, jellyfish, shrimp, and mollusks that serve as prey for Kemp's ridley sea turtles. These foraging areas are larger and more common throughout Florida and the U.S. Caribbean than the specific habitat types like seagrass beds, hard bottom, limestone outcroppings, and reefs that must be avoided under this Opinion. In addition, the 89 to 4,450 $ft^2$of impact is very small compared to the remaining large areas that support sea turtle prey species. Sea turtles can travel long distances to forage. The array of individual projects covered under Activity 4 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and the U.S. Caribbean), and sea turtles can forage in nearby areas outside of active project sites.

Given the above, effect to sea turtles from the potential loss of foraging habitat is insignificant. In total, based on the routes of effect analyzed here and in Section 2.2, we determined that scientific survey device activities under Activity 5 are not likely to adversely affect sea turtles.

- Smalltooth sawfish: Smalltooth sawfish may be affected by the temporary placement of structures on top of between 89 and 4,450 ft^2 of waterbottom area, which may be used for foraging and refuge. As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sawfish would only be affected by projects occurring in Florida. However, the effect on sawfish of the potential loss of foraging and refuge habitat is insignificant. For the first several years of their lives, juvenile smalltooth sawfish exhibit site fidelity to the areas in which they are pupped, typically in very shallow, nearshore waters where they can avoid predation by coastal shark species. In South Florida, sawfish have established distinct nursery areas where they utilize shallow, euryhaline habitat and red mangroves for refuge; these areas have been designated as critical habitat for the species. Projects must be sited to avoid and minimize impacts to mangroves, and mangrove removal is strictly limited by PDC AP.12 to removal related to other covered activities and to removal above the MHWL provided that red mangrove prop roots that are accessible to marine species are not removed. Therefore, the effect on juvenile sawfish of losses of small areas of shallow water refuge habitat is expected to be so small as to be undetectable. Scientific survey devices may temporarily cover small areas (1-50 ft^2 per project) of habitat that could be used as foraging habitat by smalltooth sawfish. Cumulatively, the area of impact (some amount less than 89-4,450 ft^2) is very small compared to the remaining large nearshore areas that support sawfish prey species. In addition, the scientific survey devices may be placed outside of nearshore waters, further offshore, so the area affected may not always be the nearshore areas where the species seeks forage and refuge. In addition, sawfish can travel long distances to forage. The array of individual projects covered under Activity 5 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sawfish can forage in nearby areas outside of active project sites. Based on the routes of effect analyzed here and in Section 2.2, we determined that the scientific survey device activities under Activity 5 are not likely to adversely affect smalltooth sawfish.

- Sturgeon: Sturgeon may be affected by the temporary placement of structures on top of between 89 and 4,450 ft^2ac of waterbottom area, which may be used for foraging. As is noted above, these estimates include projects in both Florida and the U.S. Caribbean, but sturgeon would only be affected by projects occurring in Florida. However, the effect on sturgeon of the potential loss of foraging habitat is insignificant. Scientific survey device projects may temporarily cover (24 months as per PDC A5.3) substrates containing sturgeon prey species, such as benthic worms and insects, as well as crustaceans and mollusks. However, sturgeon are opportunistic feeders that forage over large areas. The area of impact is very small compared to the remaining large areas that support sturgeon prey species. The array of individual projects covered under Activity 5 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sturgeon can forage in nearby areas outside of active project sites. Based on the routes of effect analyzed here and in Section 2.2, we determined that the scientific survey device activities under Activity 5 are not likely to adversely affect sturgeon.

Potential Routes of Effect to Critical Habitat

In this section of the Opinion, we evaluate the potential effects to smalltooth sawfish critical habitat, Gulf sturgeon critical habitat, and Johnson's seagrass critical habitat from scientific survey device activities. The NMFS and USACE effects determinations for this category of activity are summarized in Table 41 and the estimated impacts to each critical habitat unit, based on the assumption that each project will affect an average of 20 ft^2 of waterbottom area (see assumptions above), are summarized in Table 42.

Table 41. USACE and NMFS Determinations on the Effects of Scientific Survey Device Activities (Activity 5) to Designated Critical Habitat

Designated Critical Habitat	USACE Determination	NMFS Determination
Smalltooth sawfish critical habitat	LAA	LAA
Gulf sturgeon critical habitat	NLAA	NLAA
Johnson's seagrass critical habitat	NLAA	LAA
Effects Determinations Explained in Section 2.2		
Loggerhead critical habitat	NE	NE
Acropora critical habitat	NE	NE
North Atlantic right whale critical habitat	NE	NE
Atlantic sturgeon critical habitat	Not provided	NE
The effects analysis for loggerhead, *Acropora*, North Atlantic right whale, and Atlantic sturgeon critical habitat was provided at the beginning of Section 2.2.		

Table 42. Estimated Number of Scientific Survey Device Projects and Associated Temporary Impacts in Critical Habitat with Effects Determinations

Project Location	Number of Projects (Table 8)	Minimum estimated impact of 1 ft^2 per project (ft^2)	Maximum estimated impact of 50 ft^2 per project (ft^2)	Average estimated impact of 20 ft^2 per project (ft^2)	Average estimated impact (ac)
Sawfish critical habitat	2	2	100	40	0.00[25]
Gulf sturgeon critical habitat	2	2	100	40	0.00[26]
Johnson's seagrass critical habitat	17	17	850	340	0.01

[25] 40 ft^2 is approximately 0.0009 ac, which rounded to 2 decimal places is 0.00 ac.

[26] 40 ft^2 is approximately 0.0009 ac, which rounded to 2 decimal places is 0.00 ac.

Potential Routes of Effect to Smalltooth Sawfish Critical Habitat

We believe the temporary placement of scientific survey devices will have no effect on the essential features of smalltooth sawfish critical habitat. USACE anticipates that 2 scientific survey activities meeting the requirements of this Opinion may be authorized per 5-year period in smalltooth sawfish critical habitat. The PDCs for *Mangroves, Seagrasses, Corals and Hardbottom for All Projects* (PDC AP.12) preclude the removal of mangroves for this activity and otherwise limit mangrove removal to removal that will not affect marine species (i.e., removal above the MHWL provided that red mangrove prop roots that are accessible to marine species are not removed). In addition, PDC A5.3 requires that when the survey devices are removed, the site is returned to pre-construction conditions. These 2 projects also may or may not even occur in areas that support the essential features of smalltooth sawfish critical habitat. Even if they did occur in an area with essential features, we believe that neither of the essential features will be affected by the temporary placement of 2 scientific survey devices with an estimated potential impact of 2-100 ft^2 (average 40 ft^2), given that the devices must be installed in a way that does not result in the removal of red mangroves and that the installation will not change the depth of the shallow, euryhaline essential feature.

Potential Routes of Effect to Gulf Sturgeon Critical Habitat

We believe the effect of the temporary placement of scientific survey devices is not likely to adversely affect Gulf sturgeon critical habitat. USACE anticipates that 2 scientific survey activities meeting the requirements of this Opinion may be authorized per 5-year period in Gulf sturgeon critical habitat with the potential temporary impact of 2-100 ft^2 (average 40 ft^2) of habitat (Table 42). Although we do not know to what extent these areas contain the PCEs of Gulf sturgeon critical habitat, we evaluate the potential effects to the PCEs below assuming these areas contain the first 3 PCEs (abundant prey items, water quality, sediment quality), and evaluate the effect to the fourth PCE (safe and unobstructed migratory pathways) based on best assumptions below.

1. <u>Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages</u>. The placement of 2 small scientific survey devices for up to 24 months (PDC A5.3) may affect 2-100 ft^2 (average 40 ft^2) by temporarily covering bottom substrates containing sturgeon prey species; however, the effects to this PCE will be insignificant. The effect to this area is temporary, and the affected area is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat with sediments quality that we estimate supports sturgeon prey species and Gulf sturgeon foraging.

2. <u>Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages.</u> The placement of 2 of these projects is not expected to generate water quality issues from turbidity and therefore will have no effect on this essential feature.

3. <u>Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.</u> The placement of 2 small scientific survey devices for up to 24 months (PDC A5.3) may affect 2-100 ft^2 (average 40 ft^2) by temporarily

covering these areas, but will not change or affect sediment quality. Therefore, there will be no effect to this PCE.

4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats. The small size of these structures (1-50 ft^2 each) is not expected to impede the movement of species in the area or their use of habitat by Gulf sturgeon, therefore the migratory pathway PCE will not be affected. Also, PDC A5.2 requires that scientific survey devices be placed so as not to restrict species movement.

Because the effects to the PCEs of abundant prey items will be insignificant and there will be no effect to the water quality, sediment quality, and safe and unobstructed migratory pathways PCE, we believe that scientific survey activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat.

Potential Routes of Effect to Johnson's Seagrass Critical Habitat

We believe the temporary placement of scientific survey devices may affect Johnson's seagrass critical habitat. USACE anticipates that 5 scientific survey activities meeting the requirements of this Opinion may be authorized per 5-year period in Johnson's seagrass critical habitat. We believe that the temporary placement of between 17 and 850 ft^2 (average 340 ft^2) of equipment in Johnson's seagrass critical habitat will not permanently alter Johnson's seagrass critical habitat essential features. The placement of the structure may temporarily affect water quality if turbidity is generated during placement, but this will settle quickly from a small structure. While the structure is in place, it may temporarily affect 850 ft^2 of the water transparency feature by blocking sunlight and covering the stable, unconsolidated essential feature. These effects will be discussed further in Section 5.

2.2.6 Activity 6 (A6): Boat Ramps

General Description

This category of activity includes the installation, repair (including all forms of maintenance), replacement, and removal of boat ramps. Boat ramps are typically installed either in the uplands connecting to the water body or extending from the shore a short distance to provide the proper depth for vessels to safely enter the water. Most boat ramps require minor dredging/grading either to cut the upland location or to shape the slope of the ramp into the water. Following this site preparation, the pre-fabricated concrete slabs are typically placed, creating the ramp. Boat ramps are typically installed quickly (a day to a few days for smaller projects to a few weeks for larger ramps). Boat ramps can range from small private ramps for canoes or boats at a single-family residence to public ramps supporting multiple entrances to the water. Many ramps also support a dock structure along the ramp to tie-up vessels during launching and to enter or exit the vessel. The construction of bulkheads and tie-up piers (i.e., docks) are analyzed separately under shoreline stabilization or construction of pile-supported structures. Below is a sample drawing of a boat ramp (Figure 17).

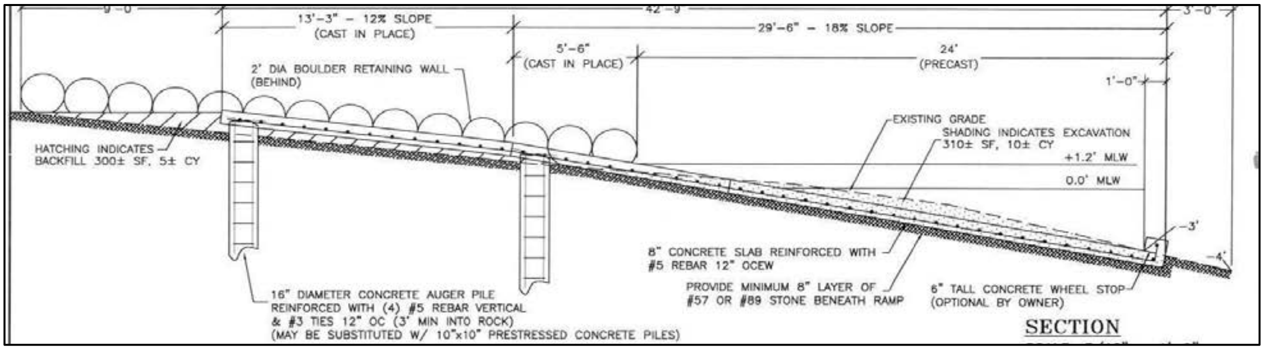

Figure 17. Example drawing of a boat ramp installed by placing prefabricated concrete slabs. Note that excavation for this example was minimal (removed approximately 10 cubic yards in this instance) and limited to shaping the slope of the boat ramp. This ramp extends to -3 ft MLW. Drawings prepared by Glen Boe and Associates, Inc. submitted to NMFS as part of a consultation request.

Project Design Criteria

PDCs Specific to Activity 6 for Boat Ramps:

A6.1. Activities covered by this Opinion include:

A6.1.1. Removal or reconfiguration of existing boat ramps. The removal of upland-cut boat basins by walling off and filling them in is a type of shoreline stabilization covered under Activity 1, PDC A1.1, Section 2.2.1.

A6.1.2. Installation of new boat ramps for motorized vessels (1) are limited in size to 40 ft wide, (2) can have up to 2 boat lanes, and (3) can be associated with no more than 50 trailered vehicle parking spaces.

A6.1.3. New boat ramps for non-motorized vessels are limited in size to 60 ft wide.

A6.1.4. Repair and replacement of existing boat ramps can occur within the same footprint of the existing ramp, even if the repaired or replaced boat ramp does not meet the size requirements in PDC A6.1.2 and A6.1.3. Reconfiguration of boat ramps for motorized vessels that propose to expand the footprint must meet the size limitations described in A6.1.2 (i.e., the reconfiguration must be no more than 40 ft wide and can have up to 2 boat lanes).

The following PDCs apply to all the activities described in PDC A6.1 above:

A6.2. Excavation is limited to the area necessary for site preparation. All excavated material shall be removed to an area that is not waters of the United States, as that term is defined and interpreted under the CWA, including wetlands.

A6.3. All commercial or public boat ramps must have signs posted in a visible location(s) on the dock(s), alerting boaters of listed species in the area susceptible to vessel strikes or hook-and-line captures. These signs shall include contact information for the sea turtle and marine mammal stranding networks and smalltooth sawfish encounter database. Please visit our website (http://sero.nmfs.noaa.gov/protected_resources/section_7/protected_species_educational_signs/index.html) to determine which signs are required for your area, for sign installation guidance, and to download the most current version of the signs. In addition, A6.3.1. All projects shall use the *Save Sea Turtle, Sawfish, and Dolphin* sign.

A6.3.2. Projects within the North Atlantic right whale educational sign zone (as defined in Section 2.1.1.4) shall post the *Help Protect North Atlantic Right Whales* sign.

A6.3.3. Projects in the range of Gulf, Atlantic, or shortnose sturgeon also shall post the *Report Sturgeon* sign.

A6.3.4. We are still developing the signs to be used in the U.S. Caribbean. Once developed, those signs will be included at the website above.

A6.4. All commercial and public boat ramps also must install and maintain for the life of the facility monofilament recycling bins to reduce the risk of turtle or sawfish entanglement in or ingestion of marine debris. Monofilament recycling bins must:

A6.4.1. Be constructed and labeled according to the instructions provided at http://mrrp.myfwc.com or any equivalent guidance for the U.S. Caribbean.

A6.4.2. Be maintained for the life of the facility in working order and emptied frequently so that they do not overflow.

A6.5. The length of new boat ramps and changes to existing boat ramps to make them longer should ensure a water depth at the end of the ramp is deep enough to minimize sediment resuspension associated with launching vessels in shallow water.

A6.6. New boat ramps cannot be installed on ocean beaches that are used by nesting sea turtles.

Additional PDCs for Activity 6 applicable in critical habitat:

In addition to the PDCs above, the project must be designed to meet the following PDCs if the project occurs in critical habitat, as described below.

A6.7. Smalltooth Sawfish critical habitat:

A6.7.1. New or expanded ramps located within smalltooth sawfish designated critical habitat cannot result in the loss of an essential feature of that critical habitat (red mangroves or shallow [MHWL to -3 ft MLLW], euryhaline water).

A6.7.2. Boat ramps can be constructed in waters between MHWL and -3 ft MLLW (shallow, euryhaline habitat essential feature), provided that the water depth is not increased to deeper than -3 ft MLLW.

A6.7.3. A boat ramp in smalltooth sawfish critical habitat may be repaired and replaced within the existing footprint.

A6.7.4. Boat ramp activities cannot occur in areas identified as smalltooth sawfish limited exclusion zone, defined in Section 2.1.1.1.

A6.7.5. Removal of upland cut boat ramps is allowed under this Opinion.

A6.8. *Acropora* critical habitat: New or expanded boat ramps are not allowed in *Acropora* critical habitat where the essential features are present. Boat ramp repair and replacement is allowed within *Acropora* critical habitat within the existing footprint.

A6.9. Johnson's seagrass critical habitat: New or expanded boat ramps are not allowed in Johnson's seagrass critical habitat where the essential features are present. Boat ramp repair and replacement is allowed within the existing footprint.

A6.10. Gulf sturgeon critical habitat: Additional noise restrictions are required for pile and sheet pile installation in the Gulf sturgeon critical habitat migratory restriction zones defined in Section 2.1.1.2.

A6.11. U.S. Caribbean sea turtle critical habitat (hawksbill, leatherback, and the NA DPS of green sea turtle critical habitat): This Opinion does not apply to new structures placed in sea turtle critical habitat in the U.S. Caribbean. Repair and replacement of shoreline protection within U.S. Caribbean sea turtle critical habitat is covered if it is within the existing footprint.

Assumptions

USACE anticipates that 708 boat ramp activities meeting the requirements of this Opinion may be authorized per 5-year period. The USACE believes that the average boat ramp will cover or remove 2,592 ft^2 of waterbottom areas. The USACE estimates that 37% of the projects will be new construction and that 63% will be the repair, replacement, or removal of existing structures. Thus, to analyze the effects of boat ramp projects, we looked at the USACE's assumptions regarding (1) the total number of covered boat ramp activities to be authorized per 5-year period; (2) whether the projects would be new construction or repair/replacement; and (3) whether the projects would occur within or outside of critical habitat. Based on this information, we determined the potential effects to species (Table 43) and critical habitat (Table 45).

Potential Routes of Effect to Listed Species

In Section 2.2 above, we evaluated routes of effect common to the 10 categories of activities covered under this Opinion on ESA-listed species identified in Table 5. Installing new or repairing/replacing boat ramp projects would result in the following common routes of effect discussed above in the section entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion* (the numbers below correspond to the section numbers). The effects analysis for each of these routes of effects is provided in those sections:

1. Direct Physical Effects from Construction Activities
2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction
6. Vessel Strikes
7. Noise

In this section of the Opinion, we evaluate the potential effects to sea turtles, smalltooth sawfish, and sturgeon from the installation, repair, replacement, and removal of boat ramps structures that were not considered in Section 2.2. NMFS and USACE effects determinations are summarized for this category of activity in Table 43. Sea turtles, smalltooth sawfish, and sturgeon may be affected by the permanent placement of materials on waterbottom areas. We quantified the potential extent of impacts (Table 44) based on (1) the assumptions of the number expected to be new versus repair/replacement, (2) the total number projects estimated by USACE from Table 8, and (3) the construction limitations defined by the PDCs. The "total estimated amount of waterbottom affected" is calculated by multiplying the number of projects expected by the percent of each expected to be new (37%) compared to repair/replacements (63%) and then multiplying the "total number of projects" by the estimated impact per project of 2,592 ft^2.

Table 43. USACE and NMFS Determinations on the Effects of Boat Ramp Activities (Activity 6) on ESA-listed Species Listed in Table 5

Listed Species	USACE Determination	NMFS Determination
Sea Turtles	NLAA	NLAA
Sawfish	NLAA	NLAA
Sturgeon	NLAA	NLAA
Effects Determinations Explained in Section 2.2		
Johnson's seagrass	NE	NE
Corals	NE	N/A
Whales	NLAA	NLAA
Nassau Grouper	Not provided	NLAA
NE= no effect; NLAA= may affect, not likely to adversely affect; N/A= not applicable (if a project may affect ESA-listed corals, separate consultation is required). The effects analysis for Johnson's seagrass, corals, whales, and Nassau grouper was provided at the beginning of Section 2.2.		

Table 44. Estimated Amount of Waterbottom Affected by from Boat Ramp per 5-Year Period

Project Type	Percent of Projects	Total Number of Projects (n = 708)	Expected Loss Per Project	Total Estimated Waterbottom Affected (ft^2)	Total Estimated Waterbottom Affected (ac)
New	37%	261.96	2,592	679,000.32	15.59
Repair/ replacement	63%	446.04	2,592	1,156,135.68	26.54
Total	100%	708		1,835,136.00	42.13

Over a 5-year period, an estimated 42.13 ac of waterbottom area may be altered by the installation of boat ramps. This estimate includes projects in both Florida and the U.S. Caribbean. Since 26.54 ac of this waterbottom area will be the repair or replacement of boat ramps in the same footprint, only 15.59 ac of waterbottom area will be covered and changed by the placement of new boat ramps resulting in the loss of shallow, nearshore waters. The 15.59 ac loss of shallow, nearshore habitat from new boat ramp projects is unlikely to be concentrated as the array of individual projects covered under Activity 6 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and the U.S. Caribbean).

- Sea Turtles: Sea turtles may be affected by the loss of 15.59 ac of shallow, nearshore waters, which could be used for foraging, from new boat ramp projects. However, the effect on sea turtles of the potential loss of foraging habitat is insignificant.
  - The affected areas may include seagrasses, which are an important forage resource for green sea turtles. However, PDC AP.13 excludes boat ramp projects from the Opinion where Johnson's seagrass is found within the project footprint and recommends that impacts to native, non-listed seagrasses be avoided and minimized to the extent practicable.
  - Limestone outcroppings and worm-rock reefs are important developmental habitat for juvenile green turtles. Therefore, under PDC AP.14, this Opinion does not apply to projects where hardbottom is found within the footprint.
  - Hawksbill sea turtles are most commonly associated with reef habitat and feed on sponges, algae, and other invertebrates. However, PDC AP.14 also limits this Opinion to projects that do not directly or indirectly affects listed corals and excludes projects if non-listed corals and hardbottom habitats, which support sponges, algae, and other forage resources for hawksbill sea turtles, are within the project footprint.
  - Boat ramp activities may cover or remove areas inhabited by sea turtle prey species, including the crustaceans and mollusks that serve as prey for loggerhead and the fish, jellyfish, shrimp, and mollusks that serve as prey for Kemp's ridley sea turtles. These foraging areas are larger and more common throughout Florida and the U.S. Caribbean than the specific habitat types like seagrass beds, hard bottom, limestone outcroppings, and reefs that must be avoided under this Opinion. The 15.59 ac of impact is very small compared to the remaining large areas that support sea turtle prey species. Sea turtles can travel long distances to forage. The new boat ramp projects covered under Activity 6 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and the U.S. Caribbean), and sea turtles can forage in nearby areas outside of active project sites.

  Given the above, the effect to sea turtles from the potential loss of foraging habitat is insignificant. In total, based on the routes of effect analyzed here and in Section 2.2, we determined that the boat ramp activities under Activity 6 are not likely to adversely affect sea turtles.

- Smalltooth sawfish: Smalltooth sawfish may be affected by the loss of 15.59 ac of shallow nearshore habitat, which could be used for foraging and refuge. As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sawfish would only be affected by projects occurring in Florida. However, the effect on sawfish from the potential loss of foraging and refuge habitat is insignificant. For the first several years of their lives, juvenile smalltooth sawfish exhibit site fidelity to the areas in which they are pupped, typically in very shallow, nearshore waters where they can avoid predation by coastal shark species. In South Florida, sawfish have established distinct nursery areas where they utilize shallow, euryhaline habitat and red mangroves for refuge; these areas have been designated as critical habitat for the species. The PDCs limit activities in smalltooth sawfish critical habitat and limits the Opinion to shoreline projection activities occurring outside of smalltooth sawfish limited exclusion zones (PDC A6.7.4). In addition, projects must be sited to avoid and minimize impacts to mangroves, and mangrove removal is strictly limited by PDC AP.12 to removal associated with other covered activities and to removal above the MHWL provided that red mangrove prop roots that are accessible to marine species are not removed. Moreover, under PDC A6.7.1, new or expanded ramps located within smalltooth sawfish designated critical habitat cannot result in the permanent loss of red mangroves. PDC A6.7.1 also prohibits the permanent removal of the depth feature of the shallow, euryhaline essential feature. Therefore, the effect on juvenile sawfish from the loss of small areas of shallow water refuge habitat is expected to be so small as to be undetectable. Boat ramp activities may also cover or remove nearshore areas inhabited by fish and crustaceans that serve as prey for smalltooth sawfish. The area of impact (some amount less than 15.59 ac) is very small compared to the remaining large nearshore areas that support sawfish prey species. Sawfish can travel long distances to forage. The placement of new boat ramps covered under Activity 6 that may affect smalltooth sawfish will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sawfish can forage in nearby areas outside of active project sites. Therefore, we believe the effect to smalltooth sawfish from the potential loss of foraging and refuge habitat is insignificant. Based on the routes of effect analyzed here and in Section 2.2, we determined that the boat ramp activities under Activity 6 are not likely to adversely affect smalltooth sawfish.

- Sturgeon: Sturgeon may be affected by the loss of 15.59 ac of shallow habitat used for foraging. As is noted above, this figure includes projects in Florida and the U.S. Caribbean, but sturgeon would only be affected by projects occurring in Florida. However, the effect on sturgeon of the potential loss of foraging habitat is insignificant. Boat ramp projects may cover and bury nearshore bottom substrates resulting in a loss of areas potentially containing sturgeon prey species, such as benthic worms and insects, as well as crustaceans and mollusks. However, sturgeon are opportunistic feeders that forage over large areas. Gulf sturgeon select foraging habitat based on substrate composition and depth, rather than prey density, abundance, or diversity. During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5 and 13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Hence, Gulf sturgeon, and likely shortnose and Atlantic sturgeon, often occupy waters deeper than those typically affected by boat ramp activities occurring from the shore and sloping out to a depth sufficient to launch a vessel. The area of impact (some amount less than 15.59 ac) is very small compared to the remaining large areas that support sturgeon prey species. The installation of new boat ramps covered under Activity 6 that may affect sturgeon will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sturgeon can forage in nearby areas outside of active project sites. Therefore, we believe the effect to sturgeon from the potential loss of foraging habitat is insignificant. Based on the routes of effect analyzed here and in Section

2.2, we determined that the boat ramp activities under Activity 6 are not likely to adversely affect sturgeon.

Potential Routes of Effect to Critical Habitat

In this section of the Opinion, we evaluate the potential effects to smalltooth sawfish critical habitat, Gulf sturgeon critical habitat, and Johnson's seagrass critical habitat from boat ramp activities. The NMFS and USACE effects determinations for this category of activity are summarized in Table 45. The estimated loss of critical habitat is summarized in Table 46 and calculated the same way we calculated the area of impacts in Table 44 above.

Table 45. USACE and NMFS Determinations on the Effects of Boat Ramp Activities (Activity 6) to Designated Critical Habitat

Designated Critical Habitat	USACE Determination	NMFS Determination
Smalltooth sawfish critical habitat	NLAA	NLAA
Gulf sturgeon critical habitat	NLAA	NLAA
Johnson's seagrass critical habitat	NE	NE
Effects Determinations Explained in Section 2.2		
Loggerhead critical habitat	NE	NE
Acropora critical habitat	NE	NE
North Atlantic right whale critical habitat	NE	NE
Atlantic sturgeon critical habitat	Not provided	NE
The effects analysis for loggerhead, *Acropora*, North Atlantic right whale, and Atlantic sturgeon critical habitat was provided at the beginning of Section 2.2.		

Table 46. Estimated Amount of Waterbottom Affected by Boat Ramp Activities in Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat per 5-Year Period

Project Location	Total Number of Projects (Table 8)	Expected Loss Per Project (ft^2)	Total Area Within Critical Habitat Affected (ft^2)	Total Area Within Critical Habitat Affected (ac)
Smalltooth sawfish critical habitat	22	2,592	57,024	1.31
Gulf sturgeon critical habitat	30	2,592	77,760	1.79
Johnson's seagrass critical habitat	2	2,592	5,184	0.12

Potential Routes of Effect to Smalltooth Sawfish Critical Habitat

We believe that boat ramp activities may affect, but are not likely to adversely affect, smalltooth sawfish critical habitat. USACE anticipates that 22 boat ramps projects meeting the requirements of this Opinion may be authorized per 5-year period in smalltooth sawfish critical habitat. In total, the USACE expects that those projects will impact 1.31 ac of waterbottom area in smalltooth sawfish critical habitat. Under PDC A6.7.1, boat ramp activities cannot result in the loss of the essential features of smalltooth sawfish critical habitat (i.e., shallow, euryhaline habitat or red mangroves). Under PDC A6.7.2, boat ramps can only be constructed in waters between the MHWL and -3 ft MLLW if they do not change the shallow, euryhaline depth feature. In addition, under PDC A6.7.3, existing boat ramps can only be repaired or replaced within the same footprint, meaning repair and replacement projects will not result in any new impacts to the depth feature of the shallow, euryhaline essential feature. Boat ramp projects under this Opinion cannot occur in sawfish limited exclusion zones (PDC A6.7.4). The placement of new boat ramp slabs may alter the first few inches of depth through grading the shoreline and placement of the materials, but will not fill or remove the -3ft MLLW depth feature. Therefore, boat ramps will not remove the shallow, euryhaline essential feature, and changes in depth between the MHWL and -3 ft MLLW will not affect this essential feature.

Potential Routes of Effect to Gulf sturgeon Critical Habitat

We believe boat ramp activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat. USACE anticipates that 30 boat ramp projects meeting the requirements of this Opinion may be authorized per 5-year period in Gulf sturgeon critical habitat, affecting an estimated 1.79 ac of waterbottom area in Gulf sturgeon critical habitat. Although we do not know to what extent these areas contain the PCEs of Gulf sturgeon critical habitat, we evaluate the potential effects to the PCEs below assuming these areas contain the first 3 PCEs (abundant prey items, water quality, sediment quality), and evaluate the effect to the fourth PCE (safe and unobstructed migratory pathways) based on best assumptions below.

1. <u>Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages</u>. Boat ramp projects may cover and bury waterbottom areas resulting in a loss of substrates potentially containing sturgeon prey species. However, we believe the effect to this PCE will be insignificant since the estimated 1.79 ac of impact is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat that we estimate support sturgeon prey species. Further, not all of the 1.79 ac of habitat affected by boat ramps support prey items or serve as preferred foraging habitat. Gulf sturgeon are suction feeders that tend to forage in calm marine and estuarine waters that support their macroinvertebrate prey including brachiopods, mollusks, worms, and crustaceans (Mason and Clugston 1993). During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5 and 13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Boat ramps occur from the shore and slope deeper to support vessel launching, meaning that not all will occur in the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. Localized and temporary reductions in water quality through increased turbidity may result from the installation, repair, or removal of boat ramps; however, the effects to this PCE will be insignificant. PDC AP.10 of the PDCs for *In-Water Activities* requires monitoring and controlling turbidity throughout the duration of all projects. Turbidity curtains will be required for most projects. When the curtains are deployed, turbidity will be contained within the active portion of the project site, and we expect any small amounts of turbidity that may escape to have an insignificant effect on water quality. In a few instances, the USACE project manager has the ability to waive the turbidity curtain requirement as described in PDC AP.10. These instances include projects that are so small that turbidity is expected to be minimal, such as the placement of a single pile, placement of a scientific survey device, or removal of marine debris. Another instance where turbidity curtains may not be used is in areas with high wave energy where securing turbidity curtains would not be feasible, thereby potentially increasing the risk of them becoming loose and entangling animals or damaging nearby habitat. In high energy areas, turbidity would dissipate quickly and would therefore not be a problem. In both of the instances where turbidity curtains will not be used (i.e., for projects that are so small turbidity is expected to be minimal and for high energy areas where turbidity will dissipate very quickly), we believe effects from turbidity on water quality would be insignificant.

3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages. The installing new boat ramps will remove some waterbottom areas, which can affect sediment quality. The installed boat ramps convert sandy substrate, capable of supporting Gulf sturgeon prey, to hard, man-made ramps that do not support prey species. However, we believe the effects to this PCE will be insignificant since the estimated 1.79 ac of impact is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat with sediments that we believe support sturgeon prey species and Gulf sturgeon foraging. Further, not all of the 1.79 ac of habitat converted solid areas supporting boat ramp projects have the sediment quality needed to support Gulf sturgeon prey or serve as preferred foraging habitat. During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5 and 13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Boat ramp projects occur from the shore and slope deeper to accommodate vessel launching, as such, these projects may not all occur in the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats. New boat ramp projects could obstruct migratory pathways for spawning if they blocked areas between estuaries and rivers. Migratory pathways also could be obstructed by boat ramp activities in Gulf sturgeon critical habitat if they prevented movement within estuarine and marine areas used for foraging. However, effects to this PCE will be discountable. The mouth of Gulf sturgeon spawning rivers and narrow inlets are identified in Section 2.1.1.2 as Gulf sturgeon critical habitat migratory restriction zones. To prevent Gulf sturgeon from being deterred from entering or exiting a spawning river, PDC A6.10 requires compliance with the noise restrictions for pile and sheet

pile installation in Gulf sturgeon critical habitat migratory restriction zones. Boat ramp projects occurring in areas outside of Gulf sturgeon critical habitat migratory restriction zones will occur along the shore and will not restrict the movement of sturgeon. Therefore, any effects are extremely unlikely to occur.

Because the effects to the PCEs of abundant prey items, water quality, and sediment quality will be insignificant and effects to safe and unobstructed migratory pathways will be discountable, we believe that boat ramp activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat.

Potential Routes of Effect to Johnson's Seagrass Critical Habitat

We believe there will be no effect to Johnson's seagrass critical habitat from boat ramps because PDC A6.9 excludes new or expanded boat ramp projects in Johnson's seagrass critical habitat where the essential features are present, and repair and replacement can only occur within the same footprint. USACE anticipates that 2 boat ramp activities meeting the requirements of this Opinion may be authorized per 5-year period in Johnson's seagrass critical habitat. Given the PDCs, these projects can only occur in areas lacking the essential features or can only occur within the same footprint (preventing new or additional effects to the essential features).

2.2.7 Activity 7 (A7): Aquatic Habitat Enhancement, Establishment, and Restoration Activities

General Description

As used in this Opinion, aquatic enhancement includes (1) constructing oyster reefs on unvegetated bottom in tidal waters, (2) constructing living shorelines, including using vegetative plantings and fill material to construct breakwaters parallel to the shore (3) enhancing or establishing submerged aquatic vegetation, (4) constructing artificial reefs, and (5) filling in areas to restore natural contours or improve water quality.

Oyster Reefs and Living Shorelines

Oyster reefs and living shorelines are placed in shallow water environments. Both can be constructed to act as a natural breakwater along eroding shorelines. Living shorelines can be constructed out of different materials, including oysters or limestone boulders. The installation methods and materials used to create oyster reefs and living shorelines are described below. Oyster reefs can be configured in a number of different ways, including as a stand-alone reef or a series of reefs. When placed near shore, oyster reefs also can act as a breakwater/living shoreline (see below). Many oyster reefs are constructed of bags filled with oyster cultch (i.e., oyster shells placed to facilitate new oyster spat recruitment). Often, these bags are hand-placed. Sometimes, a perimeter is created with the oyster bags and the center is filled with loose cultch so that the loose material is contained. Loose material is often offloaded using barge-mounted mechanical equipment. Some oyster reefs are created by placing flat mats weighted to the seafloor with oyster cultch attached. All of these methods rely on natural recruitment of live oysters from the surrounding waters. Figure 18 provides images of different types of oyster reefs and equipment and materials used in oyster reef construction.

Figure 18. Oyster reefs. The left image shows oyster bags, the middle is an oyster mat, and the right is a barge filled with loose oyster cultch. All 3 images are from the Charlotte Harbor Habitat Restoration Plan (Boswell et al. 2012).

Living shorelines are created by placing a breakwater parallel to the shore. Breakwaters can be constructed of artificial materials such as prefabricated structures like reef balls or constructed of natural materials such as oysters, limestone boulders, mangrove island barriers, or biologs. Shoreline structures are aligned parallel with the shore as straight-line sections or shaped into crescent sections to reduce wave attenuation. Vegetation is often planted landward of the structures, between structure and the shoreline, to stabilize the shoreline. Below is a cross section diagram showing the transition from the living breakwater to the uplands (Figure 19). The PDCs require that all living shoreline structures must have breaks or gaps in the sections of living shoreline to allow for tidal flushing and species movement. We developed PDCs to set the living shoreline lengths and gap widths based on the practices and recommendations of FDEP and non-government organizations that specialize in living shorelines.

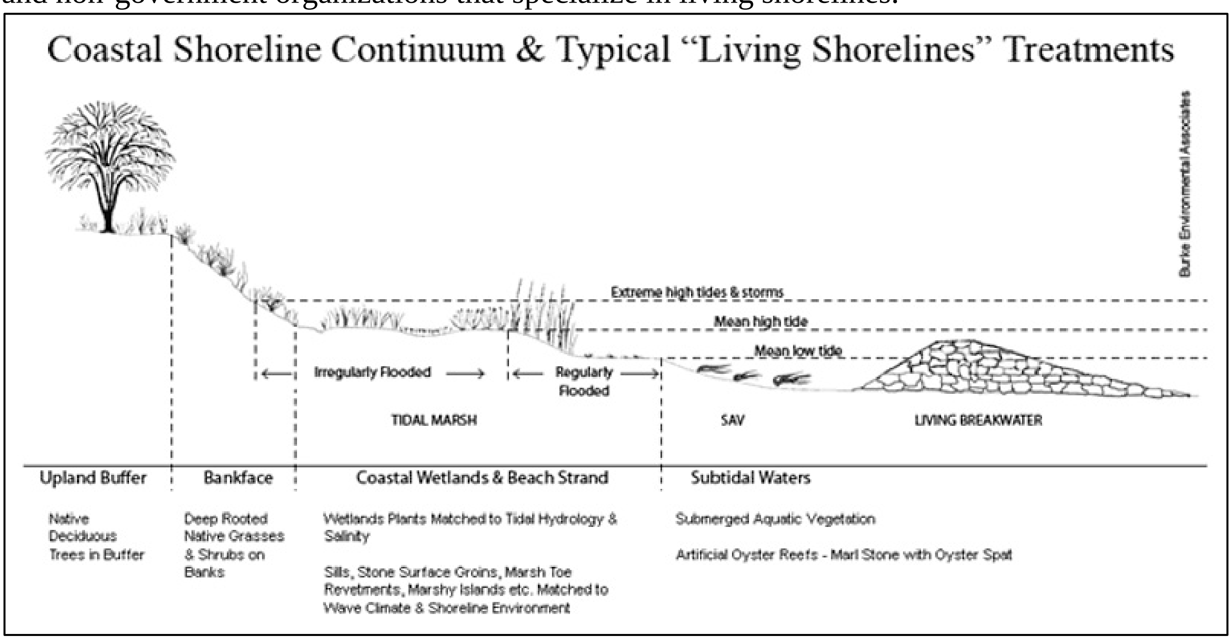

Figure 19. Living shoreline. This sample living shoreline cross-section is provided by NOAA's Habitat Conservation and Restoration website (http://www.habitat.noaa.gov/restoration/techniques/lsimplementation.html).

Seagrass Planting

Seagrass planting is often used to develop or restore seagrass beds for the purpose of aquatic habitat restoration. Sometimes, seagrass is planted on a site with no site preparation. In some cases, prior to planting, the site elevation must be restored, which is typically done by placing fill (either suitable loose sediment or bagged sediment) in blowholes/dredge holes or prop scars until the holes are filled to an elevation level with the adjacent area. Loose material is often offloaded using barge-mounted mechanical equipment. Seagrass plants typically are obtained from laboratories, specialty nurseries, or from transplants from existing seagrass bed. Bird roosting stakes sometimes are used to speed seagrass recovery by taking advantage of a natural source of fertilizer (Figure 20). Bird roosting stakes normally are small wood or plastic stakes installed by hand.

Figure 20. Seagrass restoration. The left image is the placement of sediment to return a blowhole to pre-injury elevation. The image on the right shows bird stakes placed in a restoration area (Both images are from www.darrp.noaa.gov).

Artificial Reefs

Artificial reefs can consist of a variety of materials. This Opinion is limited to reefs constructed of the materials described in the PDCs below. Materials are typically transported to the site by barge. Pre-fabricated reef modules are off-loaded by crane and loose concrete material is dumped over side onto a pre-surveyed, defined location. Pre-fabricated structures are available in a variety of shapes, including those pictured below (Figure 21).

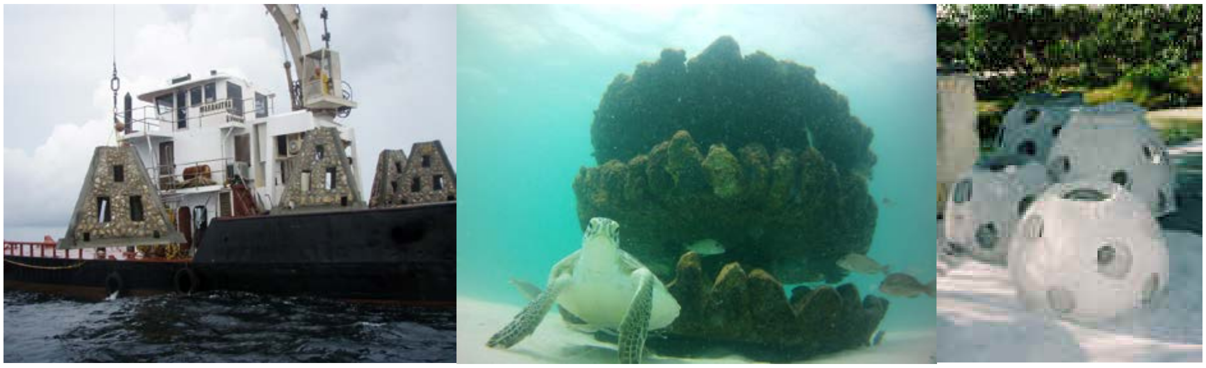

Figure 21. Artificial reef materials. The left image is an open top and bottom tetrahedron design, the middle image is a series of discs mounted to a pile, and the right image is a reef ball. Left and middle images are from Reef Maker (http://www.reefmaker.com) and the right image is from the Reef Ball Foundation (www.reefball.org).

Fill to Restore Natural Contours or Improve Water Quality

In areas where historic dredging has occurred or areas with ruts or scars from vessel groundings, fill is sometimes the best way to restore the natural contours of the area so that aquatic vegetation can recover or so that water quality can improve. With respect to water quality, if an area is significantly deeper than the surrounding habitat, it can create hypoxic conditions where oxygen levels in the deeper area are so low as to become deadly to aquatic life. Depending on the size and depth, these areas may be filled with hand held equipment or from mechanical equipment such as backhoes and bucket dredges from land or barge.

Project Design Criteria

PDCs Specific to Activity 7 for Aquatic Habitat Enhancement, Establishment, and Restoration Activities:

A7.1. Only native plant species can be planted.

Additional Conditions for living shoreline and oyster habitat on unvegetated bottom in tidal waters:

A7.2. Oyster reef materials shall be placed and constructed in a manner that ensures that materials will remain stable and that prevents movement of materials to surrounding areas (e.g., oysters will be contained in bags or attached to mats and loose cultch must be surrounded by contained bagged oysters or another stabilizing feature).

A7.3. Oyster reef materials must be placed in designated locations only (i.e., the materials shall not be indiscriminately or randomly dumped or allowed to spread outside of the reef structure).

A7.4. Living shorelines can only be constructed in unvegetated, nearshore water along shorelines to create tidal marshes or mangrove habitat for the purpose of shoreline erosion control or aquatic habitat enhancement. Native plants can be placed along the shoreline or between the shoreline and the living shoreline structure.

A7.5. Living shoreline structures and permanent wave attenuation structures can only be constructed out of the following materials: oyster breakwaters (described above in the project description and A7.2), clean limestone boulders or stone (sometimes contained in metal baskets or cages to contain the material), small mangrove islands, biologs, coir, rock sills, and pre-fabricated structures made of concrete and rebar that are designed in a manner so that they do not trap sea turtles, smalltooth sawfish, or sturgeon. Reef balls or similar structures that are not open on the bottom, open-bottom structures with a top opening of at least 4 ft, and reef discs stacked on a pile are pre-fabricated structures are designed in a manner so that they do not trap sea turtles. Other materials may be used for living shorelines if pre-approved by NMFS to ensure that they are stable and not an entanglement risk to listed species. The approval process to use other materials is described in the Section 2.3 (Project-Specific Review).

A7.6. Both living shoreline and oyster reefs must have 5 ft gaps at least every 75 ft in length, as measured parallel to the shoreline and at the sea floor, to allow for tidal flushing and species movement.

Additional Conditions for the establishment or restoration of submerged aquatic vegetation:

A7.7. The placement of loose or bagged sediment suitable for the project site in blowholes/dredge holes or in prop scars, and berm redistribution or sod replacement in excavations, must be to an elevation level with or otherwise consistent with the adjacent area.

A7.8. This Opinion covers leveling submerged spoil piles or berms if necessary to level the restoration area to match the elevation of adjacent seagrass beds.

A7.9. Exclusion cages may be used around seagrass restoration areas if necessary to allow the seagrass beds to establish themselves to the point where they are sustainable after the cages are removed. Exclusion cages can only be used on a temporary basis, for a period not to exceed 4 months. Each exclusion cage must be securely fastened to the substrate so that it does not become detached. All cages must be constructed of firm, taut materials and cannot include any loose mesh, thin twistable wire, or rope that could twist or become entangled or present an entanglement risk to species.

A7.10. Seagrass transplantation and harvesting from the donor site may occur only by hand. Donor sites could include (i) upland seagrass farms, (ii) areas with seagrasses that would be impacted by another project, or (iii) existing seagrass beds, as long as the seagrass is removed in a manner that is not detrimental to the existing seagrass bed. Transplantation methods may include, but are not limited to, plugging devices, manual transplant, peat pellets, peat pots, and coconut fiber mats. No in-water machinery (e.g., marsh buggies, track hoe) may be used in harvesting or transplanting the seagrasses. The selection of and harvesting from seagrass donor sites shall be coordinated with NMFS Habitat Conservation Division. This Opinion does not cover transplantation of the invasive seagrasses (e.g., *Halophila stipulacea*).

A7.11. In Florida, this Opinion covers installation of stakes to attract birds, if necessary or appropriate for the project. Bird stakes should not be used in areas where additional nutrients may be detrimental to the seagrass. Bird stakes are not authorized in the U.S. Caribbean.

A7.12. This Opinion covers installation of signage (supported on piles or anchored) if the signs are necessary to prevent motorized boats from entering the area and anchoring. Signs must be sized and placed in a manner that prevents the loss of native seagrasses from sign shading.

<u>Additional conditions for the installation of artificial reefs from the placement of man-made materials:</u>

A7.13. Artificial reef materials shall be clean and free from asphalt, creosote, petroleum, other hydrocarbons and toxic residues, loose free-floating material, or other deleterious substances.

A7.14. New reef sections are limited to 1 reef section measuring ¼- by ¼-nmi area (40 ac) in size with a distance of 500 ft between each section. Offshore reefs shall maintain a minimum vertical clearance of twice the height of the structure from the top of the deployed material relative to the MLW at all times.

A7.15. Reauthorization of existing reefs is limited to the previously permitted size. Approved materials defined in PDC A7.19 can be added to the existing reef area.

A7.16. No artificial reef materials shall be deployed until a benthic assessment of the bottom conditions has been accomplished by diver or submersible video camera. The inspection of the deployment area may occur at the time of deployment but no more than 1 year prior to deployment. The permittee shall maintain a deployment buffer of at least 200 ft from any submerged aquatic resources, including seagrasses, macroalgae, hard or soft coral (including coral reefs), sponges, oysters, or hard bottom when placed in areas of sand. If materials are off-loaded from a barge or placed in areas that may generate turbidity (e.g., areas with fines or muck), a 500 ft buffer is required.

A7.17. This Opinion does not cover the use of mid-water fish aggregation devices.

A7.18. All reefs must be cleaned annually to remove marine debris and derelict fishing line in areas safely accessible to recreational SCUBA divers. Cleanup efforts shall follow the PDCs for Activity 9, marine debris removal, and all pertinent general PDCs.

Additional conditions for reef materials:

A7.19. Individual reef units or modules must weigh at least 500 pounds. Reef materials shall be clean and free from asphalt, petroleum, other hydrocarbons, and toxic residues, as well as loose, free-floating material, or other deleterious substances. All artificial reef materials and/or structures will be selected, designed, constructed, and deployed to create stable and durable marine habitat. Only the following reef materials may be used under this Opinion:

- A7.19.1. Prefabricated artificial reef modules composed of ferrous and/or aluminum-alloy metals, concrete, rock, or a combination of these materials.
- A7.19.2. Natural rock boulders and pre-cast concrete material, such as culverts, stormwater junction boxes, power poles, railroad ties, jersey barriers, or other similar concrete material.
- A7.19.3. Clean steel and concrete bridge or large building demolition materials such as slabs or piles with all steel reinforcement rods cut at the base of the concrete so no rebar or metal protrudes from the concrete.

A7.20. Reef structures, materials, and installation methods shall be designed and deployed to prevent entanglement and entrapment of listed species. Open-bottom pre-fabricated reef modules may not be used unles the module also has a top opening sufficiently large to allow a turtle to escape. Approved ope-bottom modules include:

- A7.20.1. Three-sided modules where each side of the tope opening is at least 36-in in length along its edge.
- A7.20.2. Four or more sided modules where each side of the top opening is at least 40-in in length along its edge.
- A7.20.3. Modules with a round opening with a diameter of at least 40-in (oval openings are not allowed unless a 40-in diameter circle space can fit within the oval).
- A7.20.4. Modules that are approved by the FWS Artificial Reef Program as being turtle friendly. FWS is currently working on developing this list.

No open-bottom modules are allowed that include additional modules, discs, or othr materials stacked or placed on or immediately adjacent to the top opening, as they may prevent turtles from easily escaping.

A7.21. This Opinion does not cover projects that use explosives to deploy reef material.

A7.22. If pile placement is required in the construction of a reef, such placement must comply with the PDCs for Activity 2, pile-supported structures, and all applicable general PDCs.

Fill to restore natural contours or improve water quality:

A7.23. Fill of scars or ruts caused by vessel groundings or similar activities must match the surrounding natural elevation.

A7.24. This Opinion covers fill of deep holes or canal bottoms that are determined to be hypoxic (i.e., that have critically low dissolved oxygen levels).

Additional PDCs for Activity 7 applicable in critical habitat:

In addition to the PDCs above, the project must be designed to meet the following PDCs if the project occurs in the critical habitat, as described below.

A7.25. Smalltooth sawfish critical habitat: Oyster reefs, living shorelines, and artificial reefs cannot be placed in waters containing the shallow, euryhaline essential feature. Fill to restore natural contours or improve water quality and seagrass restoration can occur in waters containing the shallow, euryhaline essential feature, as long as the activity meets the PDCs for Activity 7 and all pertinent general PDCs. No aquatic habitat enhancement, establishment, or restoration activities are allowed in areas identified as smalltooth sawfish limited exclusion zones (Section 2.1.1.1).

A7.26. Gulf sturgeon critical habitat: Oyster reefs, living shorelines, and seagrass restoration in Gulf sturgeon critical habitat are restricted to areas that are in water depths shallower than -6 ft (-2 m) MHW (i.e., between the shoreline and -6 ft deep). Artificial reef structures cannot be placed in Gulf sturgeon critical habitat. Fill to restore natural contours or improve water quality can occur in Gulf sturgeon critical habitat, regardless of project depth. Living shorelines, oyster reefs, and artificial reefs cannot be placed in Gulf sturgeon critical habitat migratory restriction zones, defined in Section 2.1.1.2.

A7.27. North Atlantic right whale critical habitat: All artificial reefs must meet specifications below. Oyster reefs, living shorelines, seagrass restoration, and fill to restore natural contours or improve water quality can occur in North Atlantic right whale critical habitat, as long as those activities meet the PDCs for Activity 7 and any pertinent general PDCs, as described above.

A7.27.1. No artificial reefs can be placed in water shallower than 30 ft deep

A7.27.2. The maximum reef height off the sea floor is 20 ft

A7.27.3. The maximum footprint of new reefs shall be 1 nmi^2. If a new reef is added to an existing artificial reef, the total footprint of the combined reefs must not exceed 1 nmi^2.

A7.27.4. Density of newly permitted reefs shall not exceed 2 reefs (old or new) per 10 nmi^2

A7.27.5. All effort should be made to avoid placing reef material during North Atlantic right whale calving season (November 15 through April 15). If reef material has to be placed during North Atlantic right whale calving season, then the following additional measures are required:

- The maximum speed for all vessels involved in placing the reef material is 10 knots.
- Deployments cannot be conducted at any time when lighting or weather or sea conditions (e.g., darkness, rain, fog, sea state) prevent visual monitoring of the project area.
- Deployment activities will not commence until the protected species observer reports that no marine mammals or sea turtles have been sighted for at least 60 minutes.
- Deployment activities will cease immediately if sea turtles or marine mammals are sighted within the project area.
- Deployment activities will not recommence until the protected species observer reports that no marine mammals or sea turtles have been sighted for at least 60 minutes.

A7.28. *Acropora* critical habitat: This Opinion does not cover any aquatic habitat enhancement, establishment, or restoration activities in *Acropora* critical habitat where the essential feature is present.

A7.29. Johnson's seagrass critical habitat: Living shorelines, oyster reefs, and artificial reefs cannot be placed in waters shallower than -13 ft MHW within the geographic boundaries of Johnson's seagrass critical habitat. Seagrass restoration and fill to restore natural contours or improve water quality can occur in Johnson's seagrass critical habitat regardless of depth, as long as those activities meet the PDCs for Activity 7 and any pertinent general PDCs, as described above.

A7.30. Loggerhead critical habitat: Living shorelines, oyster reefs, and artificial reefs cannot be placed in nearshore reproductive habitat of loggerhead critical habitat. Seagrass restoration and fill to restore natural contours or improve water quality can occur in nearshore reproductive habitat of loggerhead critical habitat, as long as those activities meet the PDCs for Activity 7 and any pertinent general PDCs, as described above.

A7.31. U.S. Caribbean Sea Turtle Critical Habitat (NA DPS of green, Hawksbill, and Leatherback Sea Turtle Critical Habitat): No aquatic enhancement activities (living shorelines, oyster reefs, artificial reefs, seagrass restoration, and fill to restore natural contours or improve water quality) can occur within sea turtle critical habitat in the U.S. Caribbean.

Assumptions
The USACE anticipates 267 aquatic enhancement activities meeting the requirements of this Opinion may be authorized per 5-year period. They also provided estimates for the number of each type of aquatic enhancement project and the anticipated average waterbottom area that would be impacted per project, as shown in Table 47, below. For example, living shoreline, oyster reef, and artificial reef projects place materials on the waterbottom covering these areas (e.g., living shoreline and oyster reefs cover an average of 0.25 ac of waterbottom, and artificial reefs will cover 20 ac of waterbottom). For seagrass planting and fill to restore natural contours or improve water quality, the USACE provided the estimated area to be enhanced.

Table 47. USACE's Estimated Number of Aquatic Enhancement Projects per 5-year Period and the Anticipated Impacts per Project.

Project Type	**Percent of Total Projects**	**Estimated Waterbottom Impacts Per Project (ac)**
Living shorelines and oyster reefs	65%	0.25
Seagrass planting	15%	0.25
Artificial reefs	15%	20
Fill to restore natural contours or improve water quality	5%	1.25
Total	100%	

Information regarding the types, size, and numbers of projects is then combined with the breakdown of the estimated number of projects anticipated both within and outside of critical habitat units (see Table 8) to determine the potential critical habitat effects from this category of activity.
Thus, to analyze the effects of aquatic enhancement, we looked the USACE's assumptions regarding (1) the total number of covered aquatic enhancement activities by type to be covered per 5-year period (Table 8) and the number of these that would occur in smalltooth sawfish, Gulf sturgeon, and Johnson's seagrass critical habitat (percent estimates provided by USACE in Table 47). Based on this information, we determined the potential effects to species (Table 48) and critical habitat (Table 50).

Potential Routes of Effect to Listed Species
In Section 2.2 above, we evaluated routes of effect common to the 10 categories of activities covered under this Opinion on ESA-listed species identified in Table 5. Aquatic enhancement projects would result in the following common routes of effect discussed above in the section entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion* (the numbers below correspond to the section numbers). The effects analysis for each of these routes of effects is provided in those sections:

1. Direct Physical Effects from Construction Activities

2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction
5. Limiting Species' Movement and Access to Habitat
7. Noise

In this section of the Opinion, we evaluate the potential effects to sea turtles, smalltooth sawfish, sturgeon, and whales from aquatic habitat enhancement, establishment, and restoration activities that were not considered in Section 2.2. NMFS and USACE effects determinations are summarized for this category of activity in Table 48. Sea turtles, smalltooth sawfish, sturgeon, and whales may be affected by the placement of materials. We quantified the potential extent of impacts based on (1) the assumptions, (2) the number and location of projects estimated by USACE (Table 8), and (3) the construction limitations defined by the PDCs. In Table 49, the "total waterbottom impacts" was determined by multiplying the "total number of projects" by the "estimated waterbottom impacts per project."

Table 48. USACE and NMFS Determinations of the Effects of Aquatic Enhancement, Enhancement (Activity 7) on ESA-listed Species Listed in Table 5

Listed Species	**USACE Determination**	**NMFS Determination**
Sea Turtles	NLAA	NLAA
Sawfish	NLAA	NLAA
Sturgeon	NLAA	NLAA
Whales	NE	NLAA
Effects Determinations Explained in Section 2.2		
Johnson's seagrass	NE	NE
Corals	NE	N/A
Nassau Grouper	Not provided	NLAA
NE= no effect; NLAA= may affect, not likely to adversely affect; N/A= not applicable (if a project may affect ESA-listed corals, separate consultation is required). The effects analysis for Johnson's seagrass, corals, and Nassau Grouper was provided at the beginning of Section 2.2.		

Table 49. Estimated Amount of Waterbottom Affected by Aquatic Enhancement per 5-Year Period

Project Type	Percent of Total Projects	Total Number of Projects (n= 267)	Estimated Waterbottom Affected Per Project (ac)	Total Estimated Waterbottom Affected Per Project (ac)
Living shorelines and oyster reefs	65%	173.55	0.25	43.39
Seagrass planting	15%	40.05	0.25	10.01
Artificial reefs	15%	40.05	20	801.00
Fill to restore natural contours or improve water quality	5%	13.35	1.25	16.69
Total	100%	267		871.09

Over a 5-year period, 871.09 ac of waterbottom may be affected by the aquatic enhancement activities (Table 49). This estimate includes projects in both Florida and the U.S. Caribbean. These waterbottom impacts are unlikely to be concentrated as the array of individual projects covered under this Opinion for Activity 7 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and the U.S. Caribbean).

- Sea turtles: Sea turtles may be affected by aquatic enhancement activities as these activities may remove foraging habitat (by placing structures on top of the habitat). Effects may also be beneficial, as these projects may enhance foraging or resource areas used by sea turtles.
  - Living shorelines, oyster reefs, and artificial reefs could be placed on foraging areas used by sea turtles. Seagrasses growing in nearshore waters are an important forage resource for green sea turtles. Living shoreline, oyster reefs, and nearshore artificial reef projects could be placed on of waterbottom that could contain seagrasses used by green turtles for foraging; however, under PDC AP.13, the Opinion does not apply to projects where Johnson’s seagrass is found within the project footprint and recommends that effects to non-ESA listed, native seagrasses be avoided and minimized to the extent practicable. In addition, seagrass restoration projects are allowed to place temporary exclusion cages around new seagrass transplants for a maximum of 4 months to allow the seagrass beds to become established (PDC A7.9). These cages will prevent sea turtles from foraging in this area for a short period of time. Since sea turtles can travel long distances to forage, we believe the potential loss of small areas seagrass foraging areas from the placement of materials or the temporary exclusion of areas from seagrass transplant cages, will have insignificant effects on the ability of sea turtles to forage.
  - Living shoreline, oyster reef, and artificial reef projects may cover or remove areas that may support sea turtle prey species, including the crustaceans and mollusks that serve as

prey for loggerhead and the fish, jellyfish, shrimp, and mollusks that serve as prey for Kemp's ridley sea turtles. These foraging areas are common throughout Florida and the U.S. Caribbean. Since sea turtles can travel long distances to forage, we believe the potential loss of these foraging areas will have insignificant effects on the ability of sea turtles to forage.

- Seagrass restoration in areas in up to 10.01 ac of waterbottom has the potential to increase foraging habitat for green sea turtles. In addition, the filling deep holes to restore natural contours or to improve low water quality in up to 16.69 ac of waterbottom also has the potential to increase foraging areas by returning low quality waterbottom areas to the natural habitat that could recruit foraging resources such as (1) seagrasses used by green sea turtles; (2) crustaceans or mollusks that serve as prey for loggerhead; or (3) fish, jellyfish, shrimp, and mollusks that serve as prey for Kemp's ridley sea turtles.
- Limestone outcroppings and worm-rock reefs that are important developmental habitat for juvenile green turtles; however we believe there will no effect to this foraging habitat since, under PDC AP.14, this Opinion does not apply to projects where hardbottom is found within the footprint.
- Hawksbill sea turtles are most commonly associated with reef habitat and feed on sponges, algae, and other invertebrates, which may be found in the waterbottoms affected by Activity 7. PDC AP.14 also limits this Opinion to projects that do not directly or indirectly affect ESA-listed corals, and excludes projects if non-listed corals and hardbottom habitats, which support sponges, algae, and other forage resources for hawksbill sea turtles, are within the project footprint. Activity 7 also allows the installation of artificial reefs and living shorelines on the waterbottom. The installation of these materials may enhance the areas that provide foraging habitat for hawksbills.

The array of individual projects covered under this Opinion for Activity 7 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and the U.S. Caribbean), and sea turtles can forage in nearby areas outside of active project sites. Given the above, effect to sea turtles from interactions with foraging resources is insignificant or beneficial.

Sea turtles can become trapped in certain artificial reef structures. It is possible for a sea turtle to position itself under the edge of open-bottom reef structures and then become wedged or trapped inside the reef material when trying to extract itself. PDC A7.20 requires that reef structures, materials, and installation methods be designed and deployed to prevent entanglement and entrapment of listed species and specifically prohibits the use of open-bottom structures, unless the structure has at least a 4-ft opening at the top of the structure for turtles to escape (an example of an open top and bottom tetrahedron structure is shown in the left side of Figure 21 above). Based on these requirements, entrapment from artificial reefs is extremely unlikely to occur and thus the effect on sea turtles from potential entrapment is considered discountable.

Sea turtles can become entangled in fishing debris that accumulates on artificial reefs. In order to minimize the risk of fishing debris (e.g., broken fishing line and fishing gear), the

PDCs require underwater cleanup efforts annually at all artificial reefs (PDC A7.18). By regularly removing debris, we believe the risk of entanglement with sea turtles in discountable.

In total, based on the routes of effect analyzed here and in Section 2.2, we determined that aquatic restoration activities under Activity 7 are not likely to adversely affect sea turtles.

- Smalltooth sawfish: Smalltooth sawfish may be affected by oyster reef and living shoreline projects, which will be placed on 43.39 ac waterbottom, areas that the species may have used for foraging and refuge. As is noted above, this estimate includes projects in Florida and the U.S. Caribbean, but sawfish would only be affected by projects occurring in Florida. However, we believe the effect on sawfish from the potential loss of nearshore foraging and refuge habitat is insignificant.
  - For the first several years of their lives, juvenile smalltooth sawfish exhibit site fidelity to the areas in which they are pupped, typically in very shallow, nearshore waters where they can avoid predation by coastal shark species. In South Florida, sawfish have established distinct nursery areas where they utilize shallow, euryhaline waters and red mangroves for forage and refuge; these areas have been designated as critical habitat for the species. Projects must be sited to avoid and minimize impacts to mangroves, and mangrove removal for projects is strictly limited by PDCs AP.12 to removal related to other covered activities and to removal above the MHWL provided that red mangrove prop roots that are accessible to marine species are not removed. PDC A7.25 prohibits the placement of oyster reefs, living shorelines, and artificial reefs in areas where the shallow, euryhaline essential feature of smalltooth sawfish critical habitat is present, and prohibits activities in areas identified as smalltooth sawfish limited exclusion zones. During construction, smalltooth sawfish can use surrounding areas for forage and refuge and we expect them to return. Therefore, we believe the effect on sawfish of the potential loss of nearshore foraging and refuge habitat is insignificant.
  - The installation of artificial reefs also will cover areas of waterbottom. In particular, we anticipate that artificial reefs will impact 801 ac of waterbottom. However, because artificial reefs are typically placed in deeper waters than those used by juvenile smalltooth sawfish, none of these projects are expected to have effects to foraging or refuge habitat.

  Seagrass restoration and the filling of scars and holes to return the area to natural contours and to improve water quality are allowed in shallow, euryhaline waters, but we do not expect such activities to affect how sawfish use these areas once construction is complete.

  Smalltooth sawfish could become entangled in the cages placed around seagrass restoration areas. To minimize this risk, PDC A7.9 requires that these exclusion cages be securely fastened and made of firm, taut materials and cannot include any loose mesh, thin twistable wire, or rope that could twist or become entangled. The placement of cages is also limited to a maximum of 4 months (PDC A7.9). No aquatic restoration activities, including the seagrass restoration projects for which cages might be used, can be placed in smalltooth sawfish limited exclusion zones, as these areas may be used more frequently for sawfish pupping (PDC A7.25). Based on these PDCs, we believe it is extremely unlikely that the placement of these cages will affect smalltooth sawfish, and thus the effect on the species from the cages is discountable.

The array of individual projects covered under this Opinion for Activity 7 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida). Based on the routes of effect analyzed here and in Section 2.2, we determined that aquatic restoration activities under Activity 7 are not likely to adversely affect smalltooth sawfish.

- Sturgeon: Sturgeon may be affected by projects placed on the waterbottom that they may have used for foraging habitat. In addition, installing living shorelines and nearshore oyster reefs and restoring holes to natural contours may benefit Gulf sturgeon by increasing foraging areas.
  - Living shorelines, oyster reefs, artificial reefs, and seagrass restoration may cover and bury bottom substrates containing sturgeon prey species, such as benthic worms and insects, as well as crustaceans and mollusks. However, sturgeon are opportunistic feeders that forage over large areas. Gulf sturgeon select foraging habitat based on substrate composition and depth, rather than prey density, abundance, or diversity. During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5 and 13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Within Gulf sturgeon critical habitat, we do expect Gulf sturgeon to be affected by these projects since PDC A7.26 limits living shorelines, oyster reefs, and seagrass restoration projects in these areas to waters shallower than -6 ft (-2 m) MHW. In addition, PDC A7.26 prohibits artificial reef structures within the geographic boundary of Gulf sturgeon critical habitat since these projects often occupy large areas and would potentially remove large areas of Gulf sturgeon foraging habitat. Outside of Gulf sturgeon critical habitat, we expect effects to all sturgeon (Gulf, shortnose, and Atlantic) to be insignificant. As is noted above, sturgeon are opportunistic feeders and we expect they will be able to use other areas for foraging as the projects will be separated spatially (throughout Florida) and temporally (over a 5-year period). Thus, we believe the effect on sturgeon from the potential loss of nearshore foraging habitat is insignificant.
  - In addition, installing living shorelines and nearshore oyster reefs may provide an indirect benefit to Gulf sturgeon by enhancing the diversity of prey available to them. This may happen by the creation of a patchwork of oyster reefs that, over time, provide more diverse and structurally complex habitat for prey species (Boudreaux et al. 2006). As these prey species (e.g., macrofaunal species such as amphipods, polychaetes, gastropods, and bivalves) increase in abundance in the shallow nearshore project area, there will be a spill-over effect to neighboring areas that are deeper than 6 ft, where increased prey abundance will benefit Gulf sturgeon that may forage in those waters in the long-term. The use of oyster reefs as breakwaters to mitigate against coastal erosion also encourages nektonic production that could lead to greater prey availability in the immediate surroundings for Gulf sturgeon (Seitz et al. 2006).
  - The filling deep holes with low water quality in up to 16.69 ac of waterbottom also has the potential to increase foraging areas by returning low quality waterbottom areas to the natural habitat that could recruit Gulf sturgeon prey species.

Based on the routes of effect analyzed here and in Section 2.2, we determined that aquatic restoration activities under Activity 7 are not likely to adversely affect sturgeon.

- Whales: Whales may be affected by the placement of 801 ac of artificial reefs in waters deep enough to be accessible to whale species, though not all 801 ac of artificial reef material will be placed in waters accessible to whales. Whales may have used these waters as a migratory pathway and as calving areas. North Atlantic right whales frequently come much closer to shore than other whale species, where the water is shallower. In North Atlantic right whale critical habitat, under PDC A7.27, artificial reef materials cannot be placed in waters shallower than 30 ft deep and cannot extend more than 20 ft off the sea floor. In addition, under the same PDC, the density of artificial reefs in North Atlantic right whale critical habitat is limited to no more than 2 reefs (including the new reef and any existing reefs) measuring 1 nmi^2 per 10 nmi^2 area (PDC A7.27). By limiting the vertical height of reef materials to 20 ft, and limiting reef placement in shallow waters (waters shallower than 30 ft deep), we believe that artificial reef will not create an obstacle for migration and movement within calving areas for North Atlantic right whales in their critical habitat. Outside of North Atlantic right whale critical habitat, the PDCs also limit the density of material placement to 1 reef section measuring ¼- by ¼-nmi area (40 ac) in size within a distance of 500 ft between each section, and states that offshore reefs shall maintain a minimum vertical clearance of twice the height of the structure from the top of the deployed material relative to the MLW at all times (PDC A7.14). These density limitations allow whales to easily move over and around these reefs and ensure that the reefs do not dramatically change the landscape in this habitat. Based on these restrictions, we believe that the change in depth and restrictions or limitations on species movement from the placement of materials will be so minimal that it will have insignificant effects on ESA-listed whales using the area for foraging or migrating.

Potential Routes of Effect to Critical Habitat

In this section of the Opinion, we evaluate the potential effects to smalltooth sawfish critical habitat, Gulf sturgeon critical habitat, and Johnson's seagrass critical habitat from aquatic enhancement activities and to North Atlantic right whale critical habitat from the placement of artificial reefs. NMFS and USACE's effects determinations for this category of activity are summarized in Table 50 and the estimated impacts to each critical habitat unit are summarized in Table 51. In these tables, N/A denotes activities that are not allowed in a particular critical habitat unit based on the PDCs of this Opinion, as described below.

Table 50. USACE and NMFS Determinations on the Effects of Aquatic Enhancement (Activity 7) to Designated Critical Habitat

<table>
<tr><th></th><th colspan="3">USACE Determinations</th><th colspan="3">NMFS Determinations</th></tr>
<tr><th>Project Type</th><th>Sawfish Critical Habitat</th><th>Gulf sturgeon Critical Habitat</th><th>Johnson’s seagrass Critical Habitat</th><th>Sawfish Critical Habitat</th><th>Gulf sturgeon Critical Habitat</th><th>Johnson’s seagrass Critical Habitat</th></tr>
<tr><td>Living shoreline and oyster reefs</td><td rowspan="4">NE</td><td rowspan="4">NE</td><td rowspan="4">NE</td><td>NE</td><td>NLAA</td><td>NE</td></tr>
<tr><td>Seagrass restoration</td><td>NE</td><td>NLAA</td><td>NLAA</td></tr>
<tr><td>Artificial reefs</td><td>NE</td><td>N/A[27]</td><td>NE</td></tr>
<tr><td>Fill to restore natural contours or improve water quality</td><td>NE</td><td>NLAA</td><td>NE</td></tr>
<tr><td colspan="7">Effects Determinations Explained in Section 2.2</td></tr>
</table>

	USACE Determinations	NMFS Determinations
Loggerhead critical habitat	NE	NE
Acropora critical habitat	NE	NE
North Atlantic right whale critical habitat	NE	NE for oyster reefs, living shorelines, seagrass restoration, and fill to restore natural contours or water quality NLAA for artificial reefs, as discussed below
Atlantic sturgeon critical habitat	Not provided	NE
The effects analysis for loggerhead, *Acropora*, North Atlantic right whale, and Atlantic sturgeon critical habitat was provided at the beginning of Section 2.2.		

[27] Under PDC A7.26, artificial reef structures cannot be placed in Gulf sturgeon critical habitat.

Since we do not know how many of each of these aquatic restoration methods will occur in or may affect each critical habitat unit, we based the calculations in Table 51 on the following assumptions:

Fill to restore natural contour or improve water quality: Since projects involving filling areas to restore the natural contour or to improve water quality are expected to be rare, the USACE estimates that these projects will not exceed 5% of all projects in critical habitat, and we assume each such project will affect 1.25 ac of waterbottom. Thus, we assumed that fill to restore the natural contour = (number of projects per critical habitat unit x 5% for fill projects) x 1.25 ac of impact per project.

Artificial reefs: Under the PDCs, artificial reefs cannot be placed in the critical habitat units (A7.26-Gulf sturgeon critical habitat) or in areas that support the essential features of critical habitat (A7.25-smalltooth sawfish critical habitat, see also PDC AP.12 regarding impacts to mangroves; A7.29-Johnson's seagrass critical habitat[28]), with the exception of North Atlantic right whale critical habitat. Therefore, we believe that artificial reefs either will not occur in or will not affect these critical habitat units. The effects of artificial reefs on North Atlantic right whale critical habitat are discussed in a separate section below.

Living shoreline and oyster reefs, and seagrass restoration: Since we know 5% of the projects occurring in critical habitat will be fill projects, and we know that no artificial reef projects will occur in designated critical habitat or in areas where they can affect the essential features of critical habitat, we can assume that the 95% of projects in areas supporting the essential features of critical habitat will be a combination of (1) living shoreline and oyster reef projects and (2) seagrass restoration projects, each of which result in an average of 0.25 ac of impact per project. Hence, we can calculate the estimated impacts these projects combined to determine the potential extent of impacts, as follows: Living shoreline and oyster reefs, and seagrass restoration = (number of projects per critical habitat unit x 95% living shoreline and oyster reefs, and seagrass restoration projects) x 0.25 ac of impact per project.

However, in certain circumstances, living shoreline and oyster reef projects cannot be placed in areas that support the essential features of critical habitat (A7.25-smalltooth sawfish critical habitat, see also PDC AP.12 regarding impacts to mangroves; A7.29-Johnson's seagrass critical habitat), (shown as N/A in Table 51 below). In those instances, we will assume that the remaining 95% of projects occurring in areas supporting the essential features of critical habitat are seagrass restoration projects and attribute impacts to those projects.

[28] Under this PDC, artificial reefs cannot be placed in waters shallower than -13 ft MHW within the geographic boundaries of Johnson's seagrass critical habitat. We believe areas deeper than -13 ft MHW do not support enough light transmittance to function as critical habitat.

Table 51. Maximum Area Supporting the Essential Features of Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat that May Be Affected by Aquatic Restoration Projects per 5-Year Period

Type of Dredging	Percent of Projects	Total Number of Projects per Critical Habitat	Estimated Average Area Supporting Essential Features Affected Per Project (ac)	Estimated Total Area Supporting Essential Features Affected (ac)
Smalltooth sawfish critical habitat (n = 46)				
Living shorelines and oyster reefs	0[29]	N/A	N/A	0.00
Seagrass restoration	95%	43.70	0.25	10.93
Artificial Reefs	0[30]	N/A	N/A	0.00
Fill to restore natural contours or improve water quality	5%	2.30	1.25	2.88
Total		46		13.81
Gulf sturgeon critical habitat (n = 91)				
Living shorelines and oyster reefs and seagrass restoration	95%	86.45	0.25	21.61
Artificial Reefs	0[31]	N/A	N/A	0.00
Fill to restore natural contours or improve water quality	5%	4.55	1.25	5.69
Total		91		27.31
Johnson's seagrass critical habitat (n = 7)				
Living shorelines and oyster reefs	0[32]	N/A	N/A	0.00
Seagrass restoration	95%	6.65	0.25	1.66
Artificial Reefs	0[33]	N/A	N/A	0.00
Fill to restore natural contours or improve water quality	5%	0.35	1.25	0.44
Total		7		2.10

[29] Under PDC A7.25, living shorelines and oyster reefs cannot be placed in waters containing the shallow, euryhaline essential feature, and, under PDC AP.12, the Opinion does not apply to any such projects requiring removal of red mangroves, so we do not expect these projects to be in areas where they will affect the essential features of smalltooth sawfish critical habitat.
[30] Under PDC A7.25, artificial reefs cannot be placed in waters containing the shallow, euryhaline essential feature, and, under PDC AP.12, the Opinion does not apply to any such projects requiring removal of red mangroves, so we do not expect these projects to be in areas where they will affect the essential features of smalltooth sawfish critical habitat.
[31] Under PDC A7.26, artificial reefs cannot be placed in Gulf sturgeon critical habitat.
[32] Under PDC A7.29, living shorelines and oyster reefs cannot be placed in waters shallower than -13 ft MHW within the geographic boundaries of Johnson's seagrass critical habitat, and we think waters deeper than -13 ft MHW do not support the essential features of critical habitat.
[33] Under PDC A7.29, artificial reefs cannot be placed in waters shallower than -13 ft MHW within the geographic boundaries of Johnson's seagrass critical habitat, and we think waters deeper than -13 ft MHW do not support the essential features of critical habitat.

Potential Routes of Effect to Smalltooth Sawfish Critical Habitat

We believe that aquatic enhancement projects will have no effect on the essential features of smalltooth sawfish critical habitat. USACE anticipates that 46 aquatic enhancement activities meeting the requirements of this Opinion may be authorized per 5-year period in smalltooth sawfish critical habitat. Mangroves are 1 of the essential features of smalltooth sawfish critical habitat, and PDC AP.12 does not allow removal of mangroves for these projects. Shallow, euryhaline water is the other essential feature of smalltooth sawfish critical habitat. As explained above, only seagrass restoration and fill to restore natural contours can occur in shallow, euryhaline habitat (PDC A7.25) and none of the activities can remove mangroves (PDC AP.12). Combined, seagrass restoration and fill to restore natural contours are expected to result 13.81 ac of impacts. Although we expect the seagrass restoration projects to affect 10.93 ac of waterbottom, we do not expect seagrass restoration to have any effect on the shallow, euryhaline essential feature since restoring seagrasses does not affect the depth or salinity of the water. In addition, we do not expect the 2.88 ac of restoration fill projects to have an effect on the shallow, euryhaline water essential feature. Filling in areas to restore their natural contour or to improve water quality returns the area to its natural depth contour. This actually could decrease project area depths (i.e., filling in deeper areas reduces the water depth). Thus, filling in the areas would not increase the depth of the water beyond the -3 ft MLLW essential feature depth. Therefore, no effects to the essential features are expected from any of these aquatic enhancement activities.

Potential Routes of Effect to Gulf Sturgeon Critical Habitat

We believe that aquatic enhancement projects may affect, but are not likely to adversely affect Gulf sturgeon critical habitat. USACE anticipates that 91 aquatic enhancement activities meeting the requirements of this Opinion may be authorized per 5-year period in Gulf sturgeon critical habitat. As explained above, given the PDC limitations, we assume that 5% of these projects will be activities to fill in areas to the natural depth contour or to improve water quality and the remaining 95% will be some combination of living shoreline/oyster reefs and seagrass restoration (PDC A7.26 prohibits artificial reef projects within the boundaries of Gulf sturgeon critical habitat). These nearshore aquatic enhancement projects (living shorelines and oyster reefs, seagrass restoration, fill in areas to the natural depth contour or fill in areas to restore water quality with low water quality area) could impact 27.31 ac of waterbottom in Gulf sturgeon critical habitat over a 5-year period. Although we do not know to what extent these areas contain the PCEs of Gulf sturgeon critical habitat, we evaluate the potential effects to the PCEs below assuming these areas contain the first 3 PCEs (abundant prey items, water quality, sediment quality), and evaluate the effect to the fourth PCE (safe and unobstructed migratory pathways) based on best assumptions below.

1. Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages. We believe that living shorelines and oyster reefs, seagrass restoration, and placing fill to return areas to the natural contour or to improve water quality may cover and bury bottom substrates containing sturgeon prey species; however, the effects to this PCE will be insignificant. Restoration activities that fill in areas to the natural depth contour or fill in areas to restore water quality with low water quality would not affect the prey abundance PCE of Gulf sturgeon critical habitat as the areas being filled would not support prey abundance. Thus, only 21.61 ac of impacts associated with living shorelines

and oyster reefs, and seagrass restoration could affect the prey abundance PCE. We believe the effects to this PCE will be insignificant since the estimated 21.61 ac of impact is very small compared to the approximately1.5 million ac of available marine and estuarine critical habitat that we believe support sturgeon prey species.

Further, not all of the 21.61 ac impacted will support prey items or serve as preferred foraging habitat. PDC A7.26 restricts living shorelines and oyster reefs as well as and seagrass restoration to areas where water depths are shallower than -6 ft (-2 m) MHW. Gulf sturgeon are suction feeders that tend to forage in calm marine and estuarine waters that support their macroinvertebrate prey including brachiopods, mollusks, worms, and crustaceans (Mason and Clugston 1993). During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002), beyond the depth limit placed on these activities. Thus, although these activities may occur within Gulf sturgeon critical habitat, not all such projects will occur in the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

In addition, installing living shorelines and nearshore oyster reefs may provide an indirect benefit to this PCE by enhancing the number and diversity of prey available to them. This may happen by the creation of a patchwork of oyster reefs that, over time, provide more diverse and structurally complex habitat for prey species (Boudreaux et al. 2006). In addition, as these prey species (e.g., macrofaunal species such as amphipods, polychaetes, gastropods, and bivalves) increase in abundance in the shallow nearshore project area, there will be a spill-over effect to neighboring areas that are deeper than 6 ft, where increased prey abundance will benefit Gulf sturgeon that may forage in those waters in the long-term. The use of oyster reefs as breakwaters to mitigate against coastal erosion also encourages nektonic production that could lead to greater prey availability in the immediate surroundings for Gulf sturgeon (Seitz et al. 2006).

2. <u>Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages.</u> Living shorelines and oyster reefs, seagrass restoration, and placing fill to return areas to the natural contour or to improve water quality may generate turbidity that could cause localized and temporary reductions in water quality; however, we believe the effects to this PCE will be insignificant. Restoration activities that fill in areas to the natural depth contour or fill in areas to restore water quality with low water quality would not affect the water quality PCE of Gulf sturgeon critical habitat as these areas would not support water quality. Thus, only 21.61 ac of impacts associated with living shorelines and oyster reefs, and seagrass restoration could affect the water quality PCE, and we expect effects to this PCE from turbidity to be insignificant. PDC AP.10 of the PDCs for *In-Water Activities* requires monitoring and controlling turbidity throughout the duration of all projects. Turbidity curtains will be required for most projects. When the curtains are deployed, turbidity will be contained within the active portion of the project site, and thus we expect any small amounts of turbidity that may escape to have an insignificant effect on water quality. In a few instances, the USACE project manager has the ability to waive the turbidity curtain requirement as described in PDC AP.10. These instances include projects that are so

small that turbidity is expected to be minimal, such as the placement of a single pile, placement of a scientific survey device, or removal of marine debris. Another instance where turbidity curtains may not be used is in areas with high wave energy where securing turbidity curtains would not be feasible, thereby potentially increasing the risk of them becoming loose and entangling animals or damaging nearby habitat. In high energy areas, turbidity would dissipate quickly and would therefore not be a problem. In both of the instances where turbidity curtains will not be used (i.e., for projects that are so small turbidity is expected to be minimal and for high energy areas where turbidity will dissipate very quickly), and thus the effects from turbidity on water quality would be insignificant.

3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages. Living shorelines and oyster reefs, seagrass restoration, and placing fill to return areas to the natural contour or to improve water quality may cover and bury nearshore bottom substrates and affect sediment quality. Restoration activities that fill in areas to the natural depth contour or fill in areas to restore water quality with low water quality would not affect the sediment quality PCE of Gulf sturgeon critical habitat as these areas would not support sediment quality. Thus, only 21.61 ac associated with living shorelines and oyster reefs, and seagrass restoration could affect the sediment quality PCE and we expect effects to this PCE to be insignificant since the estimated 21.61 ac of impact is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat with sediments that we believe support sturgeon prey species. Further, not all of the 21.61 ac of habitat affected by living shorelines and oyster reefs, and seagrass restoration are expected to have the sediment quality needed to support Gulf sturgeon prey or serve as preferred foraging habitat. PDC A7.26 restricts living shorelines and oyster reefs as well as seagrass restoration to areas that are in water depths shallower than -6 ft (-2 m) MHW. During foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002), in areas deeper than these materials are allowed to be placed. Thus, although these activities may occur within Gulf sturgeon critical habitat, not all such projects will occur in the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats. Living shorelines and oyster reefs, seagrass restoration, and placing fill to return areas to the natural contour or to improve water quality could obstruct migratory pathways for spawning if they blocked areas between estuaries and rivers. Migratory pathways could also be obstructed by the placement of materials in Gulf sturgeon critical habitat if they prevented movement within estuarine and marine areas used for foraging; however, we believe there will be no effect to this PCE. The mouth of Gulf sturgeon spawning rivers and narrow inlets are identified in Section 2.1.1.2 as Gulf sturgeon critical habitat migratory restriction zones. To prevent Gulf sturgeon from being deterred from entering or exiting a spawning river, PDC A7.26 limits activities in Gulf sturgeon critical habitat and states that no aquatic enhancement activities can occur in the Gulf sturgeon critical habitat migratory restriction zones. We believe that the placement of living shorelines and oyster reefs placed parallel with the shore will not affect migration of sturgeon, as they will create no impediment to the species passing along the shore.

Additionally, the PDCs require that living shorelines and oyster reefs provide a break in the reef to allow for movement of species (A7.6). Seagrass restoration and restoring areas by filling holes to the natural depth contour would not create obstacles to migration. Therefore, we believe aquatic restoration activities will have no effect on the migratory pathway PCE.

Because the effects to the PCEs of abundant prey items, water quality, and sediment quality will be insignificant and there will be no effect to safe and unobstructed migratory pathways, we believe that shoreline stabilization activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat.

Potential Routes of Effect to Johnson's Seagrass Critical Habitat

As we explained above, we expect 5% of the projects occurring in areas supporting the essential features of Johnson's seagrass critical habitat to be fill projects to restore natural contours or improve water quality and 95% to be seagrass restoration. We believe there will be no effect from fill projects to restore natural contours or improve water quality on Johnson's seagrass critical habitat. We also believe that seagrass restoration may affect, but is not likely to adversely affect, Johnson's seagrass critical habitat.

As stated above, living shorelines, oyster reefs, and artificial reefs cannot be placed in waters shallower than -13 ft MHW within the geographic boundaries of Johnson's seagrass critical habitat (PDC A7.29). Studies show that Johnson's seagrass occurs in waters shallower than 10-13 ft (3-4 m) (NMFS 2007a). Water depths greater than 13 ft are not believed to provide the water transparency necessary for enough sunlight to reach the sea floor to support Johnson's seagrass growth. Therefore, living shorelines and oyster reefs, and artificial reefs will occur in areas that do not support 1 of the essential features of Johnson's seagrass critical habitat (water transparency for enough sunlight to reach the seafloor for Johnson's seagrass growth), and when 1 of the features is affected, the area ceases to function as critical habitat. For this reason, in Table 50 above, we did not assume that any of these projects would affect Johnson's seagrass critical habitat.

Fill to restore natural contours or improve water quality is allowed in Johnson's seagrass critical habitat and could result in impacts to 0.44 ac of critical habitat (Table 51). These areas are typically either (1) filled during seagrass restoration to restore the appropriate depth to support seagrasses or (2) involve filling holes or depressions often resulting from dredging that result in reduced water quality. The deep holes often have an accumulation of nutrients and chemicals that are harmful to seagrasses in the area if the area of low water quality is stirred up and distributed from events like hurricanes. By filling these areas with clean fill, it prevents potential seagrass die offs in the area and can restore areas that may then be able to support future seagrass recruitment. The areas to be filled would not be considered critical habitat since they would be unable to support seagrasses and therefore lack the essential features of Johnson's seagrass, including water quality. We believe this activity would have no effect on Johnson's seagrass critical habitat.

Seagrass restoration is allowed within Johnson's seagrass critical habitat and could result in impacts to 1.66 ac of critical habitat (Table 51). The water transparency essential feature of Johnson's seagrass critical habitat may be affected from the temporary turbidity that may occur during seagrass restoration and filling activities. We believe that this effect will be temporary (likely 1 day or 2) and that turbidity will settle out quickly. Thus, we believe the effect on the critical habitat from turbidity will be insignificant. Restoration of an area to support seagrasses, including filling blow holes and leveling sediments to the surrounding elevation, may have a beneficial effect on Johnson's seagrass by providing additional area for the species to recruit to These benefits are not certain, and depend on the proximity of the species to the restored area. Restoration of areas within Johnson's seagrass critical habitat will have an insignificant effect on the essential features of critical habitat since restoring areas to be able to support seagrasses will not preclude Johnson's seagrass from recruiting into the newly restored areas, and will not affect the functionality of critical habitat.

Potential Routes of Effects to North Atlantic Right Whale Critical Habitat
We believe that aquatic enhancement activities may affect, but are not likely to adversely affect North Atlantic right whale critical habitat. The placement of artificial reefs in North Atlantic right whale critical habitat has the potential to affect both North Atlantic right whales and the essential features of their critical habitat. PDC A7.27 requires that materials be limited to placement in waters deeper than 30 ft deep, that materials not extend more than 20 ft off the sea floor, and that the density of materials in an area be limited to no more than 2 reefs per 10 nmi^2 area. Also any new reefs shall be limited to 1 nmi^2 in total size (PDC A7.27.3). In addition, if a new reef is added to an existing artificial reef, the total footprint of the combined reefs must not exceed 1 nmi^2. The water depth essential feature includes areas -20-92 ft deep that are "selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves." By limiting the vertical height of reef materials to 20 ft, we believe that this will not create an obstacle to whales. The PDCs also limit the density of material placement in an area to be no more than 2 reefs per 10 nmi^2 (PDC A7.27.4) so that whales can easily move over and around these reefs without dramatically changing the landscape in this habitat. Based on these restrictions, we believe that the change in depth and placement of materials will be so minimal that it will have insignificant effects to North Atlantic right whales using the area and an insignificant effect to the essential features of critical habitat.

2.2.8 Activity 8 (A8): Transmission and Utility Lines

General Description
This category of activity includes the installation, repair (including all forms of maintenance), replacement, and removal of transmission and utility lines including aerial and subaqueous lines. Aerial transmission or utility lines are typically placed over smaller water bodies with the support piles or structures positioned on the uplands. When crossing larger bodies of water, support structures are placed in the water at set intervals. Support structures can reach approximately 1,500 ft^2 in size; however, such large structures are rare. Each support is typically constructed quickly (e.g., less than a day for a pile to a few weeks for larger footings). The specific requirements for size and placement are described in the PDCs below.

Subaqueous transmission or utility lines are installed on top of or under the bottom sediment. The same methods used to install new subaqueous transmission and utility lines often are used during repair/replacement activities because during repair/replacement, existing buried lines often are left in place and a new line or section of a line is installed alongside or on top of the existing line.

The placement of subaqueous transmission or utility lines under the bottom sediments can be accomplished by temporarily trenching the location for the line, placing the line, and backfilling the trench using barge-mounted equipment. The trench in which the line is buried can be created by sidecasting materials temporarily outside of the trench and then refilling it over the buried line. Other equipment and methods are being developed to expedite this process including the use of a jet plow. This machine simultaneously jets a trench, lays the cable, and backfills it as moves forward along the line path. When repairing or replacing subaqueous utility or transmission lines, riprap or concrete materials may be used to stabilize the line. These materials may also be used to stabilize new lines placed in high erosion areas.

Another option to place subaqueous transmission or utility lines under the bottom sediments is to use horizontal directional drilling. This method restricts all construction equipment work to uplands or within an area that is dewatered and contained in a cofferdam. The drill is set and bores a hole under the waterbody. Once the drill reaches the other side of the waterbody, it is attached to the line or pipe to be installed, and the new line is pulled back through the drilled hole with the drill as it is removed. Typically, the entire fused length of new line is pulled at one time with no interruptions. The horizontal directional drilling process requires the use of drilling fluid/mud (i.e., bentonite) to act as a lubricant and sealant. The drilling fluid is composed of naturally occurring bentonite clay and water. The drilling mud pressure and volume are monitored during drilling operations to assure there are no leakages due to fractures in the structure of the material being drilled through. If a fracture is present, it is possible for drilling mud to escape onto the surface or into the water. This rare event is called a "frac-out." An example Frac-out Contingency Plan is located in Appendix D. Below is a sample image of how directional drilling is performed (Figure 22).

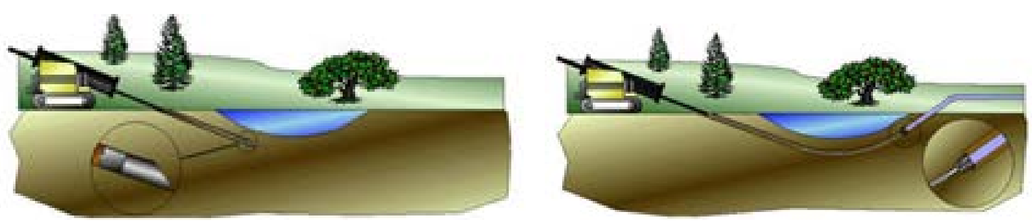

Figure 22. Sample image of horizontal directional drilling (Image from Underground Solutions at http://www.undergroundsolutions.com)

Project Design Criteria

PDCs specific to Activity 8 for Transmission and Utility Line Activities:	
A8.1.	Activity 8 includes the installation, repair, replacement, and removal of support structures, footers, foundations, as well as the placement of riprap or concrete mat for pipeline protection. The USACE defines a "utility/transmission line" as any pipe or pipeline for the transportation of any gaseous, liquid, liquescent, or slurry substance, for any purpose, and any cable, line, wire or optical fiber for the transmission for any purpose of electrical energy, telephone, telegraph messages, digital signal, Internet, and radio or television communication.

A8.2. Structures permanently placed on the waterbottom (e.g., foundations, piles, and footings) to support aerial transmission lines must total less than a 0.5 ac for all structures combined. Because permanent structures have the potential to interfere with or impede sea turtles from entering or exiting the beach, they cannot be placed on or near beaches used for sea turtle nesting.

A8.3. Subaqueous utility and transmission lines may be installed (including as part of a repair/replacement project) using horizontal directional drilling, if the drilling originates and terminates on the uplands (i.e., no in-water work). For subaqueous transmission lines installed, repaired, or replaced using horizontal directional drilling, the applicant must provide and follow a frac-out contingency plan in Appendix D or another plan with at a minimum the same level of information as is provided in the plan contained in Appendix D.

A8.4. Subaqueous utility and transmission lines may be installed (including as part of a repair/replacement project) by trenching. When excavating the trench, the bottom sediments may be temporarily sidecast into areas devoid of submerged aquatic vegetation and mangroves. Immediately upon completing the excavation and placing the transmission or utility line into the trench, the trench must be filled and the bottom contours must be restored to pre-construction conditions. The District Engineer may allow the trench to remain open and temporary sidecasting to continue after the excavation is complete, as long as the total time the trench is open and the material is sidecast during and after excavation does not exceed 180 days.

A8.5. New subaqueous transmission and utility lines shall not be placed on the sea floor (i.e., pinned or anchored and not buried) under this Opinion. Sections of existing buried lines may be repaired or replaced above the sea floor by pinning or anchoring the new section of line in place to ensure that it does not move and damage surrounding seagrasses, hardbottom, coral, or coral reef habitat.

A8.6. When repairing existing transmission or utility lines, riprap and articulated mats may be placed on subaqueous lines that are buried in trenches or on lines that are attached to the sea floor (in accordance with A8.5) to stabilize the line. Riprap and articulated mats may also be used to stabilize new subaqueous lines placed in high erosion areas. These stabilization materials are limited to the minimum amount necessary to stabilize and protect the lines existing lines (which may have been exposed by scouring) and cannot be placed on seagrasses, hardbottom, corals, or coral reef habitat.

Additional PDCs for Activity 8 applicable in critical habitat:

In addition to the PDCs above, the project must be designed to meet the following PDCs if the project occurs in the critical habitat, as described below.

A8.7. *Acropora* critical habitat: This Opinion does not apply to the new installation of transmission and utility lines within the geographic boundary of *Acropora* critical habitat. This Opinion covers the repair and replacement of transmission and utility lines in *Acropora* critical habitat, but only if the essential feature is not present, and only if the placement meets the measures described in PDC A8.5 to limit movement of the lines.

A8.8. Smalltooth sawfish critical habitat: Structures supporting aerial transmission or utility lines, such as foundation towers and transmission line poles, cannot be placed in smalltooth sawfish critical habitat in areas where the essential features are present. Transmission or utility line projects are not allowed in areas identified as smalltooth sawfish limited exclusion zones, as defined in Section 2.1.1.1, above.

A8.9. Johnson's seagrass critical habitat: All newly installed subaqueous transmission or utility lines must be placed using horizontal directional drilling from the uplands. Repair and replacement of existing subaqueous lines, whether the existing lines are buried within trenches or placed on the sea floor outside of trenches, is allowed in the same footprint as the existing line. Structures supporting aerial transmission or utility lines, such as foundation towers and transmission line poles, cannot be placed in Johnson's seagrass critical habitat in waters shallower than -13 ft deep.

A8.10. Gulf sturgeon: No new transmission and utility line activities installation are allowed in the Gulf sturgeon critical habitat migratory restriction zones (defined in Section 2.1.1.2) between September and March, when sturgeon are likely to be present in these areas. Repair/replacement activities may occur in Gulf sturgeon critical habitat migratory restriction zones at any time of year as long as the repair or replacement is accomplished without the use of heavy in-water equipment (i.e., if the repair or replacement does not require trenching). Additional noise restrictions are required for pile and sheet pile installation in the Gulf sturgeon critical habitat migratory restriction zones defined in Section 2.1.1.2.

A8.11. U.S. Caribbean sea turtle critical habitat (hawksbill, leatherback, and the NA DPS of green sea turtle critical habitat): Under this Opinion, the only transmission and utility line projects that can occur in U.S. Caribbean sea turtle critical habitat are repair and replacement projects

Assumptions
The USACE anticipates that 288 transmission and utility line activities meeting the requirements of this Opinion may be authorized per 5-year period (Table 8). The USACE provided the following estimated impacts per project:

- Subaqueous transmission or utility lines installed via trenching will temporarily affect (by trenching and refilling) an area of waterbottom that is approximately 2 ft wide and 1,000 ft long (2,000 ft^2 [0.05 ac]).

- Installation of aerial transmission or utility lines (i.e., placement of piles and footers to support the lines) will cover an average of 0.5 ac of waterbottom per project.
- Repair or replacement of subaqueous transmission and utility lines could result in the loss of 200 ft^2 of Johnson's seagrass per 5-year period based on information provided by Florida Power and Light (FPL) utility company. PDC AP.13 states that the Opinion does not apply to projects where Johnson's seagrass is within the project footprint, but makes an exception for these repair/replacement projects.

To analyze the effects of transmission and utility line projects, we looked the assumptions regarding (1) the total number of covered activities to be authorized a 5-year period and (2) the average size of the impacted waterbottom based on the assumptions and PDCs; and (3) the average amount of Johnson's seagrass lost per project based on the assumptions and PDCs. Based on this information, we determined the potential effects to species (Table 52) and critical habitat (Table 55).

Potential Routes of Effect to Listed Species
In Section 2.2 above, we evaluated routes of effect common to the 10 categories of activities covered under this Opinion on ESA-listed species identified in Table 5. Installing new or repairing/replacing transmission and utility lines would result in 5 of the common routes of effect discussed above in the section entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion* (the numbers below correspond to the section numbers). The effects analysis for each of these routes of effects is provided in those sections:

1. Direct Physical Effects from Construction Activities
2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction
7. Noise

In this section of the Opinion, we evaluate the potential effects to sea turtles, smalltooth sawfish, sturgeon, and Johnson's seagrass from the installation, repair, replacement, and removal of aerial and subaqueous transmission and utility lines, and associated structures that were not considered in Section 2.2. NMFS and USACE effects determinations are summarized for this category of activity in Table 52. Sea turtles, smalltooth sawfish, sturgeon, and Johnson's seagrass may be affected by the placement of transmission or utility lines and their support structures. We quantified the potential extent of impacts based on (1) the assumptions, (2) the USACE estimated impacts per project based on the type of transmission and utility line project (Table 53), and (3) the construction limitations defined by the PDCs.

Table 52. USACE and NMFS Determinations on the Effects of Transmission and Utility Line Projects on ESA-listed Species Listed in Table 5

Listed Species	USACE Determination	NMFS Determination
Sea Turtles	NLAA	NLAA
Sawfish	NLAA	NLAA
Sturgeon	NLAA	NLAA
Johnson's seagrass	LAA	LAA
Effects Determinations Explained in Section 2.2		
Corals	NLAA	N/A
Whales	NE	NE
Nassau Grouper	Not provided	NLAA
NE= no effect; NLAA= may affect, not likely to adversely affect; N/A= not applicable (if a project may affect ESA-listed corals, separate consultation is required). The effects analysis for Johnson's seagrass, corals, whales, and Nassau Grouper was provided at the beginning of Section 2.2.		

Table 53. Estimated Waterbottom Covered by Transmission and Utility Line Projects Per Project

Project Type	Area Impacted per Project
Installing subaqueous transmission or utility lines (new installation or repair/replacement) via horizontal directional drilling	0
Installing subaqueous transmission or utility lines via trenching (new installation or repair/replacement)	2 ft wide x 1,000 ft long = 2,000 ft^2 [0.05 ac]*
Installing foundations, piles, and footings to support aerial transmission or utility lines	0.5 ac
*Impacts are temporary, given PDC A8.4, which requires trenches to be backfilled to natural contours immediately, or, pending District Engineer permission, after 180 days.	

We assume that most transmission and utility line projects (whether new installation or repair/replacement) will be installed by trenching; however, we do not know how many of the estimated 288 utility projects will be installed by trenching versus other methods. Since we do not know the exact number of each project type and installation method, we calculate a minimum and maximum amount of waterbottom that will be altered or covered. As shown in Table 53, the minimum amount of impacts to waterbottom are from installing using horizontal directional drilling that will have no in-water impacts (i.e., 0 ac of waterbottom impacted). The maximum amount of waterbottom that may be altered by transmission and utility line projects would be from the installation of foundations, piles, and footings to support aerial transmission or utility lines, which cover 0.5 ac of waterbottom per project. If we assume that all 288 projects could affect 0.5 ac of waterbottom per project, we could expect a maximum of 144 ac of waterbottom impacted (288 projects x 0.5 ac per project).

Horizontal directional drilling could result in a waterbottom alteration that would be greater than just the impacts from drilling if the drilling process resulted in a frac-out. We assume the potential for a frac-out is extremely rare and do not expect a frac-out from any of the projects authorized under this Opinion. If horizontal directional drilling is used as the installation method, the applicant must provide and follow a frac-out contingency plan that not only will require that turbidity barriers be in place, but that will further require that the exposure of bentonite be limited through isolation of the event and removal of the material in a timely manner. Additionally, the plan must require the directional drilling to stop immediately and must require a clean-up crew to be activated immediately upon a frac-out occurring. The plan also must require notification and documentation with state and federal agencies to provide additional assurances that the event will be contained. Further, horizontal directional drilling is not allowed within the geographic boundary of *Acropora* critical habitat since this area has a higher potential for subsurface sediments to fracture. Based on the extremely low risk of a frac out and the additional protective measures required if this method is used, we believe the risk to both species and critical habitat is discountable and will not be discussed further in this section. Because we do not expect a frac out from the horizontal directional drilling, we will continue to assume that such methods will not affect the waterbottom.

Potential Routes of Effect to Sea Turtles, Smalltooth Sawfish, and Sturgeon

Over a 5-year period, between 0 and 144 ac of waterbottom may be temporarily altered by trenching or permanently covered by the installation, repair, replacement, and removal of aerial and subaqueous utility and transmission lines, and the associated structures. This impacts to waterbottom is unlikely to be concentrated as the array of individual projects covered under this Opinion for Activity 8 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida).

- <u>Sea turtles:</u> Sea turtles may be affected by the loss of up to 144 ac of waterbottom, which the species may have used for foraging. However, the effect on sea turtles resulting from the loss of foraging habitat from transmission and utility line activities is insignificant.
  - The affected areas might include seagrasses, which are an important forage resource for green sea turtles. However, PDC AP.13 excludes transmission and utility line projects from the Opinion where Johnson's seagrass is present within the project footprint and recommends that impacts to native, non-listed seagrasses be avoided and minimized to the extent practicable.
  - Limestone outcroppings and worm-rock reefs are important developmental habitat for juvenile green turtles. Therefore, under PDC AP.14, this Opinion does not apply to projects where hardbottom is found within the footprint.
  - Hawksbill sea turtles are most commonly associated with reef habitat and feed on sponges, algae, and other invertebrates. However, PDC AP.14 also limits this Opinion to projects that do not directly or indirectly affect listed corals, and excludes projects if non-

listed corals and hardbottom habitats, which support sponges, algae, and other forage resources for hawksbill sea turtles, are within the project footprint.

- Utility line activities may cover or remove areas inhabited by sea turtle prey species, including the crustaceans and mollusks that serve as prey for loggerhead and the fish, jellyfish, shrimp, and mollusks that serve as prey for Kemp's ridley sea turtles. These foraging areas are larger and more common throughout Florida and the U.S. Caribbean than the specific habitat types like seagrass beds, hard bottom, limestone outcroppings, and reefs that must be avoided under this Opinion. In addition, the maximum area of impact (144 ac) is very small compared to the remaining large areas that support sea turtle prey species. Sea turtles can travel long distances to forage. The array of individual projects covered under this Opinion for Activity 8 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and the U.S. Caribbean), and sea turtles can forage in nearby areas outside of active project sites.

Given the above, we believe the effect to sea turtles from the potential loss of foraging habitat is insignificant. In total, based on the routes of effect analyzed here and in Section 2.2, we determined that the utility line activities under Activity 8 are not likely to adversely affect sea turtles.

- Smalltooth sawfish: Smalltooth sawfish may be affected by the loss of up to 144 ac of waterbottom, which the species may have used for foraging and refuge. This estimate includes projects in Florida and the U.S. Caribbean, but sawfish would only be affected by projects occurring in Florida. However, the effect on sawfish of the potential loss of foraging and refuge habitat is insignificant. For the first several years of their lives, juvenile smalltooth sawfish exhibit site fidelity to the areas in which they are pupped, typically in very shallow, nearshore waters where they can avoid predation by coastal shark species. In South Florida, sawfish have established distinct nursery areas where they utilize shallow, euryhaline habitat and red mangroves for forage and refuge; these areas have been designated as critical habitat for the species. Projects must be sited to avoid and minimize impacts to mangroves, and mangrove removal is strictly limited by PDCs AP.12 to removal for other covered activities and to removal above the MHWL provided that red mangrove prop roots that are accessible to marine species are not removed. PDC A8.8 also prohibits installation of foundation and footers to support aerial transmission or utility lines in smalltooth sawfish critical habitat if such installation would result in the loss of any of the essential features. The PDC A8.8 also prohibits activities in the limited exclusion zones. Therefore, the effect on juvenile sawfish of the temporary losses of small areas of shallow water forage and refuge habitat is expected to be so small as to be undetectable. The array of individual projects covered under this Opinion for Activity 8 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sawfish can seek forage and refuge in nearby areas outside of active project sites. Based on the routes of effect analyzed here and in Section 2.2, we determined that utility line activities under Activity 8 are not likely to adversely affect smalltooth sawfish.

- <u>Sturgeon:</u> Sturgeon may be affected by the loss of up to 144 ac of waterbottom, which the species may have used for foraging. However, the effect on sturgeon of the potential loss of foraging habitat is insignificant. Utility line projects may cover and bury bottom substrates containing sturgeon prey species, such as benthic worms and insects, as well as crustaceans and mollusks. However, sturgeon are opportunistic feeders that forage over large areas. The estimated area of impact is very small compared to the remaining large areas that support sturgeon prey species. The array of individual projects covered under this Opinion for Activity 8 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sturgeon can forage in nearby areas outside of active project sites. Based on the routes of effect analyzed here and in Section 2.2, we determined that the utility line activities under Activity 8 are not likely to adversely affect sturgeon.

Potential Effects to Johnson's Seagrass

We believe that the repair, replacement, or removal of transmission lines may affect, but is not likely to adversely affect, Johnson's seagrass. The PDCs for *Mangroves, Seagrasses, Corals and Hardbottom for All Projects* (PDC AP.13) exclude transmission and utility line projects from the Opinion if Johnson's seagrass is found within the project footprint, with an exception for projects repairing existing lines within the same footprint. Depending on the location of the repair required, Johnson's seagrass may be lost during the repair. In the last 5 years, FPL reported the loss of 200 ft^2 of Johnson's seagrass during utility line repairs and they believe that similar losses may be experienced per 5-year period. We believe this amount of loss is likely to adversely affect Johnson's seagrass and the effect is further evaluated in Section 5.

Potential Routes of Effect to Critical Habitat

In this section of the Opinion, we evaluate the potential effects on smalltooth sawfish critical habitat, Gulf sturgeon critical habitat, and Johnson's seagrass critical habitat transmission and utility line activities. The estimated impacts on each critical habitat unit and NMFS and USACE effects determinations for this category of activity are summarized in Tables 54 and 55.

Table 54. Estimated Potential Impacts to Areas Supporting the Essential Features of Smalltooth Sawfish, Gulf Sturgeon, and Johnson's Seagrass Critical Habitat from Transmission and Utility Line Projects Per 5-Year Period.

Potential Loss of Essential Feature	**Estimated Area of Impact Per Project (Table 53)**	**Smalltooth Sawfish Critical Habitat (n = 9)**	**Gulf Sturgeon Critical Habitat (n = 28)**	**Johnson's Seagrass Critical Habitat (n = 12)**
Installing subaqueous transmission or utility lines (new installation or repair/replacement) via horizontal directional drilling	0	N/A PDC A8.3 requires that horizontal directional drilling proceed from the uplands and does not involve any in-water work.		
Installing foundations, piles, and footings to support aerial transmission or utility lines	0.5 ac	N/A PDC A8.8 does not allow the placement of structures supporting aerial transmission or utility lines, such as foundation towers and transmission line poles, where the essential features are present.	Maximum of 14 ac if all projects were installed in areas supporting the essential features using this method (28 projects x 0.5 ac per project = 14 ac)	N/A PDC A8.9 placement of structures supporting aerial transmission or utility lines, such as foundation towers and transmission line poles is limited to waters deeper than -13 ft deep.
Installing subaqueous transmission or utility lines via trenching (new installation or repair/replacement)	0.05 ac	Maximum of 0.45 ac if all projects were installed in shallow, euryhaline waters using this method (9 projects x 0.05 ac per project = 0.45 ac)	Maximum of 1.4 ac if all projects were installed in areas supporting the essential features using this method (28 projects x 0.05 ac per project = 1.4 ac)	N/A PDC A8.9 limits trenching to only repair and replacement within the same footprint of the existing line. Areas previously altered by installing the existing line no longer function as critical habitat since they lack the stable, unconsolidated sediments that are free from physical disturbance essential feature.

Table 55. USACE and NMFS Determinations on the Effects of Transmission and Utility Line Projects (Activity 8) on Designated Critical Habitat

Designated Critical Habitat	USACE Determination	NMFS Determination
Smalltooth sawfish critical habitat	NLAA	NLAA
Gulf sturgeon critical habitat	LAA	NLAA
Johnson's seagrass critical habitat	LAA	NLAA
Effects Determinations Explained in Section 2.2		
Loggerhead critical habitat	NE	NE
Acropora critical habitat	NE	NE
North Atlantic right whale critical habitat	NE	NE
Atlantic sturgeon critical habitat	Not provided	NE
The effects analysis for loggerhead, *Acropora*, North Atlantic right whale, and Atlantic sturgeon critical habitat was provided at the beginning of Section 2.2.		

Potential Routes of Effect to Smalltooth Sawfish Critical Habitat
We believe that the installation, repair, or replacement of transmission lines may affect, but is not likely to adversely affect, smalltooth sawfish critical habitat. USACE anticipates that 9 transmission line activities may be covered under this Opinion per 5-year period in smalltooth sawfish critical habitat. The PDCs limit activities in smalltooth sawfish critical habitat (PDC AP.12) and prohibit activities in exclusion zones (PDC A8.8). In particular, projects must be sited to avoid and minimize impacts to mangroves, and mangrove removal is strictly limited by PDC AP.12 to removal for other covered activities and to removal above the MHWL provided that red mangrove prop roots that are accessible to marine species are not removed. PDC A8.8 also protects against permanent impacts to the shallow, euryhaline habitat essential feature in smalltooth sawfish critical habitat by excluding the installation of foundation and footer type structures supporting aerial utility or transmission lines in areas where the shallow, euryhaline essential features is present. PDC A8.3 requires that all transmission and utility lines installed by horizontal directional drilling do not involve any in-water work so the shallow, euryhaline essential feature would not be affected. Therefore, we believe there will be no effect to the essential features of smalltooth sawfish critical habitat from aerial transmission line projects or lines installed by horizontal directional drilling.

The shallow, euryhaline essential feature could be temporarily affected by installing new or replacing existing subaqueous lines via trenching. As calculated in Table 54, if all projects were installed in shallow, euryhaline waters using trenching, a maximum of 0.45 ac of the shallow, euryhaline habitat may be affected. However, the trenches for these projects are generally shallow and we do not believe the trenches remove or modify the depth feature. Moreover, the effects of trenching are temporary as the trenches must be refilled within 180 days and any sidecast material can only be left on the waterbottom for up to 180 days based on PDC A8.4.

Potential Routes of Effect to Gulf Sturgeon Critical Habitat
We believe that the installation, repair, or replacement of transmission lines may affect, but is not likely to adversely affect, Gulf sturgeon critical habitat. USACE anticipates that 28 transmission line activities may be covered under this Opinion per 5-year period in Gulf sturgeon critical habitat. Since utility line projects in Gulf sturgeon critical habitat can be installed, repaired, or replaced by any of the methods discussed for Activity 8, the potential areas with the essential features could range from none if all of the projects relied upon horizontal directional drilling to up to 14 ac if all projects involved the installation of foundations, piles, and footings to support aerial transmission or utility lines (Table 54). Although we do not know to what extent these areas contain the PCEs of Gulf sturgeon critical habitat, we evaluate the potential effects to the PCEs below assuming these areas contain the first 3 PCEs (abundant prey items, water quality, sediment quality), and evaluate the effect to the fourth PCE (safe and unobstructed migratory pathways) based on best assumptions below.

1. Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages. Permanent structures associated with utility lines (e.g., footings and foundations) may cover and bury bottom substrates containing sturgeon prey species; however, the effects to this PCE will be insignificant. Assuming all projects expected in Gulf sturgeon critical habitat involved aerial transmission lines, 14 ac of Gulf sturgeon critical habitat would be permanently covered or buried. The estimated 14 ac of loss is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat that we believe support sturgeon prey species. Further, not all of the 14 ac of habitat lost will support prey items or serve as preferred foraging habitat.

   If we assume all projects involve subaqueous lines requiring trenching, a total of 1.4 ac of waterbottom will be temporarily disturbed. Trenching up to 0.05 ac of habitat per project (28 projects total) for transmission or utility line placement will temporality displace prey in the linear trench where the line will be placed; however that area will be restored with the same bottom sediments within 180 days (PDC A8.4). Because similar habitat is expected to be present pre- and post-trenching, it is anticipated that the benthic biota in the areas will have the ability to recover and re-colonize. We expect that benthic prey availability will recover in 3-24 months (Culter and Mahadevan 1982; Wilber et al. 2007). Thus, we believe trenching will have an insignificant effect on this PCE.

2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. Localized and temporary reductions in water quality through increased turbidity may result from the installation, repair, or replacement of lines and associated structures; however, the effects to this PCE will be insignificant. PDC AP.10 of the PDCs for *In-Water Activities* requires monitoring and controlling turbidity throughout the duration of all projects. Turbidity curtains will be required for most projects. When the curtains are deployed, turbidity will be contained within the active portion of the project site, and we expect any small amounts of turbidity that may escape to have an insignificant effect on water quality. In a few instances, the USACE project manager has the ability to waive the turbidity curtain requirement as described in PDC AP.10. These instances include when

projects that are so small that turbidity is expected to be minimal, such as the placement of a single pile, placement of a scientific survey device, or removal of marine debris. Another instance where turbidity curtains may not be used is in areas with high wave energy where securing turbidity curtains would not be feasible, thereby potentially increasing the risk of them becoming loose and entangling animals or damaging nearby habitat. In high energy areas, turbidity would dissipate quickly and would therefore not be a problem. In both of the instances where turbidity curtains will not be used (i.e., for projects that are so small turbidity is expected to be minimal and for high energy areas where turbidity will dissipate very quickly), we believe effects from turbidity on water quality would be insignificant.

3. <u>Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages</u>. Permanent structures associated with aerial transmission or utility lines (e.g., footings and foundations) can affect sediment quality; however, the effects to this PCE will be insignificant. The placement of materials on the waterbottom converts sandy substrate capable of supporting Gulf sturgeon prey to hard man-made materials that do not support prey species. However, the estimated maximum of 14 ac of impact is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat with sediments that we believe support sturgeon prey species and Gulf sturgeon foraging.

   Trenching up to 1.4 ac of habitat for transmission or utility line placement will temporality affect sediment quality in the area where the line will be placed; however this area will be restored with the same bottom sediments within 180 days (PDC A8.4). Because similar habitat is expected to be present pre- and post-trenching, it is anticipated that the benthic biota in the dredging areas will have the ability to recover and re-colonize. We expect that benthic prey availability will recover in 3-24 months (Culter and Mahadevan 1982; Wilber et al. 2007). Thus, we believe trenching will have an insignificant effect on this PCE.

4. <u>Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats</u>. Transmission or utility line activities could obstruct migratory pathways for spawning if they blocked areas between estuaries and rivers. Migratory pathways could also be obstructed by permanent structures (e.g., footings and foundations for aerial transmission line) in Gulf sturgeon critical habitat if they prevented movement within estuarine and marine areas used for foraging; however, we believe there will be no effect to this PCE. The mouth of Gulf sturgeon spawning rivers and narrow inlets are identified in Section 2.1.1.2 as Gulf sturgeon critical habitat migratory restriction zones. To prevent Gulf sturgeon from being deterred from entering or exiting a spawning river, PDC A8.10 states that transmission or utility line projects cannot occur in the Gulf sturgeon critical habitat migratory restriction zones. Temporary trenching of transmission or utility lines and installation by horizontal directional drilling will not create obstacles to migration. Permanent structures built to support aerial transmission lines are typically spaced along the length of the aerial transmission and utility line to support it meaning that it does not create a barrier to species movement.

Because the effects to the PCEs of abundant prey items, water quality, and sediment quality will be insignificant and there will be no effects to safe and unobstructed migratory pathways, we believe that transmission or utility activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat.

Potential Routes of Effect to Johnson's Seagrass Critical Habitat
We believe that the installation, repair, or replacement of transmission or utility lines may affect, but is not likely to adversely affect, Johnson's seagrass critical habitat. USACE anticipates that 12 transmission line activities meeting the requirements of this Opinion may be authorized per 5-year period in Johnson's seagrass critical habitat. As shown in Table 54, none of the methods allowed under this Opinion for the installation, repair, or replacement of transmission and utility lines will affect the essential features of Johnson's seagrass critical habitat. Specifically:

- Transmission and utility lines installed by horizontal directional drilling requires that all drilling proceed from the uplands and does not involve any in-water work and therefore would not affect any of the essential features (PDC A8.3).

- Placement of structures supporting aerial transmission or utility lines, such as foundation towers and transmission line poles are limited to waters deeper than -13 ft deep (PDC A8.9). Studies show that Johnson's seagrass occurs in waters shallower than 10-13 ft (3-4 m) (NMFS 2007a). Water depths greater than 13 ft are not believed to provide the water transparency necessary for enough sunlight to reach the sea floor to support Johnson's seagrass growth. Therefore, these waters do not support the water transparency essential feature of Johnson's seagrass critical habitat, and the loss of 1 of the essential features results in a total loss in the conservation function of the critical habitat. Therefore, these structures will be placed in waters that do not function as critical habitat and will not affect the essential features of critical habitat.

- Transmission and utility line repair, or replacement involving trenching would be limited to only repair and replacement within the same footprint of the existing line (PDC A8.9). No new installation of transmission and utility lines is allowed by trenching in Johnson's' seagrass critical habitat. Areas previously altered by installing the existing line no longer function as critical habitat since they lack the stable, unconsolidated sediments that are free from physical disturbance essential feature. Therefore repairs occurring in these areas would have no effect to the essential features since the area already does not function as critical habitat.

2.2.9 Activity 9 (A9): Marine Debris Removal

General Description
The need for marine debris removal is typically identified by divers, snorkelers, or aerial surveys. The debris to be removed can come from a multitude of sources and events, including storm damage, lost fishing gear, or illegal dumping. Removal is often done as part of a clean-up event in which a large number of divers and boats work cooperatively with an organization to clean-up a given area. For instance, in Florida, the Florida Fish and Wildlife Research Institute has 2 programs to remove lost and abandoned traps including "the spiny lobster, stone crab, and blue crab trap retrieval program" and the "derelict trap and trap debris removal program." The term derelict trap refers to traps left in the water following the date by which they must be

removed under the pertinent law. During clean-up, debris is typically collected by divers in dive bags. The bags can be tied to a rope or chain to be pulled back to the supporting vessel by hand or by winch. This Opinion covers marine debris removal by the methods and in the circumstances described in the PDCs below.

Project Design Criteria

PDCs specific to Activity 9 for Marine Debris Removal:	
A9.1.	In-water activities are limited to the removal of marine debris that poses a threat to human health and safety and/or aquatic natural resources (flora, fauna, and their habitats) such as, but not limited to, large fishing nets, cables, crab traps, and derelict vessels.
A9.2.	Removal of marine debris shall require visual confirmation (e.g., divers, swimmers, and camera) that the item can be removed without causing further damage to aquatic natural resources.
A9.3.	If an item cannot be removed without causing harm to surrounding coral (ESA listed or non-listed), the item will be disassembled as much as practicable so that it no longer can accidentally harm or trap species.
A9.4.	Monofilament debris will be carefully cut loose from coral (ESA listed or non-listed) so as not to cause further harm. Under no circumstance will line be pulled through coral since this could cause breakage of coral.
A9.5.	Marine debris shall be lifted straight up and not be dragged through seagrass beds, coral reefs, coral, or hard bottom habitats. Trawling also cannot be used as a means of marine debris removal. Debris shall be properly disposed of in appropriate facilities in accordance with applicable federal and state requirements.
A9.6.	An absorbent blanket or boom shall be immediately deployed on the surface of the water around any derelict vessel to be removed if fuel, oil, or other free-floating pollutants are observed during the work.

Assumptions

The USACE believes that there will be no effect any species listed in Table 5 or critical habitat listed in Table 6 from the removal of marine debris given the PDCs. USACE anticipates that 54 marine debris removal activities meeting the requirements of this Opinion may be authorized per 5-year period (Table 8). Of those, they estimate that 11 projects will occur in smalltooth sawfish critical habitat, 7 in Gulf sturgeon critical habitat, and 11 in Johnson's seagrass critical habitat. Thus, to analyze the effects of marine debris removal, we looked the USACE's assumptions the number of projects to be authorized per 5-year period and the amount of waterbottom each project will affect. Based on this information, we determined the potential effects to species (Table 56) and critical habitat (Table 57).

Potential Routes of Effect to Listed Species
In Section 2.2 above, we evaluated routes of effect common to the 10 categories of activities covered under this Opinion on ESA-listed species identified in Table 5. Removal of marine debris would result in 3 of the common routes of effect discussed above in the section entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion* (the numbers below correspond to the section numbers). The effects analysis for each of these routes of effects is provided in those sections:

1. Direct Physical Effects from Construction Activities
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction

In this section of the Opinion, we evaluate the potential route of effects to sea turtles, smalltooth sawfish, and sturgeon from marine debris removal activities that were not considered in Section 2.2. NMFS and USACE effects determinations are summarized for this category of activity in Table 56. In the previous categories of activities, we considered the amount of waterbottom that would be covered or buried by the placement of materials and calculated the amount of waterbottom that would be removed in a table. Since this activity is limited to carefully removing marine debris from the waterbottom, we do not expect this activity to cover any waterbottom, but rather to expose and clean up the waterbottom.

Table 56. USACE and NMFS Determinations on the Effects of Marine Debris Removal Activities (Activity 9) to ESA-listed Species listed in Table 5

Listed Species	**USACE Determination**	**NMFS Determination**
Sea Turtles	NE	NLAA
Sawfish	NE	NLAA
Sturgeon	NE	NLAA
Effects Determinations Explained in Section 2.2		
Johnson's seagrass	NE	NE
Corals	NE	N/A
Whales	NE	NE
Nassau Grouper	NE	NLAA
NE= no effect; NLAA= may affect, not likely to adversely affect; N/A= not applicable (if a project may affect ESA-listed corals, separate consultation is required). The effects analysis for Johnson's seagrass, corals, whales, and Nassau Grouper was provided at the beginning of Section 2.2.		

Potential Routes of Effect to Sea Turtles, Smalltooth Sawfish, Sturgeon
We do not believe that the removal of marine debris will affect sea turtles, smalltooth sawfish, or sturgeon by affecting the species directly or by affecting their foraging or sheltering habitat. The removal of marine debris will be visually monitored and conducted so as to avoid harm to the species and surrounding environment during removal. Therefore, no effects are anticipated to

any of these species or their foraging or refuge habitat from the removal activity itself. In addition, the removal of these materials may allow habitat used by these species to recover and eventually provide foraging or refuge habitat, which could have a beneficial effect on the species.

Given the above, we believe there will be no effect to sea turtles, smalltooth sawfish, or sturgeon. In total, based on the routes of effect analyzed here and in Section 2.2, we determined that marine debris removal activities under Activity 9 are not likely to adversely affect sea turtles.

Potential Routes of Effect to Critical Habitat
In this section of the Opinion, we evaluate the potential effects to smalltooth sawfish critical habitat, Gulf sturgeon critical habitat, and Johnson's seagrass critical habitat from marine debris removal activities. NMFS and USACE effects determinations for this category of activity are summarized in Table 57. The USACE estimated 54 marine debris projects may be authorized per 5-year period. A breakdown of how many of these projects will occur within specific critical habitat unit is provided in Table 8.

Table 57. USACE and NMFS Determinations on the Effects of Marine Debris Removal (Activity 9) to Designated Critical Habitats

Project Location	**USACE Determination**	**NMFS Determination**
Sawfish critical habitat	NE	NE
Gulf sturgeon critical habitat	NE	NE
Johnson's seagrass critical habitat	NE	NE
Effects Determinations Explained in Section 2.2		
Loggerhead critical habitat	NE	NE
Acropora critical habitat	NE	NE
North Atlantic right whale critical habitat	NE	NE
Atlantic sturgeon critical habitat	Not provided	NE
The effects analysis for loggerhead, *Acropora*, North Atlantic right whale, and Atlantic sturgeon critical habitat was provided at the beginning of Section 2.2.		

Potential Routes of Effect to Critical Habitat (Smalltooth Sawfish, Gulf Sturgeon, or Johnson's Seagrass)
USACE anticipates that a maximum of 29 marine debris removal activities will occur in these smalltooth sawfish (11), Gulf sturgeon (7), or Johnson's seagrass (11) critical habitat units per 5-year period. The PDCs state that marine debris will be removed in a manner that does not cause it to be dragged or swung into any surrounding resources during removal (PDC A9.5). Divers, swimmers, or cameras will be used to assure the item(s) can be removed safely without causing further damage to aquatic resources (A9.2). The removal of debris may result in localized turbidity that is expected to be extremely small and temporary and not affect the water quality

essential features/PCEs of Johnson's seagrass or Gulf sturgeon critical habitat. In addition, the removal of debris could potentially result in beneficial effects to critical habitat by restoring the essential features such as exposing appropriate sediments for Johnson's seagrass (stable, unconsolidated sediments that are free from physical disturbance). With respect to smalltooth sawfish critical habitat, we do not expect removal of marine debris to change or modify the shallow, euryhaline essential feature, nor will such activity remove or affect red mangroves (PDC AP.12). Therefore, we believe there will be no effect to any of these designated critical habitats from the removal of marine debris.

2.2.10 Activity 10 (A10): Temporary Platforms, Fill, and Cofferdams

General Description

This activity category is limited to the (1) placement of temporary platforms and fill, (2) installation of pile jackets around piles to protect them (e.g., cathodic protection used for bridge supports), and (3) installation of cofferdams to dewater an area for construction. All of these activities are typically associated with construction of linear transportation projects and bridges. Cofferdams may also be used for other types of projects that require containment or a dewatered space to complete construction.

Temporary platforms and fills: Temporary platforms and fills may be required for new construction and to support bridge and causeway maintenance activities. Constructing temporary platforms and fills typically requires the use of barges, cranes, pumps, boats, front-end loaders, and track hoes.

Temporary platforms include space-frame structures (i.e., truss-like, lightweight, rigid structures constructed from interlocking struts in a geometric pattern) that provide high capacity working surfaces that are capable of spanning large decks or traversing the length of a bridge. Other temporary platforms include pontoons and work trestles, the latter of which are rigid frames used as support, especially referring to a bridge composed of a number of short spans supported by such frames.

Temporary fill includes roads of fill created in the waterbody near the bridge to transport equipment and materials or temporary islands of fill created to support equipment. Temporary fills covered by the Opinion must be removed in their entirety and the affected areas must be returned to pre-construction elevations.

Pile Jacket Construction: Pile jackets are a material or sleeve applied around a pile as protection. Types of equipment involved in pile jacket construction typically include barges, cranes, pumps, boats, etc. The equipment will be trucked, self-propelled, or barged to the site. Turbidity curtains, silt fences, sand bags, synthetic bales, or some combination of these items are used as directed by the project engineer to maintain State Water Quality Standards. Strict adherence to Section 104 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction is required to provide reasonable assurance that water quality standards will not be violated. Pile jackets typically include cathodic protection, cathodic protection with structural protection, and structural support jackets, as described below.

1. Cathodic Protection Pile Jackets (see Figure 23) - Cathodic protection is a technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell. This pile jacket type provides galvanic cathodic protection to a pile to control corrosion but does not provide any additional structural strength to the pile. The jackets are a fiberglass form with pre-installed zinc mesh. The bottom of the pile jacket is always placed in the water, typically -6 in MLW with an anode installed below the jacket on a galvanized steel strap. The jacket contains negative and positive connection wires that are connected to the existing pile, the anode, zinc mesh and then to a terminal box. The jacket is then filled with an epoxy grout.

2. Structural Cathodic-Protection Pile Jackets (See Figure 24) - These are the same type of system as the cathodic jacket but it also provides structural strengthening. The jacket is made wider to accommodate the new reinforcing steel and is filled with concrete.

3. Structural-Only Jackets - These are purely for structural strengthening and do not provide cathodic protection. The jackets are not used in an environment where corrosion related damage can occur.

<u>Cofferdams</u>: Temporary metal or concrete boxes placed in the water to allow dewatering so construction can be completed in-the-dry inside the cofferdam. Cofferdams can be installed either by a vibratory hammer or via impact hammer; however, to be covered under this Opinion, cofferdams must be installed by vibratory method. This Opinion does not cover installation using an impact hammer.

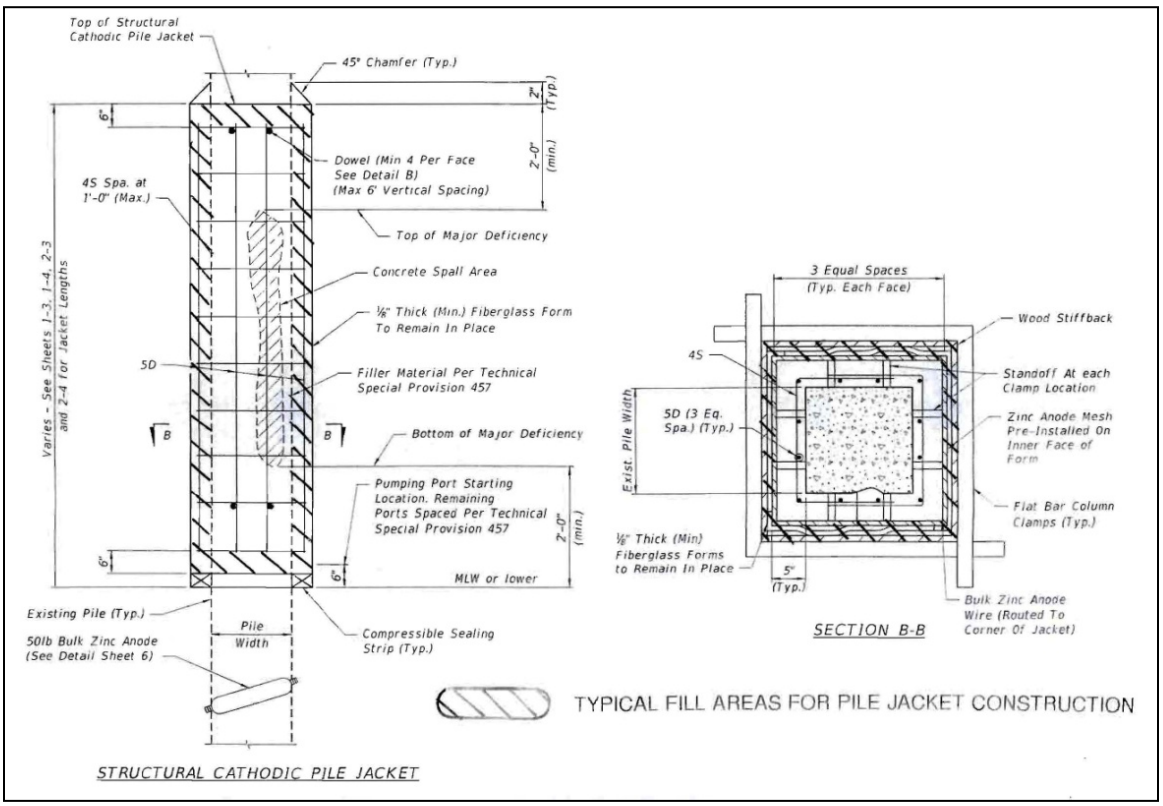

Figure 23. Cathodic pile jacket (Image provided by USACE)

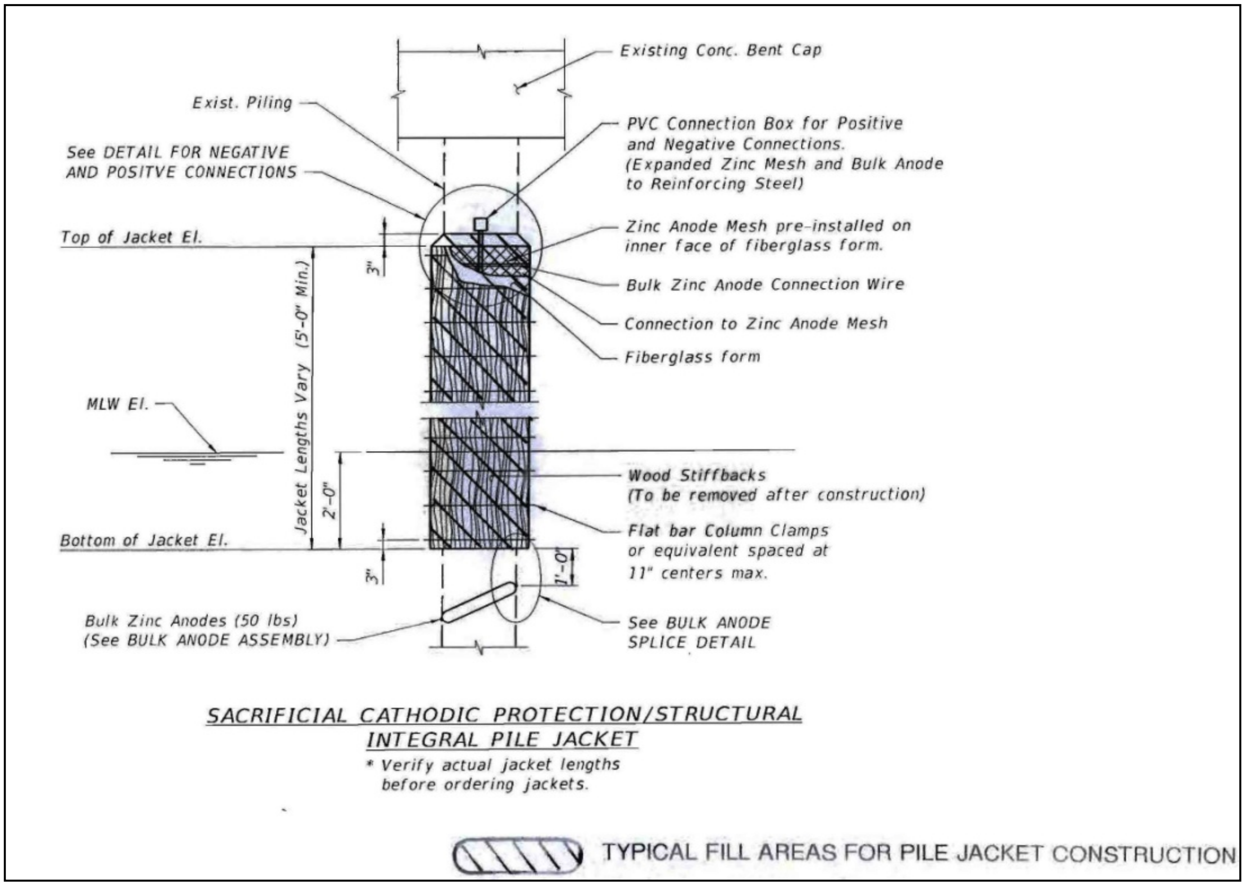

Figure 24. Structural cathodic pile jacket (Image provided by USACE)

Project Design Criteria

PDCs Specific to Activity 10 for Temporary Platform, Fill, and Cofferdam Activities:

A10.1. This Opinion covers the installation, repair, replacement, and removal of pile jackets and cathodic protection; temporary platforms; temporary fill; and temporary cofferdams.

A10.2. Temporary platforms and fills are limited to a total of 0.5 ac of clean fill per project; For platforms and fills, "temporary" is defined as fill that is in place for 120 days or less.

A10.3. Before placing the temporary platform or fill, the applicant must place a geotextile barrier around the entire area to be filled to ensure that the fill will be removed completely at the end of construction.

A10.4. Temporary fill materials must be placed in a manner that they will not be eroded by high water flows. Temporary fills and geotextile barriers must be removed in their entirety and the affected areas must be returned to pre-construction elevations.

A10.5. Temporary platforms and fill placed in confined areas, such as a channel or river, must be placed so that they do not impede normal downstream flows or species movement in the area.

A10.6. Temporary cofferdams cannot be installed by impact hammer. For cofferdam installation, "temporary" is defined as cofferdams that are in place for 120 days or less.

A10.7. Projects under Activity 10 are not allowed on or contiguous to ocean beaches that may be used by nesting sea turtles.

A10.8. The applicant must ensure that ESA-listed sea turtles and fish are not located in the cofferdam prior to dewatering the cofferdam to avoid entrapment.

Additional PDCs for Activity 10 applicable in critical habitat:

***In addition to the PDCs above, the project must be designed to meet the following PDCs if the project occurs in the critical habitat, as described below*.**

A10.9. Projects under Activity 10 are not allowed in Johnson's seagrass critical habitat or *Acropora* critical habitat where the essential feature(s) of these critical habitats are present.

A10.10. Smalltooth sawfish critical habitat: Projects under Activity 10 cannot occur in the smalltooth sawfish limited exclusion zones, defined in Section 2.1.1.1.

A10.11. Gulf sturgeon critical habitat: No temporary platforms, fill, or cofferdam projects are allowed in the areas defined as Gulf sturgeon critical habitat migratory restriction zones, defined in Section 2.1.1.2.

A10.12. U.S. Caribbean sea turtle critical habitat (hawksbill, leatherback, and the NA DPS of green sea turtle critical habitat): Only temporary cofferdams needed to complete other activities covered under this Opinion can occur in U.S. Caribbean sea turtle critical habitat. Cofferdams are not allowed on or contiguous to ocean beaches that may be used by nesting sea turtles.

Assumptions
The USACE believes that the average pile jack installation, temporary platform, temporary fill, and temporary cofferdam project will cover or bury the following amount of waterbottom:

- Pile jacket installation: no additional waterbottom area will be covered or buried since these structures are placed on existing piles.

- Temporary fill: 0.5 ac of waterbottom area will be temporarily covered during construction.

- Temporary platforms: The piles supporting the temporary platforms will result in an average impact of 10 ft^2 (10 piles, each 1 ft^2).

- Cofferdam: 250 ft^2 of waterbottom area will be temporarily covered during construction.

The USACE believes that they permit a ratio of 2 cofferdams to every 1 temporary platform or temporary fill. USACE anticipates that it will authorize 116 temporary platforms, temporary access fill, and temporary cofferdams meeting the requirements of the Opinion per 5-year period. The USACE was unable to estimate the number of pile jacket activities it expected to authorize. Since pile jackets are installed on existing piles and do not come in contact with the sea floor or any benthic resources and do not affect species using the area, we believe there will be no effect from pile jacket installation.

To analyze the effects of the other types of projects covered under Activity 10 (temporary fill, temporary platforms, and cofferdams), we looked the USACE's assumptions regarding the total number of covered activities per type to be authorized a 5-year period and the estimated size of the area affected. Based on this information, we determined the potential effects to species (Table 58) and critical habitat (Table 60).

Potential Routes of Effect to Listed Species
In Section 2.2 above, we evaluated routes of effect common to the 10 categories of activities covered under this Opinion on ESA-listed species identified in Table 5. Installing temporary platforms, fill, and cofferdams would result in the following common routes of effect discussed above in the section entitled *Construction Related Effects for All Categories of Activities Analyzed under this Opinion* (the numbers below correspond to the section numbers). The analysis for each of these routes of effects is provided in those sections:

1. Direct Physical Effects from Construction Activities
2. Turbidity
3. Potential Entanglement in Construction Materials
4. Exclusion from Areas during Construction
5. Limiting Species' Movement and Access to Habitat
7. Noise

In this section of the Opinion, we evaluate the potential effects to sea turtles, smalltooth sawfish, and sturgeon from the installation and removal of temporary platforms, fill, and cofferdams activities that were not considered in Section 2.2. NMFS and USACE effects determinations are summarized for this category of activity in Table 58.

In the previous categories of activities, we considered if placement of materials or activities could permanently remove, cover, or bury waterbottom and calculated the amount of waterbottom so affected in a table. For this category of activities, sea turtles, smalltooth sawfish, and sturgeon also may be affected by the temporary inability to use the area covered by the temporary platforms or temporary fill (limited to 120 days by PDC A10.2), or surrounded by the temporary cofferdam (PDC A10.6). We quantified the potential extent of impacts based on (1) the assumptions, (2) the number and estimated amount of waterbottom covered by each type of project based on estimates from the USACE (Table 59), and (3) the construction limitations defined by the PDCs.

Table 58. USACE and NMFS Determinations on the Effects of Temporary Platforms, Fill, and Cofferdam Activities (Activity 10) on Sea Turtles, Smalltooth Sawfish, and Sturgeon

Listed Species	USACE Determination	NMFS Determination
Sea Turtles	NLAA	NLAA
Sawfish	NLAA	NLAA
Sturgeon	NLAA	NLAA
Effects Determinations Explained in Section 2.2		
Johnson’s seagrass	NLAA	NE
Corals	NE	N/A
Whales	NE	NE
Nassau grouper	Not provided	NLAA
NE= no effect; NLAA= may affect, not likely to adversely affect; N/A= not applicable (if a project may affect ESA-listed corals, separate consultation is required). The effects analysis for Johnson’s seagrass, corals, whales, and Nassau Grouper was provided at the beginning of Section 2.2.		

Table 59. Estimated Amount of Waterbottom Affected by Temporary Platforms, Fill, and Cofferdam Activities in Florida and the U.S. Caribbean per 5-Year Period

Project Type (temporary)	Ratio of Projects	Number of Projects (n = 116)	Estimated Waterbottom Affected per Project (ft^2)	Estimated Waterbottom Affected Per 5-Year Period (ft^2)	Estimated Waterbottom Affected Per 5-Year Period (ac)
Platforms	1	19.33	10	193.33	0.00[34]
Fill		18.33	21,780	399,300.00	9.17
Cofferdams	2	77.33	250	19,333.33	0.44
Total		116		418,826.67	9.61

- Sea turtles: Sea turtles may be affected by the temporary inability to access 9.61 ac of waterbottom area, which could be used as foraging habitat. The activities will temporarily cover foraging habitat for up to 120 days (PDC A10.2, A10.6) and areas affected by temporary platforms and fill would be returned to reconstruction elevations (PDC A10.4). However, the effect on sea turtles from the temporary loss of foraging habitat is insignificant.
  - The waterbottom affected by Activity 10 could contain seagrasses, which are an important forage resource for green sea turtles. However, PDC AP.13 excludes projects from the Opinion that affected ESA-listed Johnson's seagrass and recommends that impacts to native, non-listed seagrasses be avoided and minimized to the extent practicable.
  - Limestone outcroppings and worm-rock reefs are important developmental habitat for juvenile green turtles, therefore, under PDC AP.14, this Opinion does not apply to projects where hardbottom is found within the footprint.
  - Hawksbill sea turtles are most commonly associated with reef habitat and feed on sponges, algae, and other invertebrates. PDC AP.14 also limits this Opinion to projects that do not directly or indirectly affect listed corals, and excludes projects if non-listed corals and hardbottom habitats, which support sponges, algae, and other forage resources for hawksbill sea turtles, are within the project footprint.
  - Temporary platforms, fill, and cofferdams activates may cover or remove areas inhabited by sea turtle prey species, including the crustaceans and mollusks that serve as prey for loggerhead and the fish, jellyfish, shrimp, and mollusks that serve as prey for Kemp's ridley sea turtles. These foraging areas are larger and more common throughout Florida and the U.S. Caribbean than the specific habitat types like seagrass beds, hard bottom, limestone outcroppings, and reefs that must be avoided under this Opinion. In addition,

[34] 193.33 ft^2 is approximately 0.004 ac, which rounded to 2 decimal places is 0.00 ac.

impacts to 9.61 ac is very small compared to the remaining large areas that support sea turtle prey species and we would expect these resources to return and recolonize in the areas covered by temporary platforms and temporary fill post construction. Sea turtles can travel long distances to forage. The array of individual projects covered under this Opinion for Activity 10 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida and U.S. Caribbean), and sea turtles can forage in nearby areas outside of active project sites.

Given the above, effect to sea turtles from the potential loss of foraging habitat is insignificant. In total, based on the routes of effect analyzed here and in Section 2.2, we determined that the temporary platform, fill, and cofferdam activities under Activity 10 are not likely to adversely affect sea turtles.

- Smalltooth sawfish: Smalltooth sawfish may be affected by the temporary inability to access 9.61 ac of waterbottom area, which may be used a foraging and refuge habitat. This estimate includes projects in Florida and the U.S. Caribbean, but sawfish would only be affected by projects occurring in Florida. For the first several years of their lives, juvenile smalltooth sawfish exhibit site fidelity to the areas in which they are pupped, typically in very shallow, nearshore waters where they can avoid predation by coastal shark species. In South Florida, sawfish have established distinct nursery areas where they utilize shallow, euryhaline habitat and red mangroves for foraging and refuge; these areas have been designated as critical habitat for the species. However, the effect on sawfish from the potential loss of nearshore foraging and refuge habitat is insignificant. The PDCs prohibit activities in smalltooth sawfish limited exclusion zones (PDC A10.10), which are areas that research shows support higher levels of smalltooth sawfish pupping. Additionally, projects must be sited to avoid and minimize impacts to mangroves, and mangrove removal is not covered under this Opinion for this activity by PDCs AP.12. The only mangrove removal allowed that could be used in connection with this activity is removal above the MHWL provided that red mangrove prop roots that are accessible to marine species are not removed. Temporary platform, fill, and cofferdam activities may also cover or remove nearshore areas inhabited by fish and crustaceans that serve as prey for smalltooth sawfish. The area of impact (some amount less than 9.61 ac) is very small compared to the remaining large nearshore areas that support sawfish prey species, and will be temporary (120 days or less). We expect these resources to return and recolonize. In the meantime, sawfish can travel long distances to forage. The array of individual projects covered under this Opinion for Activity 10 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sawfish can forage in nearby areas outside of active project sites. Based on the routes of effect analyzed here and in Section 2.2, we determined that that the temporary platform, fill, and cofferdam activities under Activity 10 are not likely to adversely affect smalltooth sawfish.

- Sturgeon: Sturgeon may be affected by the temporary loss of 9.61 ac of waterbottom, which may be used for foraging. This estimate includes projects in Florida and the U.S. Caribbean, but sturgeon would only be affected by projects occurring in Florida. Projects under Activity 10 may temporarily cover and bury substrates containing sturgeon prey species, such as benthic worms and insects, as well as crustaceans and mollusks. However, the effect on sturgeon of the potential loss of foraging habitat is insignificant. These effects are primarily short-term in nature, consisting of a temporary loss of benthic invertebrate populations in the project area. Observed rates of benthic community recovery after dredging, range from 3-24 months (Culter and Mahadevan 1982; Saloman et al. 1982; Wilber et al. 2007). The relatively species-poor benthic assemblages associated with low salinity estuarine sediments can recover in periods of time ranging from a few months to approximately 1 year, while the more diverse communities of high salinity estuarine sediments may require a year or longer. Hence, we believe that these areas will ultimately recover after the platforms, fill, or cofferdams are removed. Also, sturgeon are opportunistic feeders that forage over large areas and the area of impact (some amount less than 9.61 ac) is small compared to the remaining areas that support sturgeon prey species. The array of individual projects covered under this Opinion for Activity 10 will likely be separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida), and sturgeon can forage in nearby areas outside of active project sites. Based on the routes of effect analyzed here and in Section 2.2, we determined that that the temporary platform, fill, and cofferdam activities under Activity 10 are not likely to adversely affect sturgeon.

Potential Routes of Effect to Critical Habitat

In this section of the Opinion, we evaluate the potential effects to smalltooth sawfish critical habitat, Gulf sturgeon critical habitat, and Johnson's seagrass critical habitat from the installation and removal of temporary platforms, fill, and cofferdams activities. The estimated temporary exclusion of water areas in each critical habitat unit and NMFS and USACE effects determinations for this category of activity are summarized in Table 60 and the calculated amount of waterbottom affected by these projects is calculated in Table 61.

Table 60. USACE and NMFS Determinations on the Effects of Temporary Platform, Fill, and Cofferdam Activities under (Activity 10) to Designated Critical Habitat

Designated Critical Habitat	USACE Determination	NMFS Determination
Smalltooth sawfish critical habitat	LAA	NLAA
Gulf sturgeon critical habitat	LAA	NLAA
Johnson's seagrass critical habitat	NE	NE
Effects Determinations Explained in Section 2.2		
Loggerhead critical habitat	NE	NE
Acropora critical habitat	NE	NE
North Atlantic right whale critical habitat	NE	NE
Atlantic sturgeon critical habitat	Not provided	NE
The effects analysis for loggerhead, *Acropora*, North Atlantic right whale, and Atlantic sturgeon critical habitat was provided at the beginning of Section 2.2.		

Table 61. Estimated Amount of Waterbottom Affected by Temporary Platform, Fill, and Cofferdam Activities under (Activity 10) in Smalltooth Sawfish, Gulf sturgeon, and Johnson's Seagrass Critical Habitat per 5-Year Period

Project Type (Temporary)	Ratio of Projects	Number of Projects	Estimated Waterbottom Affected per Project (ft^2)	Estimated Waterbottom Affected Per 5-Year Period (ft^2)	Estimated Waterbottom Affected Per 5-Year Period (ac)
Smalltooth sawfish critical habitat (n = 31)					
Platforms	1	5.17	10	51.67	0.00[35]
Fill		18.33	21,780	399,300.00	9.17
Cofferdams	2	20.67	250	5,166.67	0.12
Total		31		404,518.33	9.29
Gulf sturgeon critical habitat (n = 12)					
Platforms	1	2.00	10	20.00	0.00[36]
Fill		2.00	21,780	43,560.00	1.00
Cofferdams	2	8.00	250	2,000.00	0.05
Total		12		45,580.00	1.05
Johnson's seagrass critical habitat (n = 12)					
Platforms	1	2.00	10	20.00	0.00[37]
Fill		2.00	21,780	43,560.00	1.00
Cofferdams	2	8.00	250	2,000.00	0.05
Total		12		45,580.00	1.05

[35] 51.67 ft^2 is approximately 0.001 ac, which rounded to 2 decimal places is 0.00 ac.
[36] 20 ft^2 is approximately 0.0005 ac, which rounded to 2 decimal places is 0.00 ac.
[37] 20 ft^2 is approximately 0.0005 ac, which rounded to 2 decimal places is 0.00 ac.

Potential Routes of Effect to Smalltooth Sawfish Critical Habitat
We believe that temporary platforms, fill, and cofferdam activities may affect, but are not likely to adversely affect, smalltooth sawfish critical habitat. USACE anticipates 31 temporary platforms, fill, and cofferdam activities meeting the requirements of this Opinion may be authorized per 5-year period in smalltooth sawfish critical habitat.

In Table 61, we determined that these activities will result in 9.29 ac of temporary effects to waterbottom areas in smalltooth sawfish critical habitat. Mangroves are 1 of the essential features of smalltooth sawfish critical habitat, and PDC AP.12 does not allow removal of mangroves for these projects. Shallow, euryhaline waters are the other essential feature of smalltooth sawfish critical habitat. Temporary platforms, fills, and cofferdam projects could temporarily affect the shallow, euryhaline essential feature. However, these projects must be completed in 120 days (PDC A10.2) and the areas where the structures were placed must be returned to pre-construction elevations (PDC 10.4).[38] Therefore, there will be no permanent change to either of the essential features and the temporary effects to critical habitat are expected to be insignificant.

Potential Routes of Effect to Gulf Sturgeon Critical Habitat
We believe that temporary platforms, fill, and cofferdam activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat. USACE anticipates 12 temporary platforms, fill, and cofferdam activities will be covered under this Opinion per 5-year period in Gulf sturgeon critical habitat. In Table 61, we determined that these activities will result in 1.05 ac of temporary effects to waterbottom areas in Gulf sturgeon critical habitat. Although we do not know to what extent these areas contain the PCEs of Gulf sturgeon critical habitat, we evaluate the potential effects to the PCEs below assuming these areas contain the first 3 PCEs (abundant prey items, water quality, sediment quality), and evaluate the effect to the fourth PCE (safe and unobstructed migratory pathways) based on best assumptions below.

1. <u>Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages</u>. These activities may temporarily cover and bury nearshore bottom substrates containing sturgeon prey species; however, the effects to this PCE will be insignificant. These effects are primarily short-term in nature, consisting of a temporary loss of benthic invertebrate populations in the affected areas. Observed rates of benthic community recovery after dredging range from 3-24 months (Culter and Mahadevan 1982; Saloman et al. 1982; Wilber et al. 2007). The relatively species-poor benthic assemblages associated with low salinity estuarine sediments can recover in periods of time ranging from a few months to approximately 1 year, while the more diverse communities of high salinity estuarine sediments may require a year or longer. Hence, we believe that these areas will ultimately recover after the platforms, fill, or cofferdams are removed. The estimated 1.05 ac of impact is very small compared to the approximately 1.5 million ac of available marine and

[38] This section addresses only the effects of placing the cofferdam, not the effects of the structure surrounded by the cofferdam. The cofferdam and the structure that it surrounds both must meet the PDCs of this Opinion.

estuarine critical habitat that we believe support sturgeon prey species and not all the activities are likely to occur in the preferred foraging depth range or in the sand substrate that supports Gulf sturgeon prey species.

2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. Localized and temporary reductions in water quality through increased turbidity may result from temporary platforms, fill, and cofferdam activities; however, the effects to this PCE will be insignificant. PDC AP.10 of the PDCs for *In-Water Activities* requires monitoring and controlling turbidity throughout the duration of all projects. Turbidity curtains will be required for most projects. When the curtains are deployed, turbidity will be contained within the active portion of the project site, and we expect any small amounts of turbidity that may escape to have an insignificant effect on water quality. In a few instances, the USACE project manager has the ability to waive the turbidity curtain requirement as described in PDC AP.10. These instances include projects that are so small that turbidity is expected to be minimal, such as the placement of a single pile, placement of a scientific survey device, or removal of marine debris. Another instance where turbidity curtains may not be used is in areas with high wave energy where securing turbidity curtains would not be feasible, thereby potentially increasing the risk of them becoming loose and entangling animals or damaging nearby habitat. In high energy areas, turbidity would dissipate quickly and would therefore not be a problem. In both of the instances where turbidity curtains will not be used (i.e., for projects that are so small turbidity is expected to be minimal and for high energy areas where turbidity will dissipate very quickly), these activities are expected to have insignificant effects on the water quality feature.

3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages. Temporary platform, fill, and cofferdam activities can affect sediment quality; however, the effects to this PCE will be insignificant. The placement of these materials will temporarily cover areas that support prey species, but not alter the physical or chemical properties of the sediment itself. In addition, the estimated 1.05 ac of impact is very small compared to the approximately 1.5 million ac of available marine and estuarine critical habitat with sediments that we believe support sturgeon prey species and Gulf sturgeon foraging. Further, the piles supporting the temporary platforms will be removed and we expect the areas temporarily affected by the fill will be restored to preconstruction elevations (PDC A10.4) so the sediment present in the area will be the same as preconstruction.

4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats. Temporary platforms, fill, and cofferdam activities could obstruct migratory pathways for spawning if they blocked areas between estuaries and rivers. Migratory pathways could also be obstructed by these activities in Gulf sturgeon critical habitat if they prevented movement within estuarine and marine areas used for foraging. However, effects to this PCE will be discountable. The mouth of Gulf sturgeon spawning rivers and narrow inlets are identified in Section 2.1.1.2 as Gulf sturgeon critical habitat migratory restriction zones. To prevent Gulf sturgeon from being deterred from

entering or exiting a spawning river, PDC A10.11 prohibits these temporary activities in Gulf sturgeon critical habitat migratory restriction zones.

Because the effects to the PCEs of abundant prey items, water quality, and sediment quality will be insignificant and effects to safe and unobstructed migratory pathways will be discountable, we believe that temporary platforms, fill, and cofferdam activities may affect, but are not likely to adversely affect, Gulf sturgeon critical habitat.

Potential Routes of Effect to Johnson's Seagrass Critical Habitat

USACE anticipates 12 temporary platform, fill, and cofferdam activities will be covered under this Opinion per 5-year period in Johnson's seagrass critical.

We believe that temporary platforms, fill, and cofferdam activities will have no effect on Johnson's seagrass critical habitat. PDC A10.9 states that these activities cannot occur in areas where the essential features of critical habitat are present.

2.2.11 Summary and Cumulative Effect of Proposed Action to Listed Species and Critical Habitat

Sections 2.2.1 – 2.2.10 addressed the effect of each type of activity that can be covered under this Opinion and the potential that these activities are likely to adversely affect listed species or critical habitat. Our effects determinations for species and critical habitat are summarized in Tables 62-63.

Table 62. Summary of NMFS Determination of Effects to Species by Activity Type[39]

	Activity	Sea turtles[40]	Smalltooth sawfish	Sturgeon[41]	Johnson's seagrass	Corals[42]	Whales[43]	Nassau Grouper	Scalloped Hammerhead Shark
1	Shoreline stabilization	NLAA	NLAA	NLAA	NE	NE	NE	NLAA	NLAA
2	Pile-supported structure	NLAA	NLAA	NLAA	LAA	NE	NLAA	NLAA	NLAA
3	Dredging	NLAA	NLAA	NLAA	LAA	NE	NE	NLAA	NLAA
4	Water-management outfall structures	NLAA	NLAA	NLAA	NE	NE	NE	NLAA	NLAA
5	Scientific survey devices	NLAA	NLAA	NLAA	NE	NE	NE	NLAA	NLAA
6	Boat ramps	NLAA	NLAA	NLAA	NE	NE	NLAA	NLAA	NLAA
7	Aquatic enhancement	NLAA	NLAA	NLAA	NE	NE	NLAA	NLAA	NLAA
8	Transmission/ utility lines	NLAA	NLAA	NLAA	LAA	NE	NE	NLAA	NLAA
9	Marine debris removal	NLAA	NLAA	NLAA	NE	NE	NE	NLAA	NLAA
10	Temporary platforms, fill, and cofferdams	NLAA	NLAA	NLAA	NE	NE	NE	NLAA	NLAA

[39] Note that some of the effects determinations summarized in this table cover multiple types of activities (e.g., aquatic enhancement covers artificial reefs, living shorelines and oyster reefs). The effects determination summarized above is the worst-case scenario addressed in this Opinion and that the determination may be different for each activity type within the category of activities.

[40] Green, hawksbill, Kemp's ridely, leatherback, and loggerhead

[41] Atlantic, Gulf, and shortnose

[42] Elkhorn, staghorn, boulder star, lobed star, mountainous star, pillar, rough cactus

[43] North Atlantic right, blue, fin, sei, sperm

Table 63. Summary of NMFS Determination of Effects to Critical Habitat by Activity Type[44]

	Activity	Smalltooth sawfish critical habitat	Gulf sturgeon critical habitat	Johnson's seagrass critical habitat	Loggerhead sea turtle critical habitat	*Acropora* critical habitat	North Atlantic right whale critical habitat	U.S. Caribbean sea turtle critical habitat
1	Shoreline stabilization	LAA	NLAA	LAA	NE	NE	NE	NLAA
2	Pile-supported structure	LAA	NLAA	LAA	NE	NE	NE	NLAA
3	Dredging	NLAA	NLAA	LAA	NE	NE	NE	NLAA
4	Water-management outfall structures	LAA	NLAA	LAA	NE	NE	NE	NLAA
5	Scientific survey devices	NLAA	NLAA	NLAA	NE	NE	NE	NLAA
6	Boat ramps	NLAA	NLAA	NE	NE	NE	NE	NLAA
7	Aquatic enhancement	NE	NLAA	NLAA	NLAA	NE	NLAA	NLAA
8	Transmission / utility lines	NLAA	NLAA	NLAA	NE	NE	NE	NLAA
9	Marine debris removal	NE	NE	NE	NE	NE	NE	NLAA
10	Temporary platforms, fill, and cofferdams	NLAA	NLAA	NE	NE	NE	NE	NLAA

In the previous sections we considered the effects of each activity individually and the cumulative effects of each category of activity to each species and critical habitat unit. We now consider the cumulative effects of all activities analyzed in this Opinion occurring throughout Florida. For those activities that we believe are likely to adversely affect species or critical habitat, we consider the cumulative effects further in Sections 5 and throughout the rest of the

[44] Note that some of the effects determinations summarized in this table cover multiple types of activities (e.g., aquatic enhancement covers living shorelines, artificial reefs, and oyster reefs). The effects determination summarized above is the worst-case scenario addressed in this Opinion and that the determination may be different for each activity type within the category of activities.

NMFS published a final rule designating critical habitat for Atlantic sturgeon on August 17, 2017 (82 FR 39160). This Opinion does not provide an analysis for Atlantic sturgeon critical habitat effects, because the Opinion prohibits projects from occurring within the cricitial habitat (i.e., St Marys River).

Opinion. These include the effects to Johnson's seagrass, Johnson's seagrass critical habitat, and smalltooth sawfish critical habitat.

The cumulative effect to species from all in-water construction in Florida analyzed under this Opinion depends on the concentration of construction in an area at any given time. In other words, does the species have the ability to avoid construction by moving to a nearby area that is not currently under construction? Because we cannot know the exact location where each project will occur at a specific time in the future, we do not know the specific level of development that will occur within a given region or the distance between activities analyzed under this Opinion. Hence, we have to make assumptions based on past development in Florida and the U.S. Caribbean. We assume that projects are not likely to occur simultaneously in a small area. For instance, we assume that only 1 dock or seawall will be installed at a time within a given area (e.g., canal or stretch of shoreline). This assumption is made because the likelihood of multiple neighbors requiring construction at the same time, having the funds to perform the construction at the same time, and having multiple contract companies available to work in the same canal at the same time are extremely low. We also considered the cumulative effects if more than 1 project were to occur generally within the same time period within a region such as the same week or month. Since each of these projects is likely to be completed quickly (a couple of days to a couple of weeks depending on the type of activity), we believe that it is unlikely that multiple projects will occur simultaneously. Also, the areas identified as the most important to these species (e.g., pupping areas for smalltooth sawfish, migratory pathways to spawning rivers for sturgeon, access to nesting beaches for sea turtles) have specific protections both as general PDCs for the Opinion and activity-specific PDCs discussed throughout this document.

Based on this assumption that species will be able to move away from any particular construction location and avoid nearby construction and that sensitive areas are protected, we believe the same discussions for the cumulative effects of each category of activity discussed in the previous sections still applies when considering the cumulative effect to each species from all projects analyzed under this Opinion. Therefore, we believe the effects of construction including the risk of injury from construction, the addition of vessels to an area, the risk of blocking species movement, the temporary exclusion of areas during construction will still result in insignificant effects to these species when considering all construction in Florida addressed by this Opinion.

When considering the cumulative effects from the temporary or permanent impacts to foraging or refuge habitat from individual projects, we believe this will reduce the overall availability for sea turtles and smalltooth sawfish to find adequate foraging or refuge habitat throughout Florida. However, we believe this effect will be insignificant. The PDCs were designed to minimize the loss of these resources. Specifically, PDC AP.3 requires adherence to the PDCs for *Mangrove, Seagrasses, Corals, and Hardbottom for all Projects.* For example, this limits the loss of mangroves to only small areas for dock installation (i.e., to install a 4-8-ft wide walkway) and outfall structures (i.e., 20 lin ft of shoreline) and requires all projects avoid and minimize impacts to seagrasses. These individual and cumulative losses of resources were discussed for each category of activity. We believe these effects are still insignificant when considering the small losses allowed per individual project and that these projects are separated both temporally (over a 5-year period) and spatially (along the entire coast of Florida). Hence, mobile species like sea turtles, smalltooth sawfish, and sturgeon will be able to forage and seek refuge in nearby areas outside of active project sites.

Effects to critical habitat from each category of activity were also limited by the PDCs to avoid or minimize impacts to essential features and to areas thought to be the most sensitive within those areas (identified as exclusion zones in Section 2.1). For smalltooth sawfish critical habitat and Johnson's seagrass critical habitat, we determined that some of the categories of activities would result in the loss of essential features. The cumulative effects of these losses are discussed further in Section 5 and throughout the remainder of the document. We also determined that there would no effect to *Acropora* critical habitat from any of the proposed activities. For North Atlantic right whale critical habitat and loggerhead critical habitat, the only category of activity that would affect the essential features were the placement of artificial reef materials under Activity 7. These individual and cumulative effects were analyzed in Section 2.2.7, and determined to be insignificant.

For Gulf sturgeon critical habitat, all of the categories of activities except marine debris removal were determined to have discountable or insignificant effects to the essential features. As discussed for each category of activity, impacts to Gulf sturgeon critical habitat were limited by the PDCs that apply to all projects and the activity-specific PDCs. These were limited in ways to ensure sensitive areas used for migration were avoided, projects were completed according to seasonal restrictions so as not to effect the features while sturgeon were present, and generally limited to areas already disturbed (maintenance dredging) or areas that are shallower than the preferred foraging areas used by Gulf sturgeon. Therefore, even though there were losses of essential features within critical habitat, they were limited in ways that are not likely to adversely affect the critical habitat or diminish the ecological function for which the critical habitat was designated.

We believe that none of the types of activities analyzed under this Opinion are likely to change the landscape of Florida's nearshore waters. These activities will allow the continued development of Florida, while the PDCs will help protect species and critical habitat from both individual projects and the combined impacts from the authorization of all projects estimated to occur per 5-year period in Florida. This assumption will be confirmed through the project-level and programmatic review process defined in this Opinion.

2.3 Project-Specific Review

Before USACE or its delegated authority (e.g., FDEP, Cape Coral, Miami-Dade Division of Environmental Protection, as set forth in Section 2 above) can authorize a covered activity and rely on this Opinion to fulfill its consultation obligations under Section 7 of the ESA, the USACE or entity with delegated authority must conduct a project-specific review to ensure that all of the PDCs are met (Section 2.2). If the PDCs are met, then the project qualifies for coverage under the Opinion. Thereafter, the USACE or the entity with delegated authority must attest to, and certify, compliance with the PDCs and the Opinion in a submission to NMFS, described below (please note there is a separate process for certain projects authorized under SPGP). The USACE's ability to evaluate projects for compliance is largely limited to field observation of structural dimensions as identified on as-built drawings and requirements that are observable post-construction, for example, whether educational signs are in place. PDCs related to construction methods are not observable after construction. For example, the post-construction inspections cannot confirm whether the applicant installed a particular number of piles per day or used turbidity curtains during pile installation. All pertinent PDCs will be included as a Special Condition of the Permit. The USACE remains responsible for conducting the programmatic review, discussed in Section 2.4. In addition, as stated in Section 2, where another action agency has been designated as the lead for Section 7 consultation, the USACE remains responsible for both the project-level and programmatic review.

Submission to NMFS: USACE or its delegated authority (e.g., FDEP, Cape Coral, and Miami-Dade Division of Environmental Protection) must email the following information in the bulleted list below to both the USACE and NMFS.

Email:
1. NMFS at nmfs.ser.statewideprogrammatic@noaa.gov, and
2. USACE at usace.ser.statewideprogrammatic@usace.army.mil

Required information:
- Certification that the activity meets all of the applicable general and activity-specific PDCs of this Opinion.

- A completed form (under development) that includes specific project details, information needed to assess impacts to resources (e.g., amount of waterbottom on which the projects will be placed, size of any piles to be used, pile installation methods), and information that confirms the PDCs are being met (e.g., where the PDCs limit covered projects to a particular size, the form will solicit the size). This form is being jointly developed by NMFS and USACE. NMFS and the USACE may jointly determine that modifications to the form are necessary to ensure that project-specific information is clearly and accurately conveyed and may jointly develop a modified form.

- Any other documentation necessary to support the conclusion that the authorized activity is consistent with the applicable PDCs and is in compliance with this Opinion. This could include project plans, site survey (e.g., benthic, seagrass, hard bottom), photos, environmental assessment, and any other relevant documentation.

NMFS will acknowledge receipt of the email submission through an automatic reply email.

Projects authorized under SPGP: FDEP uses an online, electronic self-certification process that allows individuals to certify that certain single-family docks and boatlifts are in compliance with the terms and conditions of the SPGP and thus covered under the SPGP. The online system requires the applicant to answer basic questions about the property, the proposed activity, and the specific location of the proposed project. The applicant is then required to locate the proposed project using the FDEP's online mapping component to confirm its location relative to protected areas like ESA-designated critical habitat. Finally, the applicant must certify that the information it has submitted is true and accurate. If, based on the answers, the self-certification program determines that the applicant has properly certified that its proposed project complies with the terms and conditions of the SPGP, then the applicant is issued a letter stating that the proposed activity, as self-certified, is in compliance with the SPGP and may proceed. If, however, the program determines that the applicant has not properly certified that its proposed project complies with the terms and conditions of the SPGP, the applicant will be so informed and instructed to submit an application to the USACE.

As we noted at the outset, we previously consulted on effects of the SPGP and issued a biological opinion on the SPGP (SER-2011-05980). The self-certification program was developed at that time to ensure that only those projects having minor and predictable effects, discussed in the Opinion and consistent with the PDCs in the Opinion, would be immediately issued a letter confirming compliance with the SPGP. The USACE has requested that FDEP continue to be allowed to process applications for these pile-supported structures using the self-certification process, and asked that the FDEP be exempt from the requirement above that it certify to the USACE and NMFS that the projects authorized under the SPGP self-certification meet the PDCs and are in compliance with this Opinion on a case-by-case basis, but rather to provide a blanket certification at this time. According to the USACE, neither FDEP nor the USACE's compliance inspections on projects authorized under the self-certification have identified problems with this system for compliance with the PDCs of SPGP. To confirm compliance, the USACE inspects 10% of the all USACE permits, including the self-certification permits under the SPGP, after the project has been constructed. Projects authorized under SPGP are also subject to programmatic review by the USACE and NMFS as described in Section 2.4. The self-certification program will continue to apply only to private single-family docks and boatlifts that comply with a list of criteria that either meet the PDCs of this Opinion or are more restrictive than the PDCs in this Opinion. For example, the SPGP self-certification currently only applies to pile-supported structures that are docks that are 1,000 ft^2 or less over water or 500 ft^2 or less over water when in an Aquatic Preserve or Outstanding Florida Water. Given these size limitations of docks in SPGP, these structures are more restrictive than those allowed under PDC A2.1 of this Opinion. By limiting the size, SPGP self-certification only applies to very minor structures, which we expect to have less effect than those allowed under PDC A2.1. In addition, the SPGP self-certification cannot be used for projects:

- On an unbridged, undeveloped coastal island or undeveloped coastal island segment or undeveloped coastal barrier island.
- On sandy beaches fronting the Gulf of Mexico or Atlantic coast shoreline, exclusive of bays, inlets, rivers, bayous, creeks, passes, and the like
- Within 50 ft of the MHWL at any riparian location
- Located in the coastal counties of Wakulla, Taylor, Dixie, Levy, Pasco, and Monroe.
- Located in Biscayne Bay Aquatic Preserve
- Located in the range of Johnson's seagrass
- In Federal Special Waters (Biscayne Bay National Park, Blackwater Creek, Faka Union Canal, Garfield Point, Loxahatchee River, Okeechobee Waterway, Rock Springs Run, St. Marys River, Tampa Bypass Canal, Timicuan Preserve, Wekiva River)
- Located in any of the restriction or exclusion zones identified in Section 2.1.1 of this Opinion
- Location in an area with non-ESA listed seagrasses and will result in any impacts or shading to these seagrasses.

Given the lack of problems with the system in the past, the additional restrictions limiting these projects to minor pile-supported structures, and the confirmation, via the mapping feature, that these pile-supported structures will not occur in sensitive resource areas like critical habitat or within the restriction and exclusion zones identified in this Opinion, the projects that are recognized to be in compliance with the SPGP under the self-certification are not required to undergo the project-specific review procedures described above. In particular, when a project is recognized as in compliance with the SPGP via the self-certification, the FDEP need not submit the project details to NMFS and the USACE and certify that the project meets the PDCs and is in compliance with the Opinion. For projects authorized under the self-certification, the applicant has certified that the project is of the type that would be in compliance with the PDCs, and the USACE is certifying now that the projects authorized via the self-certification will meet the PDCs of this Opinion. To ensure compliance with the terms of this Opinion, the permittee must submit the self-certification statement to FDEP, which will transmit the statement to the USACE, which will transmit the statement to NMFS in connection with the quarterly submissions. Receipt of the USACE's self-certification statement documents compliance with all conditions of the permit, including terms (i.e., PDCs) of this Opinion. Projects processed under the self-certification are still subject to the programmatic review described in Section 2.4 of this Opinion. The FDEP and the USACE coordinate on FDEP's administration of the SPGP. The USACE may discuss any issues with the self-certified projects on its monthly calls with NMFS. The USACE also must include these projects in its quarterly reports to NMFS and in its annual review. If during any of these programmatic reviews (i.e., the monthly review, quarterly reports, and the annual review), NMFS or the USACE determines that this self-certification process is not working as anticipated, and projects are certified that do not meet the PDCs or other requirements of this Opinion, NMFS and the USACE will work together to take such action as appropriate to address the situation.

Superseding Process for Review and Inclusion of Substantially Similar Projects or Projects with Substantially Similar Effects: In a few instances, a project applicant may propose to use materials or installation methods that were not specifically considered in this Opinion, or the project may deviate from the PDCs in a minor fashion. For example, an applicant may propose to use a different living shoreline material than that considered in the Opinion (Activity 7) or may propose a new shoreline stabilization project that is more than 500 ft in length, and thus does not meet PDC A1.1.1 or involves more mangrove removal than allowed under PDC AP.12. In those instances, the USACE (or its delegated authority) must determine whether the effects of the modification on ESA-listed species or designated critical habitat are substantially similar to the effects considered in this Opinion. If the USACE (or its delegated authority) makes that preliminary determination, it must provide that rationale to NMFS and request permission to rely on the Opinion to satisfy its ESA Section 7 consultation obligations. If NMFS determines that the effect is substantially similar to the effects discussed and found in this Opinion, then NMFS may approve the modification, on that case-specific basis alone, and the project can be covered under this Opinion, and will be included in the programmatic review. If the USACE (or its delegated authority) seeks to authorize a project that proposes to use the same modification in the future, it still must seek permission for the modification. When requesting consideration for a new material, method, or modification, the USACE (or its delegated authority) must await written approval from NMFS before authorizing the project. This process supersedes the review process described above.

2.4 Programmatic Review

NMFS and the USACE will have monthly calls and conduct an annual programmatic review of the projects authorized in reliance on this Opinion to evaluate (1) whether the predicted nature and scale of the effects continues to be accurate; (2) whether the PDCs continue to avoid and minimize effects to species and critical habitat as designed or require modification; and (3) whether the project-specific review procedures are being followed and are effective at screening out projects that do not meet the PDCs or are not in compliance with the Opinion. In addition, the USACE will provide quarterly reports to NMFS regarding implementation of the Opinion.

NMFS and the USACE's Jacksonville District have dedicated project managers responsible for implementation, management, and administration of this and other Programmatic Opinions used by the Jacksonville District. The programmatic team leads from NMFS and the USACE, and other members as necessary, participate in monthly calls, quarterly reports, and the annual programmatic review to verify conclusions regarding the potential effects to ESA-listed species and critical habitat, review data on the cumulative effects of the combined projects from the previous year(s), and evaluate and suggest any procedural changes (e.g., modifications to the reporting form or clarification on a PDC) prompted by the review of data. If the monthly calls, quarterly reports, or the annual programmatic review show that the anticipated effects to listed species or critical habitat, as discussed in this Opinion, are different than the effects of the projects as implemented, reinitiation of consultation may be required (50 CFR 402.16). Reviews will be conducted in the following way:

Monthly Call: The USACE and NMFS will conduct a monthly call to discuss how this Opinion is being implemented. The monthly calls provide an opportunity to discuss issues as they arise and answer questions about the implementation of the program as a whole. They also provide a regular opportunity to evaluate whether the projects authorized in reliance on the Opinion are consistent with the Opinion. If both NMFS and USACE agree, the frequency of the calls can be decreased.

NMFS has previously issued programmatic opinions on groups of related USACE-permitted actions, most recently the Florida Statewide Programmatic Opinion, and the USACE and NMFS have had monthly calls to discuss implementation of these programmatic opinions. The monthly calls have proven to be an effective means of ensuring that the USACE and NMFS's understanding and interpretation of the Opinion are consistent, that both agencies are working together toward upholding the intent and integrity of the Opinion, and that the staff from both agencies who have been assigned to implement the programmatic are readily available to each other and to the project managers in both agencies to raise and answer questions as they arise.

USACE Quarterly Reports: The USACE shall provide NMFS with a completed spreadsheet of all activities authorized using this Opinion to satisfy the ESA Section 7 consultation requirements each quarter (i.e., January-March, April-June, July-September, and October-December). Before submitting the spreadsheet to NMFS, USACE shall check the spreadsheet for accuracy (e.g., properly formatted, completely filled out, no duplicates, latitude/longitude data is accurate and entered according to the formatting requirements provided). In addition, the USACE should review the data to determine whether the projects authorized in reliance on the

Opinion are consistent with the Opinion (e.g., the PDCs are being met) and to confirm that its assumptions about the number and location of the projects (and any other assumptions that formed the basis of the effects analysis in Section 2.2) were accurate. For example, this Opinion assumes that a specific number of activities will be completed over a 5-year period, identified in Sections 2.2.1-2.2.11. If the data shows that the number of projects is likely to exceed that expected number, the USACE should inform NMFS in the quarterly report. The USACE shall provide a short summary of their findings with their email submission of the spreadsheet to nmfs.ser.statewideprogrammatic@noaa.gov.

Annual Review: Each year, NMFS and the USACE will conduct an annual review of the projects authorized in reliance on this Opinion. The annual review will cover all projects authorized in the preceding year in reliance on this Opinion. The first annual review will cover projects authorized in the 12-month period starting from the date NMFS completes this Opinion. The second annual review will cover all projects authorized in the second year, and so on. The annual review consists of a USACE-data gathering and review component resulting in an annual, written report from the USACE to NMFS and a NMFS review and comment on the USACE annual report. A more specific description of the annual review process is described below.

To complete the annual review, the USACE shall:

1. Provide an Excel spreadsheet with separate tables (sheets) for each activity type to NMFS. This data shall be reviewed by the USACE to confirm that this Opinion is being implemented properly. This includes confirming that:
    a. The number of anticipated projects per activity type are consistent with (do not exceed) the anticipated number of projects from Table 8 in Section 2.2.
    b. The loss of Johnson's seagrass, Johnson's seagrass critical habitat, and smalltooth sawfish critical habitat does not exceed the anticipated loss calculated in this Opinion in Section 7 and Section 8.
    c. The PDCs were adhered to for each activity type (e.g., new seawalls do not exceed the length limit in PDC A1.1 or that docks were built according to the dock construction guidelines outlined in PDC A2.17 for length, height, and width).

2. Provide NMFS with a map of all activities authorized by activity type to confirm that they complied with the exclusion and restriction zones, did not occur in critical habitat, if required under the PDCs. NMFS will provide a map for this purpose that shows the exclusion zones, restriction zones, educational sign zones, and critical habitat boundaries to the USACE as a KMZ layer (i.e., a specific format of geographic information file known as a keyhole markup language). The USACE shall map the location of all projects authorized in reliance on the Opinion as an additional KMZ layer on this map.

3. Randomly select 10 projects from each of the 10 categories of activities for a total of 100 projects to be reviewed annually. If there are less than 10 projects in a given category, the USACE will review all of those projects. The USACE will review these projects to ensure that all information was reported accurately, all supporting documentation was provided with the project-specific review submission as outlined in Section 2.3, and that all of the PDCs were met. This review shall be documented and results provided to NMFS.

4. Provide a written report of their annual review to NMFS via email to nmfs.ser.statewideprogrammatic@noaa.gov. The report must include:
   a. A discussion of the results of the data review in Item 1 above.
   b. A discussion of the review of the mapped projects in Item 2 above.
   c. A discussion of the results of the detailed project reviews in Item 3 above.
   d. The results and summary of the USACE's pre- and post-construction compliance inspections completed during the previous year. The USACE performs compliance inspections on at least 10% of all of the projects that they permit. This information provides feedback on if the permitted actions are installed and implemented according to the observable permit conditions. Other entities that authorize projects under this Opinion under authority delegated from the USACE (e.g., FDEP, Cape Coral, Miami-Dade Division of Environmental Protection) shall also provide any compliance inspection data pertaining to projects permitted under the opinion to the USACE for inclusion in this annual report (e.g., FDEP compliance inspections of projects authorized under SPGP using this Opinion).
   e. Any lessons learned or procedural changes the USACE believes are necessary to improve the program.

NMFS will review the data the USACE submits as well as the USACE's annual report and provide comments or set up a conference call to discuss the results. The NMFS and USACE programmatic team will then work to resolve any outstanding questions or concerns and the results of these discussions will be documented.

Following the annual review, NMFS and the USACE may jointly determine that revisions to the Opinion or the PDCs are necessary. Re-initiation of consultation may be required as appropriate as provided in 50 CFR Section 402.16.

3 Status of Listed Species and Critical Habitat Likely to be Adversely Affected

3.1 Status of Species Likely to be Adversely Affected

3.1.1 Johnson's Seagrass

NMFS listed Johnson's seagrass as threatened under the ESA on September 14, 1998. Kenworthy (1993; 1997; 2000) and NMFS (2002; 2007a) discuss the results of numerous field studies and summarize an extensive literature review regarding the status of Johnson's seagrass. In addition to the published literature, the Johnson's Seagrass Recovery Implementation Team (Recovery Team) is in the process of updating the 2002 Recovery Plan for Johnson's Seagrass. The updated Recovery Plan will contain the latest information concerning the status of this species and potential threats to its persistence and recovery. The following discussion summarizes those findings relevant to our evaluation of the proposed action.

Life History and Population Biology

Based on the current knowledge of the species, Johnson's seagrass reproduction is believed to be entirely asexual, and dispersal is by vegetative fragmentation. Sexual reproduction in Johnson's seagrass has not been documented. Female flowers have been found; however, dedicated surveys in the Indian River Lagoon have not discovered male flowers, fertilized ovaries, fruits, or seeds, either in the field or under laboratory conditions (Hammerstrom and Kenworthy 2002; Jewett-Smith et al. 1997; NMFS 2007a). Searches throughout the range of Johnson's seagrass have produced the same results, suggesting either that the species does not reproduce sexually or that the male flowers are difficult to observe or describe, as noted for other *Halophila* species (Kenworthy 1997). Surveys to date indicate that the incidence of female flowers appears to be much higher near the inlets leading to the Atlantic Ocean.

Throughout its range, Johnson's seagrass occurs in dynamic and disjunctive patches. It spreads rapidly, growing horizontally from dense apical meristems with leaf pairs having short life spans (Kenworthy 1997). Kenworthy suggested that the observed horizontal spreading, rapid growth patterns, and high biomass turnover could explain the dynamic patches observed in distribution studies of this species. While patches may colonize quickly, they may also disappear rapidly. Sometimes they will disappear for several years and then re-establish, a process referred to as "pulsating patches" (Heidelbaugh et al. 2000; Virnstein and Hall 2009; Virnstein and Morris 2007). Mortality, or the disappearance of patches, can be caused by a number of processes, including burial from bioturbation and sediment deposition (Heidelbaugh et al. 2000), erosion, herbivory, desiccation, and turbidity. In the absence of sexual reproduction, one possible explanation for the pulsating patches is dispersal and re-establishment of vegetative fragments, a process that commonly occurs in aquatic plants and has been demonstrated in other seagrasses (Di Carlo et al. 2005; Philbrick and Les 1996), and was also confirmed by experimental mesocosm[45] studies with Johnson's seagrass (Hall et al. 2006).

Johnson's seagrass is a shallow-rooted species and vulnerable to uprooting by wind, waves, storm events, tidal currents, bioturbation, and motor vessels. It is also vulnerable to burial by sand movement and siltation (Heidelbaugh et al. 2000). Having a canopy of only 2 centimeter (cm) -5 cm, it may be easily covered by sediments transported during storms or redistributed by macrofaunal bioturbation during the feeding activities of benthic organisms. Mesocosm experiments indicate that clonal fragments can only survive burial for up to a period of 12 days (W.J. Kenworthy, NOAA's Center for Coastal Fisheries and Habitat Research, Beaufort, North Carolina, 1997 unpublished). Mechanisms capable of disturbing patches may create clonal fragments that become dispersed. Hall et al. (2006) showed that drifting fragments of Johnson's seagrass can remain viable for 4 to 8 days, during which time they can settle, root, and grow. The process of asexual fragmentation can occur year-round. Fragments could drift several kilometers under the influence of wind and tidally-driven circulation, providing potential recruits for dispersal and new patch formation. In the absence of sexual reproduction, these are likely to be the most common forms of dispersal and patch maintenance.

Population Status and Distribution

Johnson's seagrass occurs in a variety of habitat types, including on intertidal wave-washed sandy shoals, on flood deltas near inlets, in deep water, in soft mud, and near the mouths of

[45] A mesocosm is an experimental tool that brings a small part of the natural environment under controlled conditions.

canals and rivers, where presumably water quality is sometimes poor and where salinity fluctuates widely. It is an opportunistic plant that occurs in a patchy, disjunctive distribution from the intertidal zone to depths of approximately 2-3 m in a wide range of sediment types, salinities, and in variable water quality conditions (NMFS 2007a).

Johnson's seagrass exhibits a narrow geographical range of distribution and has only been found growing along approximately 200 km of coastline in southeastern Florida north of Sebastian Inlet, Indian River County, south to Virginia Key in northern Biscayne Bay, Miami-Dade County. This apparent endemism suggests that Johnson's seagrass has the most limited geographic distribution of any seagrass in the world. Kenworthy (Kenworthy 1997; Kenworthy 1999) confirmed its limited geographic distribution in patchy and vertically disjunctive areas throughout its range. Two survey programs have monitored the presence and abundance of Johnson's seagrass within this range. One program, conducted by the St. Johns River Water Management District since 1994, continues to survey the northern section of the species' geographic range between Sebastian Inlet and Jupiter Inlet (Virnstein and Hall 2009; Virnstein and Morris 2007). The second survey, initiated in 2006, monitored the southern range of the species between Jupiter Inlet and Virginia Key in Biscayne Bay (Kunzelman 2007). This survey is no longer conducted. Since the last status review (NMFS 2007a), there have not been any reported reductions in the geographic range of the species. In fact, the St. Johns River Water Management District observed Johnson's seagrass approximately 21 km north of the Sebastian Inlet mouth on the western shore of the Indian River Lagoon-a discovery that slightly extends the species' known northern range (Virnstein and Hall 2009).

Johnson's seagrass is a perennial species (meaning it lasts for greater than 2 growing seasons), showing no consistent seasonal or year-to-year pattern based on the northern transect surveys, but has exhibited some winter decline (NMFS 2007a). However, during exceptionally mild winters, Johnson's seagrass can maintain or even increase in abundance from summer to winter. In the surveys conducted between 1994 and 2007, it occurred in 7.1% of the l square meter (m^2) quadrats in the northern range. Depth of occurrence within these surveys ranged from 0.03 to 2.5 m. Where it does occur, its distribution is patchy, both spatially and temporally. It frequently disappeared from transects only to reappear several months or several years later (NMFS 2007a).

Based on the results of the southern transect sampling, it appears there is a relatively continuous, although patchy, distribution of the species from Jupiter Inlet to Virginia Key (NMFS 2007a). The largest reported contiguous patch of Johnson's seagrass in the southern range was observed in Lake Worth Lagoon and was estimated to be 30 ac (Kenworthy 1997). Eiseman and McMillan (1980) documented Johnson's seagrass in the vicinity of Virginia Key (latitude 25.75°N); this location is considered the southern limit of the species' range. There have been no reports of this species further south of the currently known southern distribution. The presence of Johnson's seagrass in northern Biscayne Bay (north of Virginia Key) is well documented. In addition to localized surveys, the presence of Johnson's seagrass has been documented by various field experiences and observations of the area by federal, state, and county entities. Johnson's seagrass has been documented in various USACE and USCG permit applications reviewed by NMFS. Findings from the southern transect sampling (summer 2006 and winter 2007) show little difference in the species' frequency or abundance between the summer and winter sampling period. The lower frequencies of Johnson's seagrass occurred at those sites where larger-bodied seagrasses (e.g., turtle grass, *Thalassia testudinum,* and manatee grass, *Syringodium filiforme*) were more abundant (NMFS 2007a). The southern range transect data support some of the conclusions drawn from previous studies and other surveys. This is a rare species; however, it can be found in relatively high abundance where it does occur. Based on the results of the southern transect sampling, it appears that, although it is disjunctively distributed and patchy, there is some continuity in the southern distribution, at least during periods of relatively good environmental conditions and no significant large-scale disturbances (NMFS 2007a).

Information on the species' distribution and results of limited experimental work suggest that Johnson's seagrass has a wider tolerance range for salinity, temperature, and optical water quality conditions than other species such as paddle grass, *Halophila decipiens* (Dawes et al. 1989) (Kenworthy and Haunert 1991); (Gallegos and Kenworthy 1996); (Durako et al. 2003; Kenworthy and Fonseca 1996; Torquemada et al. 2005). Johnson's seagrass has been observed near the mouths of freshwater discharge canals (Gallegos and Kenworthy 1996), in deeper turbid waters of the interior portion of the Indian River Lagoon (Kenworthy 2000; Virnstein and Morris 2007), and in clear water associated with the high energy environments and flood deltas inside ocean inlets (Heidelbaugh et al. 2000; Kenworthy 1993; Kenworthy 1997; Virnstein and Morris 2007; Virnstein et al. 1997). It can colonize and persist in high-tidal energy environments and has been observed where tidal velocities approach the threshold of motion for unconsolidated sediments (35-40 cm s^{-1}). The persistent presence of high-density, elevated patches of Johnson's seagrass on flood tidal deltas near inlets suggests that it is capable of sediment stabilization. Intertidal populations of Johnson's seagrass may be completely exposed at low tides, suggesting high tolerance to desiccation and wide temperature tolerance.

In Virnstein's study areas within the Indian River Lagoon, Johnson's seagrass was found associated with other seagrass species or growing alone in the intertidal, and, more commonly, at the deep edge of some transects in water depths down to 180 cm. In areas in which long-term poor water and sediment quality have existed until recently, Johnson's seagrass appears to occur in relatively higher abundance, perhaps due to the inability of the larger species to thrive. Johnson's seagrass appears to be out-competed in seagrass habitats where environmental conditions permit the larger seagrass species to thrive (Kenworthy 1997; Virnstein et al. 1997). When the larger, canopy-forming species are absent, Johnson's seagrass can grow throughout the full seagrass depth range of the Indian River Lagoon (NMFS 2007a; Virnstein et al. 2009).

Observations by researchers have suggested that Johnson's seagrass exploits unstable environments or newly-created unvegetated patches by exhibiting fast growth and support for all local ramets in order to exploit areas in which it could not otherwise compete. It may quickly recruit to locally uninhabited patches through prolific lateral branching and fast horizontal growth. While these attributes may allow it to compete effectively in periodically disturbed areas, if the distribution of this species becomes limited to stable areas it may eventually be outcompeted by more stable-selected plants represented by the larger-bodied seagrasses (Durako et al. 2003). In addition, the physiological attributes of Johnson's seagrass may limit growth (i.e., spreading) over large areas of substrate if the substrate is somehow altered (e.g., dredged to a depth that would preclude future recruitment of Johnson's seagrass); therefore, its ability to recover from widespread habitat loss may be limited. The clonal and reproductive growth characteristics of Johnson's sea grass result in its distribution being patchy, non-contiguous, and temporally fluctuating. These attributes suggest that colonization between broadly disjunctive areas is likely difficult and that the species is vulnerable to becoming endangered if it is removed from large areas within its range by natural or anthropogenic means.

Threats

The emerging consensus among seagrass experts on the Recovery Team is that the possibility of mortality due to reduced salinity over long periods of time is the most clearly identified threat to the species' long-term persistence. Some studies have shown that Johnson's seagrass has a wide tolerance for salinity. Conversely, short-term experiments have shown reduced photosynthesis and increased mortality at low salinities (<10 psu [practical salinity units, equivalent to parts per thousand]). Longer duration mesocosm experiments have resulted in 100% mortality of Johnson's seagrass after 10 days at salinities <10 psu (Kahn and Durako 2008). The Recovery Team has determined that the most significant threat to the species is the present or threatened destruction, modification, or curtailment of its habitat or range through water management practices and stochastic environmental factors that can alter the salinity of its habitat. Given that it is not uncommon for salinities to decline below 15 to 20 psu in its range (Steward et al. 2006), and that a number of natural and human-related factors can affect salinity throughout its range, the Recovery Team identified reduced salinity as a potential significant threat to the species because the potential for long-term mortality over a large scale could counteract the life history strategy the species uses to persist in the face of numerous, ongoing, environmental impacts. In previous reviews, including the critical habitat listing rule and the 2002 Recovery Plan, several additional factors were considered threats: (1) dredging and filling, (2) construction and shading from in-and over-water structures, (3) propeller scarring and anchor mooring, (4) trampling, (5) storms, and (6) siltation. In reviewing all information available since the original listing, the Recovery Team conducted assessments of each of these factors and has been unable to confirm that any of these pose a significant threat to the persistence and recovery of the species. A brief discussion of these factors follows.

Routine maintenance dredging associated with the constant movement of sediments in and around inlets may affect seagrasses by direct removal, light limitation due to turbidity, and burial from sedimentation. The disturbance of sediments can also destabilize the benthic community. Altering benthic topography or burying the plants may remove them from the photic zone. Permitted dredging of channels, basins, and other in- and on-water construction projects cause loss of Johnson's seagrass and its habitat through direct removal of the plants, fragmentation of habitat, shading, turbidity, and sedimentation. Although dredge-and-fill activities can and do adversely affect Johnson's seagrass and its designated critical habitat, these activities and the construction of in- and over-water structures are closely scrutinized through federal, state, and local permitting programs. The USACE, under Section 404 of the CWA and Section 10 of the RHA, has federal authority over the issuance of dredge-and-fill permits. These permits include language to protect and conserve seagrasses through field evaluations, consultations, and recommendations to avoid, minimize, and mitigate for impacts to seagrasses.

The USACE's SPGP authorizes permits for in-water construction activities such as shoreline stabilization projects; construction of boat ramps, boat launch areas, and structures associated with such ramps or launch areas; docks, pier associated facilities, and other minor piling-supported structures; and maintenance dredging of canals and channels. The previous SPGP (January 1, 2000 to March 31, 2009) was utilized 19,927 times, of which 52% was to issue permits associated with single-family docks (Stu Santos, USACE, pers. comm. to J. Cavanaugh, NMFS PRD, November 2012). The USACE requested consultation on the SPGP on October 30, 2009. NMFS completed a new biological opinion July 25, 2011 on SPGP that was valid through July 25, 2016.

The current SPGP does not allow construction in Johnson's seagrass critical habitat. For a dock to be authorized under the SPGP, the applicant must fully comply with the USACE's and NMFS's October 2002 *Key for Construction Conditions for Docks or Other Minor Structures Constructed in or Over Johnson's Seagrass (Halophila johnsonii)* and the associated August 2001 *Dock Construction Guidelines in Florida for Docks or Other Minor Structures Constructed in or over Submerged Aquatic Vegetation, Marsh, or Mangrove Habitat*. Additional PDCs apply to projects authorized under the SPGP (e.g., docks must be $\leq$ 1,000 ft^2). The Recovery Team has worked with NMFS's PRD and Habitat Conservation Division staff to develop and improve guidelines for site monitoring methods (Greening and Holland 2003), dock construction guidelines (Shafer et al. 2008), and best management practices to minimize the impact of docks on Johnson's seagrass (Landry et al. 2008).

Shafer et al. (2008) emphasized avoidance of seagrasses as a first priority in their study evaluating the regulatory construction guidelines to minimize impacts to seagrasses from single-family residential dock structures in Florida and Puerto Rico. While most dock construction is subject to the construction guidelines (i.e., the USACE's and NMFS's jointly-developed October 2002 *Key for Construction Conditions for Docks or Other Minor Structures Constructed in or over Johnson's Seagrass* and the 2001 guidelines), some docks meeting certain provisions are exempt from state permitting[46] and contribute to loss of Johnson's seagrass through construction impacts and shading. In Florida, the USACE's SPGP authorizes permits for the construction of docks, boat ramps, piers, maintenance dredging, and the construction of other minor over-water structures. The USACE is required to consult with NMFS under Section 7 of the ESA on the effects of implementing the SPGP; therefore, anticipated effects to Johnson's seagrass from implementation of the SPGP would be considered during ESA consultation between the USACE and NMFS. As is noted above, NMFS previously issued a Biological Opinion on the SPGP, which was effective until July 25, 2016. NMFS provides conservation recommendations in its Biological Opinions that, if implemented, would benefit Johnson's seagrass.

The Recovery Team has identified weaknesses in the oversight practices of state and federal agencies in the permitting process for some or all of the activities discussed above, due to budget, staffing, and technological limitations. The need for post-construction permit compliance and enforcement for dock structures in Florida and Puerto Rico has been discussed in Shafer et al. (2008). The Recovery Team also identified difficulties in monitoring Johnson's

[46] http://www.dep.state.fl.us/central/Home/SLERP/Docks/sfdock.pdf

seagrass—a rare and patchily-distributed species—in single-event surveys associated with permit applications, and continues to work with collaborators to improve monitoring methods. While it is recognized that dredging and filling projects and construction and shading from in- and over-water structures can adversely affect Johnson's seagrass and its habitat, the Recovery Team determined that these activities are typically local and small-scale. The deficiencies in the permitting process were not presently a significant threat to the survival of Johnson's seagrass because they will not individually or cumulatively result in long-term, large-scale mortality of Johnson's seagrass, nor preclude the species from its strategy of recolonizing areas.

Propeller scarring and improper anchoring are known to adversely affect seagrasses (Kenworthy et al. 2002; Sargent et al. 1995). These activities can severely disrupt the benthic habitat by uprooting plants, severing rhizomes, destabilizing sediments, and significantly reducing the viability of the seagrass community. Propeller dredging and improper anchoring in shallow areas are major disturbances to even the most robust seagrasses. This destruction is expected to worsen with the predicted increase in boating activity within Florida. The Florida Department of Highway Safety and Motor Vehicles (http://www.flhsmv.gov/html/safety.html) reported 963,057 registered commercial and recreational vessels (including canoes) statewide in fiscal year 2007. Registrations declined to 787,780 in fiscal year 2012, likely due to the economic downturn. However, this number is likely to increase based on Florida's projected population growth from 18 million in 2006 to 25 million in 2025 (www.propertytaxreform.state.f1/docs/eo06141.pdf). An increase in the number of registered vessels will likely lead to an increase in adverse effects to seagrasses caused by propeller dredging/scarring.

Other indirect effects associated with motor vessels include turbidity from operating in shallow water, dock construction and repairs, marina expansion, and inlet maintenance dredging. These activities and impacts are also likely to increase (NMFS 2007a). Damage to seagrasses from propeller scarring and improper anchoring by motor vessels is recognized as a significant resource management problem in Florida (Sargent et al. 1995). A number of local, state, and federal statutes protect seagrasses from damage due to vessel impacts, and a number of conservation measures, including the designation of vessel control zones, signage, mooring fields, and public awareness campaigns, are directed at minimizing vessel damage to seagrasses. Despite these efforts, vessel damage can have significant local and small-scale (1 m^2 to 100 m^2) impacts on seagrasses (Kirsch et al. 2005), but there is no direct evidence that these small-scale local effects are so widespread that they are a threat to the persistence and recovery of Johnson's seagrass.

Trampling of seagrass beds, a secondary effect of recreational boating, also disturbs seagrass habitat, but is a lesser concern. Trampling damages seagrasses by pushing leaves into the sediment and crushing or breaking the leaves and rhizomes. Since the designation of critical habitat; however, there have been no documented observations or reports of damage by trampling, and if there were, they would be small-scale and local. Therefore, the Recovery Team determined that trampling does not constitute a significant threat to the survival or recovery of Johnson's seagrass.

Large-scale weather events such as tropical storms and hurricanes, while often generating runoff conditions that decrease water quality, also produce conditions (wind setup and abrupt water elevation changes) that can increase flushing rates. The effects of storms can be complex. There are several specifically documented storm effects on seagrasses: (1) scouring and erosion of sediments; (2) erosion of seeds and plants by waves, currents, and surge; (3) burial by shifting sand; (4) turbidity; and (5) discharge of freshwater, including inorganic and organic constituents in the effluents (Steward et al. 2006). Storm effects may be chronic, e.g., due to seasonal weather cycles, or acute, such as the effects of strong thunderstorms or tropical cyclones. Studies have demonstrated that healthy, intact seagrass meadows are generally resistant to physical degradation from severe storms, whereas damaged seagrass beds may not be as resilient (Fonseca et al. 2000; Whitfield et al. 2002). In the late summer and early fall of 2004, a total of 4 hurricanes passed directly over the northern range (with wind strengths at landfall from <39 to 120 miles per hour) of Johnson's seagrass in the Indian River Lagoon. A post-hurricane random survey in the area of the Indian River Lagoon affected by the 4 hurricanes indicated the presence of Johnson's seagrass was similar to that reported by the St. Johns River Water Management District transect surveys prior to the storms. This indicates that while the species may temporarily decline, under the right conditions it can return quickly (Virnstein and Morris 2007). Furthermore, despite evidence of longer-term reductions in salinity, increased water turbidity, and increased water color associated with higher than average precipitation in the spring of 2005, there was no evidence of long-term chronic impacts to seagrasses and no direct evidence of damage to Johnson's seagrass that could be considered a threat to the survival of the species (Steward et al. 2006).

Silt derived from adjacent land and shoreline erosion, river and canal discharges, inlets, and internally re-suspended materials can lead to the accumulation of material on plant leaves causing light deprivation. Deposition of silt can also lead to the burial of plants, accumulation of organic matter, and anoxic sediments. Johnson's seagrass grows in a wide range of environments, including those that are exposed to siltation from all the potential sources. Documentation of the direct effects of siltation on seagrasses is generally unavailable. The absence of seagrass has been associated with the formation of muck deposits; however, and localized areas of flocculent, anoxic sediments in isolated basins and segments of the Indian River Lagoon have been observed. Furthermore, sustained siltation experimentally simulated by complete burial for at least 12 days may cause mortality of Johnson's seagrass (W.J. Kenworthy, NOAA's Center for Coastal Fisheries and Habitat Reserach, Beaufort, North Carolina, unpublished data). In general, the effects of siltation are localized and not widespread and are not likely to threaten the survival of the species.

In addition to the 6 factors discussed above, we also consider the effects of altered water quality on Johnson's seagrass. Availability of light is one of the most significant environmental factors affecting the survival, growth, and distribution of seagrasses (Abal et al. 1994; Bulthuis 1983; Dennison 1987; Kenworthy and Fonseca 1996). Water quality and the penetration of light are affected by turbidity (suspended solids), color, nutrients, and chlorophyll, and are major factors controlling the distribution and abundance of sea grasses (Dennison 1987; Kenworthy and Fonseca 1996) (Kenworthy and Haunert 1991). Increases in color and turbidity values throughout the range of Johnson's seagrass generally are caused by high flows of freshwater discharged from water management canals, which can also reduce salinity. Wastewater and storm water discharges, as well as from land runoff and subterranean sources, are also causes of increased turbidity. Degradation of water quality due to increased land use and poor water management practices continues to threaten the welfare of seagrass communities. Declines in water quality are likely to worsen, unless water management and land use practices can curb or eliminate freshwater discharges and minimize inputs of sediments and nutrients. A nutrient-rich environment caused by inorganic and organic nitrogen and phosphorous loading via urban and agricultural runoff stimulates increased algal growth that may smother or shade Johnson's seagrass, or shade rooted vegetation, and diminish the oxygen content of the water. Low oxygen conditions have a demonstrated negative impact on seagrasses and associated communities.

A long-term monitoring program implemented by the St. Johns River Water Management District assessed overall estuarine water quality in the northern and central region of Johnson's seagrass geographic range as mostly good (67%)(Winkler and Ceric 2006). Only 28% of the stations sampled had fair water quality, while 6% had poor quality. Fifty percent of the sampled estuarine sites were improving, while 6% were degrading, so many more sites were improving than were degrading. Forty-two percent of the lagoon sites had an insignificant trend while 3% had insufficient data to determine a trend. As water management experts have now become confident in the association between water quality and seagrass depth distribution, they have begun establishing water quality targets for the Indian River Lagoon based on seagrass as an indicator (Steward et al. 2005). There is a strong positive correlation between seagrass depth distribution and water quality, which enables managers to predict where seagrasses will grow based on water quality and the availability of light. Given that at least half of the sampling stations were indicating long-term improvements in water quality, it can be assumed that seagrass abundance should not be negatively impacted if water and land use management programs continue to be effective. For example, carefully controlling or reducing water flows from discharge canals will moderate salinity fluctuations and reduce turbidity, color, and light attenuation values.

There has not been a comprehensive assessment of water quality published or reported for the southern geographic range of Johnson's seagrass similar to the St. Johns River Water Management District study performed in the northern and central range. However, water quality experts at the South Florida Water Management District (SFWMD) confirm that efforts are underway to synthesize water quality information and to gain a more comprehensive understanding of the long-term status and trends of water quality in the southern range of Johnson's seagrass (Dan Crean, SFWMD, pers. comm. to Sarah Heberling, NMFS PRD, March 2011). Of particular concern is an assessment of the impacts of fluctuations in water quality corresponding with variation in climatology, especially "wet years" versus "dry years" variation. Future recovery efforts should include close coordination with the SFWMD and county environmental management agencies in Palm Beach and Dade Counties to evaluate the status and trends of water quality in these regions of the species' distribution.

Climate Change Effects on Seagrasses

Here, we consider the possible effects of climate change (i.e., rising temperatures and sea levels) on seagrasses in general and on Johnson's seagrass in particular. The earth's climate is projected to warm between 2° and 4°C by 2100, and similar projections have been made for marine systems (Sheppard and Rioja-Nieto 2005). At the margins of temperate and tropical bio-regions and within tidally-restricted areas where sea grasses are growing at their physiological limits, increased temperatures may result in losses of seagrasses and/or shifts in species composition (Short et al. 2007). The response of seagrasses to increased water temperatures will depend on the thermal tolerance of the different species and their optimum temperature for photosynthesis, respiration, and growth (Short and Neckles 1999). With future climate change and potentially warmer temperatures, there may be a 1 m-5 m rise in the seawater levels by 2100 when taking into account the thermal expansion of ocean water and melting of ocean glaciers. Rising sea levels may adversely impact seagrass communities due to increases in water depths above present meadows, reducing available light. Climate change may also reduce light by shifting weather patterns to cause increased cloudiness. Changing currents may cause erosion, increased turbidity and seawater intrusions higher up on land or into estuaries and rivers, which could increase landward seagrass colonization (Short and Neckles 1999). A landward migration of seagrasses with rising sea levels is a potential benefit, so long as suitable substrate is available for colonization.

It is uncertain how Johnson's seagrass will adapt to rising sea levels and temperatures. Much depends on how much and how quickly temperatures increase. For example, Johnson's seagrass that grows intertidally (e.g., in some parts of the Lake Worth Lagoon) may be affected by a slight change in temperature (since it may already be surviving under less than optimal conditions). However, this may be ameliorated with rising sea levels; assuming Johnson's seagrass would migrate landward with rising sea levels and assuming that suitable substrate would be available for a landward migration. However, rising sea levels could also adversely impact seagrass communities due to increases in water depths above existing meadows reducing available light.

Reduction in light availability may benefit some seagrass species (e.g., *Halophila* species) that require less light compared to the larger, canopy-forming species; therefore, much depends on the thermal tolerance of the different seagrass species and their optimum temperature for photosynthesis, respiration, and growth (Short and Neckles 1999). While sea level has changed many times during the evolutionary history of Johnson's seagrass, it is uncertain how this species will fare when considering the combined effects of rising temperatures and sea levels in conjunction with other stressors such as reduced salinity from freshwater runoff. It has been shown that evolutionary change in a species can occur within a few generations (Rice and Emery 2003), thus making it possible for seagrasses to cope if the changes occur at a rate slow enough to allow for adaptation.

Status Summary

Based on the results of 14 years of monitoring in the species' northern range (1994-2007) and 3 years of monitoring in the species' southern range (2006-2009), there has been no significant change in the northern or southern range limits of Johnson's seagrass (NMFS 2007a). It appears that the populations in the northern range are stable and capable of sustaining themselves despite stochastic events related to severe storms (Steward et al. 2006) and fluctuating climatology. Longer-term monitoring data are needed to confirm the stability of the southern distribution of the species (NMFS 2007a). However, based on the results of the southern transect sampling, it appears there is a relatively continuous, although patchy, distribution of Johnson's seagrass from Jupiter Inlet to Virginia Key, at least during periods of relatively good environmental conditions and no significant large-scale disturbances. Larger seagrasses, predominantly turtle grass *(Thalassia testudinum)*, begin to out-compete Johnson's seagrass in the southern range. While there has been a slight extension in the known northern range (Virnstein and Hall 2009), the limit of the southern range in the vicinity of Virginia Key (latitude 25.75°N) appears to be stable. There have been no reports of this species further south of the currently known southern distribution.

As discussed in the *Threats* section, the Recovery Team has determined that the possibility of mortality due to reduced salinity over long periods of time is a potential significant threat to the species. The other potential threats discussed above (i.e., dredging/filling, construction and shading from in and over-water structures, propeller scarring and anchor mooring, trampling, storms, and siltation) were determined to be local and small-scale and are not considered threats to the persistence and recovery of the species. It is uncertain how Johnson's seagrass will be affected by the synergistic effects of rising temperatures and sea levels associated with climate change (in conjunction with other stressors such as reduced salinity from freshwater runoff). However, evolutionary change in a species can occur within a few generations (Rice and Emery 2003), thus making it possible for seagrasses to cope if the changes occur at a rate slow enough to allow for adaptation.

3.2 Status of Critical Habitat Likely to be Adversely Affected

3.2.1 Johnson's Seagrass Critical Habitat

NMFS designated Johnson's seagrass critical habitat on April 5, 2000 (65 FR 17786; see also, 50 CFR 226.213). The specific areas occupied by Johnson's seagrass and designated by NMFS as critical habitat are those with 1 or more of the following criteria:

1. Locations with populations that have persisted for 10 years
2. Locations with persistent flowering populations
3. Locations at the northern and southern range limits of the species
4. Locations with unique genetic diversity
5. Locations with a documented high abundance of Johnson's seagrass compared to other areas in the species' range

Ten areas (units) within the range of Johnson's seagrass (approximately 200 km of coastline from Sebastian Inlet to northern Biscayne Bay, Florida) are designated as Johnson's seagrass critical habitat (see Table 64). The total acreage of critical habitat for Johnson's seagrass range-wide is roughly 22,574 ac (NMFS 2002).

Table 64. Designated critical habitat units for Johnson's seagrass

Unit A	A portion of the Indian River, Florida, north of the Sebastian Inlet Channel
Unit B	A portion of the Indian River, Florida, south of the Sebastian Inlet Channel
Unit C	A portion of the Indian River Lagoon, Florida, in the vicinity of the Fort Pierce Inlet
Unit D	A portion of the Indian River Lagoon, Florida, north of the St. Lucie Inlet
Unit E	A portion of Hobe Sound, Florida, excluding the federally-marked navigation channel of the ICW
Unit F	A portion of the south side of Jupiter Inlet, Florida
Unit G	A portion of Lake Worth, Florida, north of Bingham Island
Unit H	A portion of Lake Worth Lagoon, Florida, located just north of the Boynton Inlet
Unit I	A portion of northeast Lake Wyman, Boca Raton, Florida, excluding the federally-marked navigation channel of the ICW
Unit J	A portion of northern Biscayne Bay, Florida, including all parts of the Biscayne Bay Aquatic Preserve excluding the Oleta River, Miami River, and Little River beyond their mouths, the federally marked navigation channel of the Intracoastal Waterway, and all existing federally authorized navigation channels, basins, and berths at the Port of Miami to the currently documented southernmost range of Johnson's seagrass, Central Key Biscayne

The physical habitat that supports Johnson's seagrass includes both shallow intertidal and deeper subtidal zones. The species thrives either in water that is clear and deep (2-5 m) or in water that is shallow and turbid. In tidal channels, it inhabits coarse sand substrates. The spread of the species into new areas is limited by its reproductive potential. Johnson's seagrass possesses only female flowers; thus vegetative propagation, most likely through asexual branching, appears to be its only means of reproduction and dispersal. If an established community is disturbed, regrowth and reestablishment are extremely unlikely. This species' method of reproduction impedes the ability to increase distribution as establishment of new vegetation requires considerable stability in environmental conditions and protection from human-induced disturbances.

Essential Features of Critical Habitat

NMFS identified 4 habitat features essential for the conservation of Johnson's seagrass: (1) adequate water quality, defined as being free from nutrient over-enrichment by inorganic and organic nitrogen and phosphorous or other inputs that create low oxygen conditions; (2) adequate salinity levels, indicating a lack of very frequent or constant discharges of fresh or low-salinity waters; (3) adequate water transparency, which would allow sunlight necessary for photosynthesis; and (4) stable, unconsolidated sediments that are free from physical disturbance. All 4 essential features must be present in an area for it to function as critical habitat for Johnson's seagrass.

Status and Threats
A wide range of activities, many funded authorized or carried out by federal agencies, have and will continue to affect the essential habitat requirements of Johnson's seagrass. These are generally the same activities that may affect the species itself, and include: (1) vessel traffic and the resulting propeller dredging; (2) dredge and fill projects; (3) dock, marina, and bridge construction; (4) water pollution; and (5) land use practices (shoreline development, agriculture, and aquaculture).

Vessel traffic has the potential to affect Johnson's seagrass critical habitat by reducing water transparency. Operation of vessels in shallow water environments often leads to the suspension of sediments due to the spinning of propellers on or close to the bottom. Suspended sediments reduce water transparency and the depth to which sunlight penetrates the water column. Populations of Johnson's seagrass that inhabit shallow water and water close to inlets where vessel traffic is concentrated are likely to be most affected. This effect is expected to worsen with increases in boating activity.

The dredging of bottom sediments to maintain, or in some cases create, inlets, canals, and navigation channels can directly affect essential features of Johnson's seagrass critical habitat. Dredging results in turbidity through the suspension of sediments. As discussed previously, the suspension of sediments reduces water transparency and the depth to which sunlight can penetrate the water column. The suspension of sediments from dredging can also resuspend nutrients, which could result in over-enrichment and/or reduce dissolved oxygen levels. Further, dredging can destabilize sediments and alter both the shape and depth of the bottom within the dredged footprint. This may affect the ability of the critical habitat to function through the removal or modification of essential features.

Dock, marina, and bridge construction leads to loss of habitat via construction impacts (e.g., pile installation) and shading. Similar to dredging, installation of piles for docks or bridges can result in increased turbidity that can negatively impact water transparency over short durations. Additionally, installed piles also replace the stable, unconsolidated bottom sediments essential for the species. Completed structures can have long-term effects on critical habitat in the surrounding area because of the shade they produce. While shading does not affect water transparency directly, it does affect the amount and/or duration of sunlight that can reach the bottom. The threat posed by dock, marina, and bridge construction is especially apparent in coastal areas where Johnson's seagrass is found.

Other threats include inputs from adjacent land use. Johnson's seagrass critical habitat located in proximity to rivers, canal mouths, or other discharge structures is affected by land use within the watershed. Waters with low salinity that are highly colored and often polluted are discharged to the estuarine environment. This can impact salinity, water quality, and water transparency, all essential features of Johnson's seagrass critical habitat. Frequent pulses of freshwater discharge to an estuarine area may decrease salinity of the habitat and provoke physiological stress to the species. Nutrient over-enrichment, caused by inorganic and organic nitrogen and phosphorous loading via urban and agricultural land run-off, stimulates increased algal growth, decreased water transparency, and diminished oxygen content within the water. Low oxygen conditions have a demonstrated negative impact on seagrasses and associated communities. Discharges can also contain colored waters stained by upland vegetation or pollutants. Colored waters released into these areas reduce the amount of sunlight available for photosynthesis by rapidly reducing the amount of shorter wavelength light that reaches the bottom. In general, threats from adjacent land use will be ongoing, randomly occurring events that follow storm events.

3.2.2 Smalltooth Sawfish Critical Habitat

Smalltooth Sawfish Critical Habitat
The U.S. DPS of smalltooth sawfish was listed as endangered on April 1, 2003; however, at that time, NMFS was unable to determine critical habitat. After funding additional studies necessary for the identification of specific habitats and environmental features important for the conservation of the species, establishing a smalltooth sawfish recovery team, and reviewing the best scientific data available, NMFS issued a Final Rule (74 FR 45353; see also, 50 CFR § 226.218) to designate critical habitat for the U.S. DPS of smalltooth sawfish on September 2, 2009. The critical habitat consists of 2 units located along the southwestern coast of Florida: the CHEU, which is comprised of approximately 221,459 ac (346 mi^2) of coastal habitat, and the TTIEU, which is comprised of approximately 619,013 ac (967 mi^2) of coastal habitat.

Critical Habitat Unit Impacted by these Actions
This consultation focuses on an activity occurring in the both CHEU and TTIEU. The CHEU encompasses portions of Charlotte and Lee Counties (Figure 25). The CHEU is comprised of Charlotte Harbor, Gasparilla Sound, Matlacha Pass, Pine Island Sound, San Carlos Bay, and Estero Bay. The unit is fed by the Myakka and Peace Rivers to the north and the Caloosahatchee River to the east. A series of passes between barrier islands connect the CHEU with the Gulf of Mexico. The CHEU is a relatively shallow estuary with large areas of submerged aquatic vegetation, oyster bars, saltwater marsh, freshwater wetlands, and mangroves. Freshwater flows from the Caloosahatchee River are controlled by the Franklin Lock and Dam, which periodically releases water, which thereby affects downstream salinity regimes. The CHEU unit boundaries are defined in detail in the Final Rule (74 FR 45353; see also 50 CFR § 226.218).

The TTIEU is located within Collier, Monroe, and Miami-Dade Counties (see Figure 25). The unit includes the waters of Everglades National Park, Florida Bay, Everglades City, Cape Romano-Ten Thousand Islands Aquatic Preserve, and the portion of Rookery Bay Aquatic Preserve south of state road 92. There are few man-made developments within the unit as the vast majority is federally protected. Developed areas include the areas of Goodland, Everglades City, Plantation, Chokoloskee, and Flamingo. The unit receives freshwater from a number of creeks and rivers found along the coast, including those associated with the Shark River Slough, which originates in and drains central Florida. The TTIEU is a relatively shallow nearshore environment with large areas of submerged aquatic vegetation, oyster bars, mud banks, and mangroves. The TTIEU boundaries are defined in detail in the final rule (74 FR 45353; see also 50 CFR § 226.218).

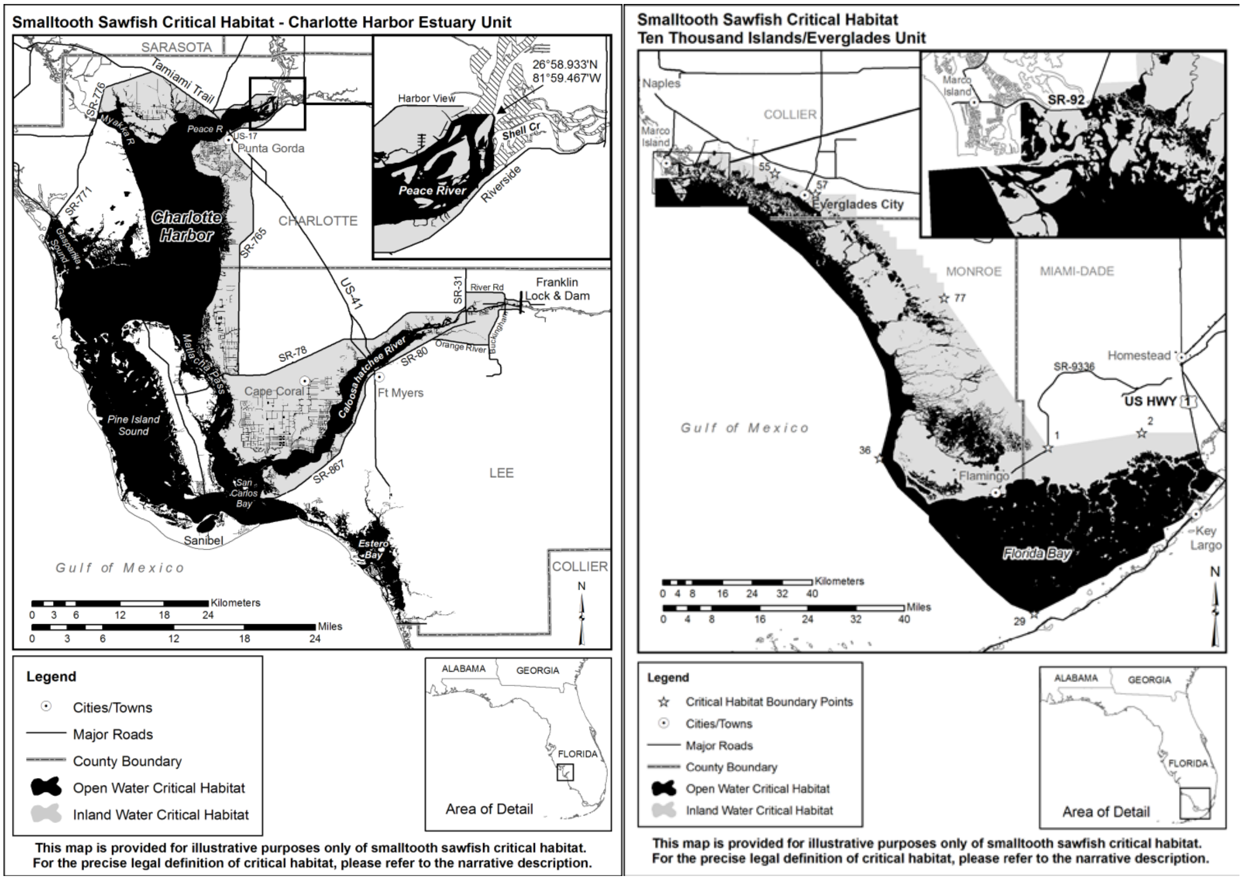

Figure 25. Map of smalltooth sawfish critical habitat –CHEU and TTIEU

Essential Features of Critical Habitat

The recovery plan developed for the smalltooth sawfish, which represents NMFS's best judgment about the objectives and actions necessary for the species' recovery, identified a need to increase the number of juvenile smalltooth sawfish developing into adulthood by protecting or restoring nursery habitat (NMFS 2009). NMFS determined that without sufficient habitat, the population was unlikely to increase to a level associated with low extinction risk and de-listing. Therefore, NMFS identified 2 habitat features essential for the conservation of this species: (1) red mangroves, and (2) shallow, euryhaline habitats (shallow, euryhaline habitats) characterized by water depths between the MHWL and -3 ft (-0.9 m) MLLW (Final Rule, 74 FR 45353). These essential features of critical habitat provide juveniles refuge from predation and forage opportunities within their nursery habitat. One or both of these essential features must be present in an action area for it to function as critical habitat for smalltooth sawfish.

Habitat Use

Juvenile smalltooth sawfish, identified as those up to 3 years of age or approximately 8 ft (2.4 m) in length (Simpfendorfer et al. 2008), inhabit the shallow waters of estuaries and can be found in sheltered bays, dredged canals, along banks and sandbars, and in rivers (NMFS 2000). 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 (Simpfendorfer 2001; 2003). The structural complexity of red mangrove prop roots creates a unique habitat used by a variety of fish, invertebrates, and birds. Juvenile smalltooth sawfish, particularly young-of-the-year (measuring less than 39.4 in (100 cm) in length), use these areas as both refuge from predators and forage grounds, taking advantage of the large number of fish and invertebrates found there.

Tracking data from the Caloosahatchee River in Florida indicate very shallow depths and specific salinity ranges are important abiotic factors influencing juvenile smalltooth sawfish movement patterns, habitat use, and distribution (Simpfendorfer et al. 2011). An acoustic tagging study in a developed region of Charlotte Harbor, Florida, identified the importance of mangroves in close proximity to shallow-water habitat for juvenile smalltooth sawfish, stating that juveniles generally occur in shallow water within 328 ft (100 m) of mangrove shorelines (Simpfendorfer et al. 2010). Juvenile smalltooth sawfish spend the majority of their time in waters shallower than 13 ft (4 m) deep (Simpfendorfer et al. 2010) and are seldom found deeper than 32 ft (10 m) (Poulakis and Seitz 2004). Simpfendorfer et al. (2010) also indicated the following developmental differences in habitat use: the smallest young-of-the-year juveniles generally used water shallower than 1.6 ft (0.5 m), had small home ranges, 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 undergo small movements coinciding with changing tidal stages. These movements often involve moving from shallow sandbars at low tide and among 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 and eventually reach sexual maturity.

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 capture rates during random sampling events within the estuary (Poulakis 2012; Poulakis et al. 2011). The areas, which were termed “hotspots,” correspond with areas where public encounters are most frequently reported. Use of these hotspots can be variable within and among years based on the amount and timing of freshwater inflow. Smalltooth sawfish use hotspots further upriver during drought (i.e., high salinity) conditions 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 (e.g., presence or absence of predators and prey) or abiotic factors (e.g., salinity) influence this habitat selection. Still, they believe a variety of conditions in addition to salinity, such as temperature, dissolved oxygen, water depth, shoreline vegetation, and food availability, may influence smalltooth sawfish habitat selection (Poulakis et al. 2011).

Status and Threats to Critical Habitat

Modification and loss of smalltooth sawfish critical habitat is an ongoing threat contributing to the current status 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; USFWS 1999). Since then, rates of loss have decreased even though habitat loss continues.

Between 1998 and 2004, approximately 2,450 ac (3.8 mi^2) of intertidal wetlands consisting of mangroves or other estuarine shrubs were lost along the Atlantic and Gulf coasts of the United States (Stedman and Dahl 2008). In another study, Orlando et al. (1994) analyzed 18 major southeastern estuaries and recorded over 703 mile (1,131 km) of navigation channels and 9,844 mile (15,842 km) of shoreline with modifications. Additionally, changes to the natural freshwater flows into estuarine and marine waters through construction of canals and other water-control devices have altered the temperature, salinity, and nutrient regimes, reduced both wetlands and submerged aquatic vegetation coverage, and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Gilmore 1995; Quigley and Flannery 2002; Reddering 1988; Whitfield and Bruton 1989). Juvenile sawfish and their critical habitat are particularly vulnerable to these kinds of habitat losses or alterations due to the juveniles' affinity for (and developmental need of) shallow, estuarine systems. Although many forms of habitat modification are currently regulated, some permitted direct and/or indirect damage to habitat from increased urbanization still occurs and is expected to continue in the future.

In Florida, coastal development often involves the removal of mangroves, the armoring of shorelines through seawall construction, and the dredging of canals. This is especially apparent in master plan communities such as Cape Coral and Punta Gorda which are located within the Charlotte Harbor Estuary. These communities were created through dredge-and-fill projects to increase the amount of waterfront property available for development, but in doing so, developers removed the majority of red mangrove habitat from the area. The canals created by these communities require periodic dredging for boat access, further affecting the shallow, euryhaline essential feature of critical habitat. Development continues along the shorelines of Charlotte Harbor in the form of docks, boat ramps, shoreline armoring, utility projects, and navigation channel dredging.

To protect critical habitat, federal agencies must ensure that their activities are not likely to result in the destruction or adverse modification of the physical and biological features that are essential to the conservation of sawfish, or the species' ability to access and use these features (ESA Section 7(a)(2); see also 50 CFR 424.12(b) [discussing essential features]). Therefore, proposed actions that may impact critical habitat require an analysis of potential impacts to each essential feature. As mentioned previously, there are 2 essential features of smalltooth sawfish critical habitat: (1) red mangroves; and (2) shallow, euryhaline habitats characterized by water depths between the MHWL and -3 ft (-0.9 m) measured at MLLW. The USACE oversee the permitting process for residential and commercial marine development in the CHEU. The FDEP and their designated authorities also regulate mangrove removal in Florida. All red mangrove removal permit requests within smalltooth sawfish critical habitat necessitate ESA Section 7 consultation. NMFS PRD tracks the loss of these essential features of smalltooth sawfish critical habitat.

Threats to Critical Habitat

<u>Dock and Boat Ramp Construction</u>

The USACE recommends that applicants construct docks in accordance with the NMFS-USACE *Dock Construction Guidelines in Florida for Docks or Other Minor Structures Constructed in or over Submerged Aquatic Vegetation (SAV), Marsh, or Mangrove Habitat* ("Dock Construction Guidelines") when possible. The current dock construction guidelines allow for some amount of mangrove removal; however, it is typically restricted to either (1) trimming to facilitate a dock, or (2) complete removal up to the width of the dock extending toward open water, which the guidelines define as a width of 4 ft. Installation or replacement of boat ramps is often part of larger projects such as marinas, bridge approaches, and causeways where natural and previously created deepwater habitat access channels already exist. Boat ramps can result in the permanent loss of both the red mangrove and the shallow, euryhaline habitat features of critical habitat for smalltooth sawfish.

Marina Construction

Marinas have the potential to adversely affect aquatic habitats. Marinas are typically designed to be deeper than -3 ft MLLW to accommodate vessel traffic; therefore, most existing marinas lacking essential features are unlikely to function as critical habitat for smalltooth sawfish. The expansion of existing marinas and creation of new marinas can result in the permanent loss of large areas of this nursery habitat.

Bulkhead and Seawall Construction

Bulkheads and other shoreline stabilization structures are used to protect adjacent shorelines from wave and current action and to enhance water access. These projects may adversely impact critical habitat for smalltooth sawfish by removal of the essential features through direct filling and dredging to construct vertical or riprap seawalls. Generally, vegetation plantings, sloping riprap, or gabions are environmentally-preferred shoreline stabilization methods instead of vertical seawalls because they provide better quality fish and wildlife habitat. Nevertheless, placement of riprap material removes more of the shallow euryhaline essential feature than a vertical seawall. Also, many seawalls built along unconsolidated shorelines require the removal of red mangroves to accommodate the seawalls.

Cable, Pipeline, and Transmission Line Construction

While not as common as other activities, excavation of submerged lands is sometimes required for installing cables, pipelines, and transmission lines. Construction may also require temporary or permanent filling of submerged habitats. Open-cut trenching and installation of aerial transmission line footers are activities that have the ability to temporarily or permanently impact critical habitat for smalltooth sawfish.

Transportation Infrastructure Construction

Potential adverse effects from federal transportation projects in smalltooth sawfish critical habitat (CHEU) include operations of the Federal Highway Administration, USACE, and FEMA. Construction of road improvement projects typically follow the existing alignments and expand to compensate for the increase in public use. Transportation projects may impact critical habitat for smalltooth sawfish through installation of bridge footers, fenders, piles, and abutment armoring, or through removal of existing bridge materials by blasting or mechanical efforts.

Dredging

Riverine, nearshore, and offshore areas are dredged for navigation, construction of infrastructure, and marine mining. An analysis of 18 major southeastern estuaries conducted in 1993-1994 demonstrated that over 7,000 km of navigation channels have already been dredged (Orlando et al. 1994). Habitat effects of dredging include the loss of submerged habitats by disposal of excavated materials, turbidity and siltation effects, contaminant release, alteration of hydrodynamic regimes, and fragmentation of physical habitats (GMFMC 1998; GMFMC 2005; SAFMC 1998). In the CHEU, dredging to maintain canals and channels constructed prior to the critical habitat designation, limits the amount of available shallow, euryhaline essential feature to the edges of waterways and these dredging activities can disturb juveniles that are using these areas. At the time of critical habitat designation, many previously dredged channels and canals existed within the boundaries of the critical habitat units; however, we are unsure which of those contained the shallow-water essential feature at that time. It is likely that many of these channels and canals were originally dredged deeper than -3 ft MLLW, but they have since shoaled in and now contain the essential feature of shallow, euryhaline habitat. Therefore, maintenance dredging impacts are counted as a loss to this essential feature, even though the areas may or may not have contained the essential feature at time of designation (see Figure 26 Diagrams A and B).

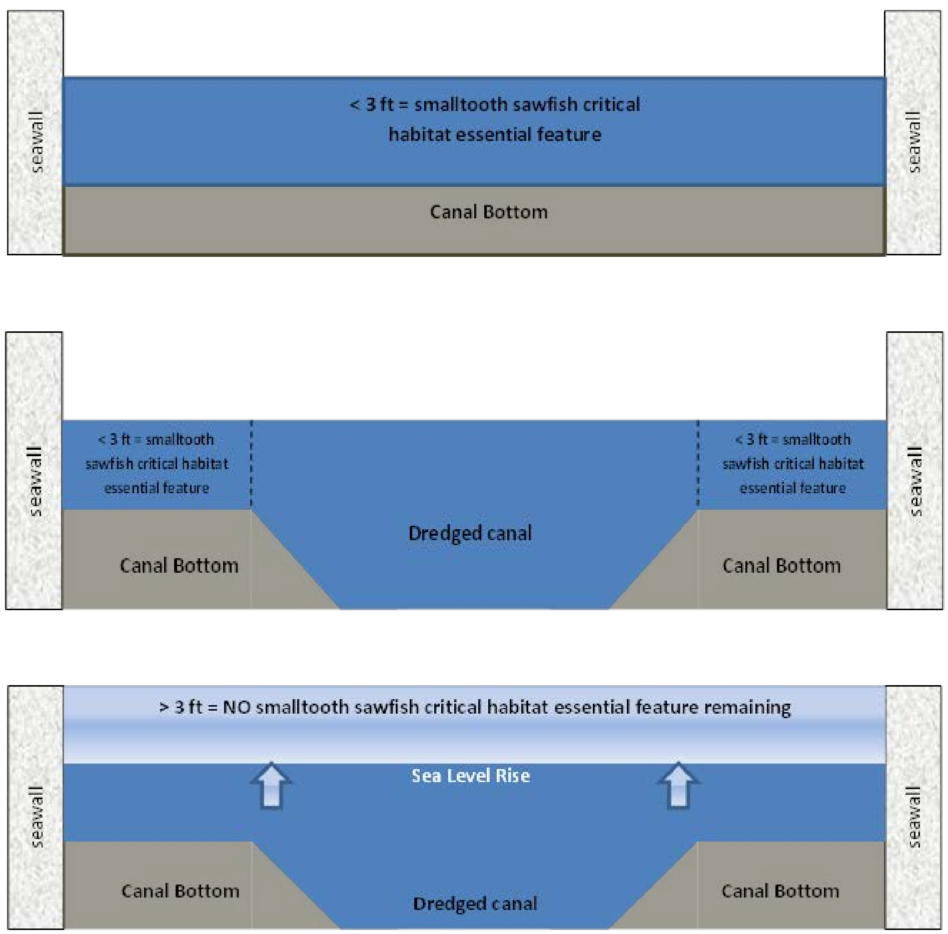

Figure 26. Diagram of a dredged channel
Diagram A depicts a cross section of a historically dredged channel/canal within the boundaries of the critical habitat units that has not been maintained. Diagram B depicts the typical cross section of a maintenance dredged channel/canal. Diagram C depicts a cross section of a maintained dredged channel/canal after sea level rise of > 1 ft.

Construction, Operations and Maintenance of Impoundments and Other Water Level Controls
Federal agencies such as the USACE have historically been involved in large water control projects in Florida. Agencies sometimes propose impounding rivers and tributaries for such purposes as flood control, salt water intrusion prevention, or creation of industrial, municipal, and agricultural water supplies. Projects to repair or replace water control structures may affect smalltooth sawfish critical habitat by limiting sufficient freshwater discharge which could alter the salinity of estuaries. The ability of an estuary to function as a nursery depends upon the quantity, timing, and input location of freshwater inflows (Garmestani and Percival 2005; Norton et al. 2012; USEPA 1994). Estuarine ecosystems are vulnerable to the following man-made disturbances: (1) decreases in seasonal inflow caused by the removal of freshwater upstream for agricultural, industrial, and domestic purposes; (2) contamination by industrial and sewage discharges; (3) agricultural runoff carrying pesticides, herbicides, and other toxic pollutants; and (4) eutrophication (e.g., influx of nutrients such as nitrates and phosphates most often from fertilizer runoff and sewage) caused by excessive nutrient inputs from a variety of nonpoint and point sources. Additionally, rivers and their tributaries are susceptible to natural disturbances, such as floods and droughts, whose effects can be exacerbated by these man-made disturbances.

As stated above, smalltooth sawfish show an affinity for a particular salinity range, moving downriver during wetter months and upriver during drier months to remain within that range (Simpfendorfer et al. 2011). Therefore, water management decisions that affect salinity regimes may impact the functionality of critical habitat. This may result in smalltooth sawfish following specific salinity gradients into less advantageous habitats (e.g., areas with less shallow-water or red mangrove habitat). Furthermore, large changes in water flow over short durations would likely escalate movement patterns for smalltooth sawfish, thereby increasing predation risk and energy output. Researchers are currently looking into the effects of large-scale freshwater discharges on smalltooth sawfish and their designated critical habitat. The most vulnerable portion of the juvenile sawfish population to water-management outfall projects appears to be smalltooth sawfish in their first year of life. Newborn smalltooth sawfish remain in smaller areas irrespective of salinity, which potentially exposes them to greater osmotic stress (a sudden change in the solute concentration around a cell, causing a rapid change in the movement of water across its cell membrane), and impacts the nursery functions of sawfish critical habitat (Poulakis et al. 2013; Simpfendorfer et al. 2011).

Climate Change Threats
The Intergovernmental Panel on Climate Change (IPCC) has stated that global climate change is unequivocal and its impacts to coastal resources may be significant (IPCC 2007). There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities (i.e., global warming mostly driven by the burning of fossil fuels). The latest report by the IPCC (2013) is more explicit, stating that, “science now shows with 95% certainty that human activity is the dominant cause of observed warming since the mid-twentieth century.” Some of the anticipated outcomes are sea level rise, increased frequency of severe weather events, and changes in air and water temperatures. NOAA’s climate change web portal provides information on the climate-related variability and changes that are exacerbated by human activities (http://www.climate.gov/#understandingClimate). The EPA’s climate change webpage also provides basic background information on these and other measured or anticipated effects (http://www.epa.gov/climatechange/index.html).

Though the impacts on smalltooth sawfish cannot, for the most part, be predicted with any degree of certainty, we can project some effects to sawfish critical habitat. We know that both essential features (red mangroves and shallow, euryhaline waters less than -3 ft deep at MLLW) will be impacted by climate change. Sea level rise is expected to exceed 3.3 ft (1 m) globally by 2100, according to the most recent publications, exceeding the estimates of the Fourth Assessment of the IPCC (Meehl et al. 2007; Pfeffer et al. 2008; Rahmstorf et al. 2009). Mean sea level rise projections have increased since the Fourth Assessment because of the improved physical understanding of the components of sea level, the improved agreement of process-based models with observations, and the inclusion of ice-sheet dynamical changes (IPCC 2013). A 1-m sea level rise in the state of Florida is within the range of recent estimates by 2080 (Pfeffer et al. 2008; Rahmstorf et al. 2009).

Sea level increases would affect the shallow-water essential feature of smalltooth sawfish critical habitat within the CHEU. A 2010 climate change study by the Massachusetts Institute of Technology forecasted sea level rise in a study area with significant overlap with the CHEU (Vargas-Moreno and Flaxman 2010). The study investigated possible trajectories of future transformation in Florida's Greater Everglades landscape relative to 4 main drivers: climate change, shifts in planning approaches and regulations, population change, and variations in financial resources. Massachusetts Institute of Technology used (IPCC 2007) sea level modeling data to forecast a range of sea level rise trajectories from low, to moderate, to high predictions (Figure 27). The effects of sea level rise on available shallow-water habitat for smalltooth sawfish would be exacerbated in areas where there is shoreline armoring (e.g., seawalls). This is especially true in canals where the centerlines are maintenance-dredged deeper than 3 ft (0.9 m) for boat accessibility. In these areas, the areas that currently contain the essential feature depth (less than -3 ft at MLLW) will be reduced along the edges of the canals as sea level rises (see previous Figure 26, Diagram C).

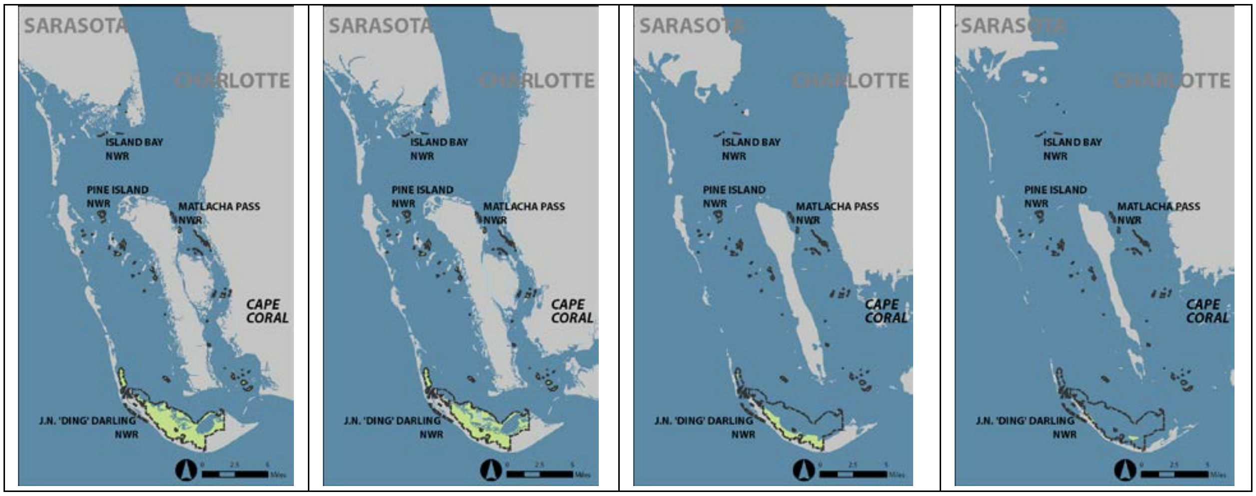

Figure 27. From left to right: current shoreline, + 3.5 in (+ 9 cm); + 18.5 in (+ 47 cm); and + 38.97 in (+ 99 cm) sea level rise by 2060.[47]

Along the Gulf Coast of Florida, and south Florida in particular, rises in sea level will impact mangrove resources. As sea levels rise, mangroves will be forced landward in order to remain at a preferred water inundation level and sediment surface elevation, which is necessary for successful growth. This retreat landward will not keep pace with conservative projected rates of elevation in sea level (Gilman et al. 2008). This forced landward progression poses the greatest threat to mangroves in areas where there is limited or no room for landward or lateral migration (Semeniuk 1994). Such is the case in areas of the CHEU where landward mangrove growth is restricted by shoreline armoring and coastal development. This man-made barrier will prohibit mangroves from moving landward and will result in the loss of the mangrove essential feature. Other threats to mangroves result from climate change: fluctuations in precipitation amounts and distribution, seawater temperature, carbon dioxide (CO_2) levels, and damage to mangroves from increasingly severe storms and hurricanes (McLeod and Salm 2006). A 25% increase in precipitation globally is predicted by 2050 (McLeod and Salm 2006), but the specific geographic distribution will vary, leading to increases and decreases in precipitation at the regional level. Changes in precipitation patterns caused by climate change may adversely affect the growth of mangroves and their distribution (Field 1995; Snedaker 1995). Decreases in precipitation will increase salinity and inhibit mangrove productivity, growth, seedling survival, and spatial coverage (Burchett et al. 1984). Decreases in precipitation may also change mangrove species composition, favoring more salt-tolerant types (Ellison 2010). Increases in precipitation may benefit some species of mangroves, increasing spatial coverage and allowing them to out-compete other salt marsh vegetation (Harty 2004). Even so, potential mangrove expansion

[47] Adapted from (Vargas-Moreno and Flaxman), M. Addressing the Challenges of Climate Change in the Greater Everglades Landscape. Project Sheet. November, 2010. Department of Urban Planning, Massachusetts Institute of Technology.

requires suitable habitat for mangroves to increase their range, which depends to a great extent on patterns and intensity of coastal development (i.e., bulkhead and seawall construction). Seawater temperature changes will have potential adverse effects on mangroves as well. Many species of mangroves show an optimal shoot density in sediment temperatures between 59°-77°F (15°-25°C) (Hutchings and Saenger 1987). Yet, at temperatures between 77°-95°F (25°-35°C), many species begin to show a decline in leaf structure and root and leaf formation rates (Saenger and Moverley 1985). Temperatures above 95°F lead to adverse effects on root structure and survivability of seedlings (UNESCO 1992) and temperatures above 100.4°F (38°C) lead to a cessation of photosynthesis and mangrove mortality (Andrews et al. 1984). Although impossible to forecast precisely, sea surface ocean temperatures are predicted to increase 1.8°-3.6°F (1°-2°C) by 2060 (Chapter 11 (IPCC 2013)), which will in turn impact underlying sediment temperatures along the coast. If mangroves shift pole-ward in response to temperature increases, they will at some point be limited by temperatures at the lower end of their optimal range and available recruitment area. This is especially true when considering already armored shorelines in residential communities such as those within and surrounding the CHEU of critical habitat for smalltooth sawfish.

As atmospheric CO_2 levels increase, mostly resulting from man-made causes (e.g., burning of fossil fuels), the world’s oceans will absorb much of this CO_2, causing potential increases in photosynthesis and mangrove growth rates. This increase in growth rate, however, would be limited by lower salinities expected from CO_2 absorption in the oceans (Ball et al. 1997), and by the availability of undeveloped coastline for mangroves to expand their range. A secondary effect of increased CO_2 concentrations in the oceans is the deleterious effect on coral reefs’ ability to absorb calcium carbonate (Hoegh-Guldberg et al. 2007), and subsequent reef erosion. Eroded reefs may not be able to buffer mangrove habitats from waves, especially during storm/hurricane events, causing additional physical effects.

Finally, the anticipated increase in the severity of storms and hurricanes may also impact mangroves. Tropical storms are expected to increase in intensity and/or frequency, which will directly impact existing mangroves that are already adversely impacted by increased seawater temperatures, CO_2, and changes in precipitation (Cahoon et al. 2003; Trenberth 2005). The combination of all of these factors may lead to reduced mangrove height (Ning et al. 2003). Further, intense storms could result in more severe storm surges and lead to potential changes in mangrove community composition, mortality, and recruitment (Gilman et al. 2006). Increased storms surges and flooding events could also affect mangroves’ ability to photosynthesize (Gilman et al. 2006) and the oxygen concentrations in the mangrove lenticels (Ellison 2010).

4 Environmental Baseline

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and the ecosystem, within the action area. By regulation, environmental baseline for Biological Opinions include the past and present impacts of all state, federal, or private actions and other human activities in the action area. We identify the anticipated impacts of all proposed federal projects in the specific action area of the consultation at issue that have already undergone formal or early Section 7 consultation as well as the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02, emphasis added).

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 designated critical habitat that occur in an action area and that will be exposed to effects from the actions under consultation. This is important because, in some phenotypic states or life history stages, listed individuals 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. The same is true for localized populations of endangered and threatened species; the consequences of changes in the fitness or performance of individuals on a population's status depends on the prior state of the population. Designated critical habitat is not different; under some ecological conditions, the physical and biotic features of critical habitat will exhibit responses that they would not exhibit in other conditions.

4.1 Factors Affecting Johnson's Seagrass and Johnson's Seagrass Critical Habitat in the Action Area

4.1.1 Federal and State Actions

A wide range of activities funded, authorized, or carried out by federal agencies may affect Johnson's seagrass and the essential features of designated critical habitat for Johnson's seagrass. These include dredging, dock/marina construction, boat shows, bridge/highway construction, residential construction, shoreline stabilization, breakwaters, and the installation of subaqueous lines or pipelines. Other federal actions (or actions with a federal nexus) that may affect Johnson's seagrass and its designated critical habitat include actions by the EPA and the USACE to manage freshwater discharges into waterways; regulation of vessel traffic by the USCG; management of National Parks; management of vessel traffic (and other activities) by the U.S. Navy; and authorization of state coastal zone management plans by NOAA's National Ocean Service. Although these actions have probably removed Johnson's seagrass and affected its critical habitat, none of these past actions have jeopardized the continued existence of Johnson's seagrass, or destroyed or adversely modified its critical habitat.

Between April 1, 2008 and January 5, 2015, according to NMFS's Public Consultation Tracking System database, NMFS completed consultation under Section 7 of the ESA on 359 proposed activities with the potential to affect Johnson's seagrass and/or its designated habitat. Of these consultations, 90 were concluded formally (i.e., with issuance of a Biological Opinion), and the majority of these projects were single- or multi-family dock construction projects that each resulted in a few square feet to a few hundred square feet of impacts to Johnson's seagrass and/or its designated critical habitat. Other types of projects fall into 1 of the categories listed in the previous paragraph and the majority of these projects resulted in impacts to less than 0.1 ac of Johnson's seagrass or its designated critical habitat. A few larger scale dredging projects resulted in more significant impacts.

Coastal Construction and Urban Development
Activities such as dock and seawall construction, dredging, and installation of smaller, less common structures like water outfall structures within the range of Johnson's seagrass and/or its critical habitat will continue, as the shoreline is highly prized for residential and commercial development. Since 2001, applicants have been encouraged to follow the NMFS and USACE's *Construction Guidelines for Minor Piling-Supported Structures in or over Submerged Aquatic Vegetation (SAV), Marsh or Mangrove Habitat*. Since 2002, they have been encouraged to follow the NMFS and USACE's *Key for Construction Conditions for Docks or Other Minor Structures Constructed in or Over Johnson's seagrass (Halophila johnsonii)* in order to minimize shading impacts to Johnson's seagrass and its critical habitat. Nevertheless, loss of Johnson's seagrass will continue due to shading and the installation of piles, even if docks are designed in full compliance with the dock construction guidelines.

Urban development since the 1960s has affected inshore water quality throughout the range of Johnson's seagrass and/or its critical habitat. However, Woodward-Clyde Consultants (1994) noted that improvements in erosion and sediment control in association with urban development in the 1980s and 1990s may have been responsible for reduced turbidity in those decades as compared to the previous 2 decades of development. Reductions in seagrasses were apparent in the 1970s, along with areas of highly turbid water. Increases in submerged aquatic vegetation were noted until coverage and density peaked in 1986, albeit at levels remaining below those observed in the decades prior to 1960. In association with upland development, water quality and transparency within the range of Johnson's seagrass are affected by storm water and agricultural runoff, wastewater discharges, and other point and nonpoint source discharges. The most clearly identified and manageable threat to the persistence and recovery of Johnson's seagrass is the possibility of mortality due to reduced salinity over long periods of time.

Recreational Vessel Traffic
Increasing recreational vessel traffic in the range of Johnson's seagrass resulting from marina and dock construction results in improper anchoring and propeller scarring. Propeller scarring and improper anchoring are known to adversely affect seagrasses (Kenworthy et al. 2002; Sargent et al. 1995) and are a major disturbance to even the most robust seagrasses in shallow waters. These activities can severely disrupt the benthic habitat by uprooting plants, severing rhizomes, destabilizing sediments, and significantly reducing the viability of the seagrass community. This destruction is expected to worsen with the predicted increase in boating activity within Florida. Damage to seagrasses from propeller scarring and improper anchoring by motor vessels is recognized as a significant resource management problem in Florida (Sargent et al. 1995). A number of local, state, and federal statutes prohibit damaging seagrasses through vessel impacts, and a number of conservation measures, including the designation of vessel control zones and mooring fields, the installation of signage and the implementation of public awareness campaigns, are directed at minimizing vessel damage to seagrasses. Despite these efforts, damage caused by vessels can have significant local and small-scale (1 m^2 to 100 m^2)

impacts on seagrasses (Kirsch et al. 2005), but there is no direct evidence that these small-scale local effects are so widespread that they are a threat to the survival of Johnson's seagrass.

4.1.2 Conservation and Recovery Activities That May Benefit Johnson's Seagrass and Johnson's Seagrass Critical Habitat

State and federal conservation measures exist to protect Johnson's seagrass and its designated critical habitat under an umbrella of management and conservation programs that address seagrasses in general (Kenworthy et al. 2006). Johnson's seagrass habitat is also included in the designation of critical habitat for the Florida manatee and is therefore subject to ESA Section 7 consultation by the USFWS, which has ESA jurisdiction over that species. These conservation measures must be continually monitored and assessed to determine if they will ensure the long-term protection of the species and the maintenance of environmental conditions suitable for its continued existence throughout its geographic distribution.

4.2 Factors Affecting Smalltooth Sawfish Critical Habitat within the Action Area

4.2.1 Federal Actions

A wide range of activities funded, authorized, or carried out by federal agencies may affect the essential features of smalltooth sawfish critical habitat. These include dredging, dock/marina construction, residential construction, shoreline stabilization, the installation of breakwaters, and the installation of utility lines. Other federal actions (or actions with a federal nexus) that may beneficially affect smalltooth sawfish critical habitat include managing freshwater discharges consulted on under the Comprehensive Everglades Restoration Plan (NMFS tracking number SER-2013-11848) and management of Everglades National Park, where most of the smalltooth sawfish critical habitat for the TTIEU is located.

Between September 2009 and March 2017, NMFS has completed 122 consultations in CHEU of smalltooth sawfish critical habitat with the majority of these being minor residential development with each resulting a few hundred square feet or less of impacts to critical habitat. Because of the comparatively few number of projects within the TTIEU (a total of 11 projects), the focus of this consultation will be the CHEU.

In addition to activities that are consulted on a project-by-project basis by NMFS, activities are also authorized in smalltooth sawfish critical habitat under USACE GPs consulted on programmatically by NMFS (see Appendix A). Specifically, USACE GP SAJ-91 allows for the continued installation of docks and seawalls in the residential canals of Cape Coral (NMFS 2012). The individual and cumulative effects of these actions are monitored and tracked by both USACE and NMFS as part of the programmatic review process.

4.2.2 State or Private Actions

A number of non-federal activities that may adversely affect designated critical habitat for smalltooth sawfish in the action area including impacts from wastewater systems, aquaculture facilities, and residential shoreline stabilization activities that do not obtain federal permits (i.e., seawall, riprap). The direct and indirect impacts from some of these activities are difficult to quantify. However, where possible, conservation actions through the ESA Section 10 permitting, ESA Section 6 cooperative agreements, and state permitting programs are being implemented or investigated to monitor or study impacts from these sources. There are numerous shoreline stabilization projects that have occurred and continue to occur within the smalltooth sawfish critical habitat that have completed the Section 7 consultation process.

4.2.3 Other Potential Factors

Natural Disturbances

Stochastic (i.e., random) events, such as hurricanes, are common throughout the range of the smalltooth sawfish, especially in the current core of its range (i.e., south and southwest Florida). These events are by nature unpredictable, and their effect on designated critical habitat and the recovery of the species is unknown. However, they have the potential to impede recovery directly if animals die, or indirectly if important habitats are damaged as a result of these disturbances. In 2005, Hurricane Charley damaged habitat within smalltooth sawfish critical habitat, which has seemed to recover.

Conservation and Recovery Actions Shaping the Environmental Baseline

Federal Essential Fish Habitat (EFH) consultation requirements pursuant to the Magnuson-Stevens Fishery Conservation and Management Act minimize and mitigate for losses of wetland and preserve valuable foraging and developmental habitat that is used by juvenile smalltooth sawfish. NMFS has designated mangrove and estuarine habitats as EFH as recommended by the Gulf of Mexico Fishery Management Council. Both essential features (shallow, euryhaline water less than/ shallower than -3 ft MLLW and red mangroves) are critical components of areas designated as EFH and receive a basic level of protection under the Magnuson-Stevens Act to the extent that the Act requires minimization of impacts to EFH resources.

5 Effects of the Action

5.1 Effects to Johnson's Seagrass

As discussed in Section 2.2 and summarized in Table 65, an estimated 22,378.96 ft² (0.51 ac) of Johnson's seagrass may be lost by pile-supported structures (Activity 2), dredging (Activity 3), and utility line repairs (Activity 8). In particular, we believe docks and other pile-supported structures could be placed on Johnson's seagrass, and dredging and utility line repairs could remove areas that support the species. NMFS believes these proposed actions are likely to adversely affect Johnson's seagrass, which is listed as threatened under the ESA. However, no incidental take statement or reasonable and prudent measures will be issued because the ESA does not require biological opinions to contain incidental take statements for threatened plants. Yet, because the actions will result in adverse effects to Johnson's seagrass, we must evaluate whether the actions are likely to jeopardize the continued existence of the species (Section 7).

Table 65. Impacts to Johnson's Seagrass Anticipated per 5-year period

Category of Activity		Loss of Johnson's seagrass (ft^2)	Loss of Johnson's seagrass (ac)
1	Shoreline stabilization	-	
2	Pile-supported structure	398.96	0.01
3	Dredging	21,780.00	0.50
4	Water-management outfall structures	-	
5	Scientific survey devices	-	
6	Boat ramps	-	
7	Aquatic enhancement	-	
8	Transmission/utility lines	200.00	0.00[48]
9	Marine debris removal	-	
10	Temporary platforms, fill, and cofferdams	-	
	Total	22,378.96	0.51

5.2 Effects to Johnson's Seagrass Critical Habitat

As discussed in Section 2.2, Johnson's seagrass critical habitat may be affected by some activities authorized under this Opinion. Table 66 summarizes the estimated loss of critical habitat.

Direct impacts to areas that support Johnson's seagrass critical habitat essential features are likely to result from the placement of shoreline stabilization materials and structures (Activity 1), the placement of pile-supported structures (Activity 2), removing sediments via dredging (Activity 3), and the placement of water-management outfall structures (Activity 4). These activities are likely to have a permanent and direct adverse effect on the stable, consolidated sediments that are free from physical disturbance essential feature of Johnson's seagrass critical habitat by placing materials on the sediment or by removing the sediment by dredging. A permanent loss of any 1 of the essential features renders the area incapable of supporting Johnson's seagrass. The placement of scientific survey devices (Activity 5) also will have a direct and adverse effect on the stable, consolidated sediments essential feature. Since PDC A5.2 limits the placement of scientific survey devices to no more than 24 months, we believe the adverse effects will be temporary and that the feature will be restored once the device is removed. We estimate that direct losses of 111,041.1 ft^2 (2.56 ac) of critical habitat will result from activities covered under this Opinion (Table 66).

[48] 200 ft^2 is approximately 0.005 ac, which rounded to 2 decimal places is 0.00 ac.

Table 66. Impacts to Johnson's Seagrass Critical Habitat Anticipated per 5-year period

	Activity	Loss of Critical Habitat (ft^2)	Loss of Critical Habitat (ac)
1	Shoreline stabilization	89,226.54	2.05
2	Pile-supported structure	3,989.56	0.10
3	Dredging	16,275.00	0.37
4	Water-management outfall structures	700.00	0.02
5	Scientific survey devices	850	0.02
6	Boat ramps	-	
7	Aquatic enhancement	-	
8	Transmission/ utility lines	-	
9	Marine debris removal	-	
10	Temporary platforms, access fill, and cofferdams		
		111,041.1	2.56

5.3 Effects to Smalltooth Sawfish Critical Habitat

Both of the essential features to smalltooth sawfish critical habitat (red mangroves and shallow, euryhaline habitat) are likely to be adversely affected from the projects analyzed in this Opinion. As discussed in Section 2.2, we used the USACE's assumptions regarding about shoreline stabilization projects (Activity 1), pile-supported structures (Activity 2), and stormwater outfall structures (Activity 4) to calculate the anticipated loss of smalltooth sawfish critical habitat essential features (i.e., red mangroves and shallow, euryhaline habitat) from the placement of these structures. The total anticipated impacts provided in Table 67 are explained in Section 2.2.1 for shoreline stabilization, Section 2.2.2 for pile-supported structures, and Section 2.2.4 for water-management outfall structures.

Using remote sensing data acquired from the Fish and Wildlife Research Institute, we were able to compile information relating to the total area of these essential features within smalltooth sawfish critical habitat. While the available mangrove and shallow, euryhaline essential features will be diminished by the proposed activities in this Opinion, we believe that individual activities spread out throughout smalltooth sawfish critical habitat and in areas not defined as high density pupping areas (hot spots) will not sever or prevent access to alternate refuge or forage areas in the area. Still, some ecological function provided to juvenile smalltooth sawfish in terms of the shallow-water and red mangrove essential features will be lost, as discussed further in Section 8.2.

Table 67. Impacts to Smalltooth Sawfish Critical Habitat Anticipated per 5-year period

Category of Activity		Impacts to Red Mangroves (lin ft)	Impacts to Shallow, Euryhaline Habitat (ft²)
1	Shoreline stabilization	-	101,614.92
2	Pile-supported structures	80	-
3	Dredging	-	-
4	Water-management outfall structures	258	1,900
5	Scientific survey devices	-	-
6	Boat ramps	-	-
7	Aquatic enhancement	-	-
8	Transmission/ utility lines	-	-
9	Marine debris removal	-	-
10	Temporary platforms, fill, and cofferdams	-	-
	Total	338	103,514.92 ft^2 (2.38 ac)

6 Cumulative Effects

Cumulative effects include the effects of future state, tribal, or local private actions that are reasonably certain to occur in the action area considered in this Opinion. Future federal actions that are unrelated to the proposed actions are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

6.1 Cumulative Effects to Johnson's Seagrass and Johnson's Seagrass Critical Habitat

No categories of effects beyond those already described are expected in the action area. Dock and marina construction will likely continue at current rates, with associated loss and degradation of seagrass habitat, including Johnson's seagrass. However, these activities are subject to USACE permitting and thus the ESA Section 7 consultation requirement. Some of the dock construction (i.e., the construction that meets the PDCs in this Opinion) will be covered under this Opinion, and must meet the requirements of this Opinion to protect the species and critical habitat. As we explained above, under the PDCs for Activity 2, all new docks or dock expansions in Johnson's seagrass critical habitat must be constructed with grated or plank decking that allows light transmission. New docks or dock expansions within the range of the species but outside of Johnson's seagrass critical habitat must meet those conditions unless there are no seagrasses within the property limits or there is seagrass, other than Johnson's seagrass. Upland development and associated runoff will continue to degrade water quality and decrease water clarity necessary for growth of seagrasses. Flood control and imprudent water management practices will continue to result in freshwater inputs into estuarine systems, thereby degrading water quality and altering salinity. Long-term, large-scale reduction in salinity has been identified as a potentially significant threat to the persistence and recovery of Johnson's seagrass.

Increased recreational vessel traffic will continue to result in damage to Johnson's seagrass and its designated critical habitat by improper anchoring, propeller scarring, and accidental groundings. However, we expect that ongoing boater education programs and posted signage about the dangers to seagrass beds from these practices may reduce impacts to Johnson's seagrass and its designated critical habitat.

6.2 Cumulative Effects to Smalltooth Sawfish Critical Habitat

Smalltooth sawfish habitat has been degraded or modified throughout the southeastern United States from agriculture, urban development, commercial activities, channel dredging, boating activities, and the diversion of freshwater runoff. While the degradation and modification of habitat is not likely the primary reason for the decline of smalltooth sawfish abundance and their contracted distribution, it has likely been a contributing factor.

The smalltooth sawfish critical habitat units will likely continue to experience the same types of actions described in the status of critical habitat in Section 3.2.2. These actions include shoreline stabilization removing shallow, euryhaline habitat and mangroves, pile-supported structures removing mangroves, and outfall structures removing mangroves. The additive effect of these actions to the essential features of critical habitat will continue to be assessed by USACE to ensure that they either meet the PDCs in this Opinion or are reviewed by NMFS on a project-level basis through the Section 7 process.

Many threats to smalltooth sawfish critical habitat are expected to be exacerbated by the effects of global climate change (see Section 3.2.2, *Threats to Critical Habitat*). Potential increases in sea level may impact the availability of nursery habitat, particularly shallow euryhaline and red mangrove lined, low-lying coastal habitats (IPCC 2014; Wanless et al. 2005). Red mangroves could be negatively affected by increased temperatures, salinities, and acidification of coastal waters (Scavia et al. 2002; Snedaker 1995; Wanless et al. 2005), as well as increased runoff and erosion due to the expected increase in extreme storm events (IPCC 2014; Wanless et al. 2005). These alterations of the marine environment due to global climate change could ultimately affect the distribution, physiology, and growth rates of red mangroves, potentially eliminating them from particular areas. The magnitude of these effects on smalltooth sawfish critical habitat are difficult to predict, yet the cyclical loss of habitat from extreme storm events combined with sea level rise may result in a decrease in juvenile survival (Norton et al. 2012; Scavia et al. 2002). However, the activities analyzed in this Opinion are limited by the PDCs to be of such a small scale, scope, and limited time frame that is not very likely to contribute to, or be affected cumulatively by climate change.

Smalltooth sawfish habitat has been degraded or modified throughout the southeastern United States from agriculture, urban development, commercial activities, channel dredging, boating activities, and the diversion of freshwater runoff. While the degradation and modification of habitat is not likely the primary reason for the decline of smalltooth sawfish abundance and their contracted distribution, it has likely been a significant factor.

7 Jeopardy Analysis

The analyses conducted in the previous sections of this Opinion serve to provide a basis to determine whether the proposed actions would be likely to jeopardize the continued existence of Johnson's seagrass. In Section 5, we outlined how the proposed actions can 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 3), the environmental baseline (Section 4), and the cumulative effects (Section 6), will jeopardize the continued existence of the affected species.

This section evaluates whether the proposed actions are likely to jeopardize the continued existence of Johnson's seagrass in the wild. To *jeopardize the continued existence of* is defined as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Thus in making this determination, NMFS must look at whether the proposed actions directly or indirectly reduce 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. Section 5 ("Effects of the Action") describes the effects of the proposed actions on species, and the extent of those effects in terms of an estimate of the area of impacts to Johnson's seagrass. In Section 5, we determined that 44,057 ft² (1.01 ac) of Johnson's seagrass could be impacted by activities authorized per 5-year period using this Opinion.

7.1 Johnson's Seagrass

As noted in Section 5, we believe that up 22,378.96 ft² (0.51 ac) of Johnson's seagrass is likely to be adversely affected by the by pile-supported structures resulting in docks placed on or over Johnson's seagrass (Activity 2), dredging removing areas that support Johnson's seagrass (Activity 3), and utility line repairs removing areas that support Johnson's seagrass (Activity 8).projects authorized per 5-year period using this Opinion. We believe that Johnson's seagrass is likely to recolonize the impacted areas based on its life history strategy (i.e., it effectively out-competes other seagrass species in periodically disturbed areas) (Durako et al. 2003). The loss of up to 22,378.96ft² (0.51 ac) of Johnson's seagrass is a reduction in numbers of the species; however, the Recovery Team has determined that effects of these types of activities are generally local and small-scale in nature and will not have larger, population scale effects. We do not consider such impacts threats to the survival of the species because these activities will not individually or cumulatively result in the long-term, large-scale mortality of Johnson's seagrass, particularly in light of its "pulsating patches" life history strategy, which allows the species to acclimate readily to disturbed areas. The loss of up to 22,378.96 ft² (0.51 ac) of Johnson's seagrass will not result in long-term mortality either in the immediate action area of each project or on a larger scale within the range of Johnson's seagrass.

Reproduction will be temporarily reduced at each project site that reduces Johnson's seagrass numbers, but NMFS does not believe that this reproductive loss appreciably reduces the likelihood of survival of Johnson's seagrass in the wild. Johnson's seagrass will continue to reproduce and spread because the proposed impacts are expected to be temporary (i.e., Johnson's seagrass is likely to recolonize the disturbed area and persist in other areas of the action area after the project is complete).

The proposed actions will not result in a complete reduction of Johnson's seagrass distribution or fragmentation of the range since we expect Johnson's seagrass will recolonize the disturbed areas and will continue to be capable of spreading via asexual fragmentation after the completion of pile-supported structures, dredging, and transmission/utility line projects covered under this Opinion since the location of these activities are expected to be spread out over all of Johnson's seagrass range and critical habitat. Therefore, the reproductive potential of the species in the action area will persist.

Recovery for Johnson's seagrass, as described in the recovery plan (NMFS 2002), will be achieved when the following recovery objectives are met: (1) the species' present geographic range remains stable for at least 10 years or increases; (2) self-sustaining populations are present throughout the range at distances less than or equal to the maximum dispersal distance to allow for stable vegetative recruitment and genetic diversity; and (3) populations and supporting habitat in its geographic range have long-term protection (through regulatory action or purchase acquisition). We review the project's expected impacts on critical habitat to determine whether it will be able to continue to provide its intended functions in achieving these recovery objectives.

The first recovery criterion for Johnson's seagrass is for its present range to remain stable for 10 years or to increase during that time. NMFS's 5-year review (2007a) of the status of the species concluded that the first recovery objective had been achieved as of 2007. In fact, the range had increased slightly northward at that time, and we have no information indicating range stability has decreased since then. We believe that the loss of up to 22,378.96ft^2 (0.51 ac) of Johnson's seagrass from pile-supported structures, dredging, and transmission/utility line projects covered under this Opinion will occur throughout the range of Johnson's seagrass and will not impede this recovery objective. These effects will not reduce or destabilize the present range of Johnson's seagrass. The loss of Johnson's seagrass from each of these activities is expected to be small and occur in individual, non-connected areas. In the case of the maintenance dredging and repair or replacement utility projects, if Johnson's is present, it is because it has regrown in this area since the last dredging or utility line installation and therefore is likely to recolonize this area again. The pile-supported projects will be required to provide decking that allows light attenuation and therefore is likely to allow at least some seagrass growth to persist or recruit to these areas. Hence, these projects will not reduce the range of the species.

The second recovery criterion for Johnson's seagrass requires that self-sustaining populations be present throughout the range at distances less than or equal to the maximum dispersal distance for the species. Drifting fragments of Johnson's seagrass can remain viable in the water column for 4-8 days (Hall et al. 2006), and can travel several kilometers under the influence of wind, tides, and waves. Because of this, we believe that the removal of seagrasses from pile-supported structures, dredging, and transmission/utility line projects covered under this Opinion will not break up self-sustaining populations and that seagrass fragments will be able to drift to and over these impacted project sites. Therefore, we believe the loss of Johnson's seagrass associated with the proposed actions will not impede the recovery criterion.

The final recovery criterion is for populations and supporting habitat in the geographic range of Johnson's seagrass to have long-term protection (through regulatory action or purchase acquisition). Though the affected project sites will not be available for the long-term, the total acreage of critical habitat for Johnson's seagrass range-wide is roughly 22,574 ac (NMFS 2002) and we assume the majority is still available for long-term protection, which would include areas surrounding the action area. Therefore, we conclude that the proposed actions' adverse effects on the essential features of Johnson's seagrass critical habitat will not impede achieving the recovery objectives listed above.

NMFS believes that the proposed actions will not appreciably reduce the likelihood of recovery of Johnson's seagrass in the wild. NMFS's 5-year review (2007a) of the status of the species concluded that the first recovery objective has been achieved. In fact, the range has increased slightly northward. The proposed actions will not impact the status of this objective. Self-sustaining populations are present throughout the range of the species. The species' overall reproductive capacity will be only minimally reduced by the reduction in Johnson's seagrass numbers and reproduction resulting from the proposed actions. The proposed actions will not lead to separation of self-sustaining Johnson's seagrass patches to an extent that might lead to adverse effects to 1 or more patches of the species. Similarly, the proposed actions are not likely to adversely affect the availability of suitable habitat in which the species can spread/flow in the future. While additional individual impacts may continue to occur, over the last decade the species has not demonstrated any declining trends. The proposed actions will not reduce or destabilize the present range of Johnson's seagrass. Therefore, the activities will not appreciably reduce the likelihood of recovery of Johnson's seagrass in the wild.

8 Destruction and Adverse Modification Analysis

NMFS' regulations define *Destruction or adverse modification* to mean a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features. 50 CFR § 402.02. Other alterations that may destroy or adversely modify critical habitat may include impacts to the area itself, such as those that would impede access to or use of the essential features. We intend the phrase "significantly delay" in development of essential features to encompass a delay that interrupts the likely natural trajectory of the development of physical and biological features in the designated critical habitat to support the species' recovery. NMFS will generally conclude that a Federal action is likely to "destroy or adversely modify" designated critical habitat if the action results in an alteration of the quantity or quality of the essential physical or biological features of designated critical habitat, or that precludes or significantly delays the capacity of that habitat to develop those features over time, and if the effect of the alteration is to appreciably diminish the value of critical habitat for the conservation of the species.

This analysis takes into account the geographic and temporal scope of the proposed actions, recognizing that "functionality" of critical habitat necessarily means that it must now and must continue in the future to support the conservation of the species and progress toward recovery. Destruction or adverse modification does not depend strictly on the size or proportion of the area adversely affected, but rather on the role the action area serves with regard to the function of the overall critical habitat, and how that role is affected by the action.

8.1 Johnson's Seagrass Critical Habitat

Ultimately, we seek to determine if, with the implementation of the proposed actions, critical habitat would remain functional (or retain the current ability for the essential features to become functional) to serve the intended conservation role for the species. This analysis takes into account the geographic and temporal scope of the proposed action, recognizing that "functionality" of critical habitat necessarily means that it must now and must continue in the future to support the conservation of the species and progress toward recovery.
Recovery for Johnson's seagrass, as described in the recovery plan, will be achieved when the following recovery objectives are met: (1) the species' present geographic range remains stable for at least 10 years, or increases; (2) self-sustaining populations[49] are present throughout the range at distances less than or equal to the maximum dispersal distance to allow for stable vegetative recruitment and genetic diversity; and (3) populations and supporting habitat in its geographic range have long-term protection (through regulatory action or purchase acquisition).

The first recovery criterion for Johnson's seagrass is for its present range to remain stable for 10 years or to increase during that time. The loss of 111,041.1 ft² (2.56 ac) of designated critical habitat for Johnson's seagrass is not likely to impede the first recovery criterion. NMFS's 5-year review (2007a) of the status of the species concluded that the first recovery objective has been achieved. In fact, the range has increased slightly northward. The proposed action will not impact the status of this objective and will not impact the small area within the action area where Johnson's seagrass exists.

The second recovery criterion for Johnson's seagrass requires that self-sustaining populations be present throughout the range at distances less than or equal to the maximum dispersal distance for the species. Due to its asexual reproductive mode, self-sustaining populations are present throughout the range of the species. The loss of critical habitat from direct construction impacts will not significantly reduce the available critical habitat such that could significantly impact Johnson's seagrass self-sustaining populations by adversely affecting the availability of suitable habitat in which the species can spread/flow in the future. Drifting fragments of Johnson's seagrass can remain viable in the water column for 4-8 days (Hall et al. 2006), and can travel several kilometers under the influence of wind, tides, and waves. Because of this, we believe that the removal of Johnson's seagrass and Johnson's seagrass critical habitat from projects spread out of in both space and the time of construction will not break up self-sustaining populations. Therefore, we believe the loss of Johnson's seagrass critical habitat associated with the proposed actions will not impede the recovery criterion requiring that self-sustaining populations be present throughout the range at distances less than or equal to the maximum dispersal distance for the species.

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[49] Self-sustaining population is a population that has been documented to persist for at least 10 years.

The final recovery criterion is for populations and supporting habitat in the geographic range of Johnson's seagrass to have long-term protection (through regulatory action or purchase acquisition). Though the affected portions of the project sites will not be available for the long-term, thousands of acres of designated critical habitat are still available for long-term protection, which would include areas surrounding the action area. Therefore, we conclude that the proposed actions adverse effects on Johnson's seagrass critical habitat will not impede achieving the recovery objectives listed above and will therefore not appreciably reduce the species' likelihood of recovery in the wild.

In Section 5.2, we determined that the proposed project will result in the combined loss of 111,041.1 ft^2 (2.56 ac) of designated critical habitat for Johnson's seagrass from installation of shoreline stabilization (Activity 1), pile-supported structures (Activity 2), dredging (Activity 3), outfall structures (Activity 4), and scientific survey devices (Activity 5) structures authorized per 5-year period. We believe the placement of materials associated with Activities 1, 2, 4, and 5 on the sediment and the dredging of the sediment (Activity 3) will have a direct adverse effect to the stable, consolidated sediments that are free from physical disturbance essential feature. The loss associated with Activities 1-4 is permanent; however, as we explained above, the loss associated with the placement of scientific survey devices (850 ft^2, 0.02 ac) is temporary because PDC A5.3 limits the placement of scientific survey devices to no more than 24 months and we believe the feature will be restored once the device is removed. We do not believe these losses will impede the third recovery objective. As discussed in Section 3.2.1, there are approximately 22,574 ac of Johnson's seagrass critical habitat. Most of the projects within critical habitat that we have consulted on have resulted in impacts to less than 1,000 ft^2 each. The loss of 111,041.1ft^2 (2.56 ac) of designated critical habitat for Johnson's seagrass from the activities covered under this Opinion would equate to a loss of 0.01% of Johnson's seagrass critical habitat (2.56 ac loss x100/ 22,574 total ac = 0.01%).

Therefore, we conclude that the proposed action's adverse effects on the essential features of Johnson's seagrass critical habitat will not impede achieving the recovery objectives listed above.

8.2 Smalltooth Sawfish Critical Habitat

In designating critical habitat for the smalltooth sawfish, we explained that the key conservation objective for the species is to facilitate recruitment of juveniles into the adult population by protecting juvenile areas. We determined that the habitat features essential to achieving that conservation objective are (1) shallow, euryhaline habitats characterized by water depths between the MHWL and 3 ft (0.9 m) measured at MLLW and (2) red mangrove shorelines. These essential features are necessary to facilitate recruitment of juveniles into the adult population because they provide for predator avoidance and habitat for prey in the areas currently being used as juvenile nursery areas. Impacts to designated critical habitat, thus, have the potential to destabilize recovery efforts and impede chances for recovery. The critical habitat designation for smalltooth sawfish is divided into 2 units in southwest Florida where the physical features essential to the species' conservation can be protected from destruction or adverse modification: the CHEU and TTIEU. Activities covered under this Opinion can occur in both the CHEU and TTIEU.

The smalltooth sawfish recovery plan identifies 3 recovery objectives (NMFS 2009). Recovery Objective #1 is to minimize human interactions and associated injury and mortality; this objective is not relevant to critical habitat. Recovery Objective #2 is to protect and/or restore smalltooth sawfish habitats. Recovery Objective #3 is to ensure smalltooth sawfish abundance increases substantially and the species reoccupies areas from which it had previously been extirpated. Our analysis evaluates whether the anticipated impacts to critical habitat associated with the proposed action would interfere with the conservation objective behind the designated critical habitat—that is, facilitation of juvenile recruitment into a recovering adult population.

8.2.1 Protect and Restore Smalltooth Sawfish Habitat (Recovery Objective #2)

In establishing Recovery Objective #2, we recognized that recovery and conservation of smalltooth sawfish depends on the availability and quality of nursery habitats. Historically, juvenile sawfish were documented in mangrove and non-mangrove habitat in the southeastern United States. Due to the protections provided by the Ten Thousand Islands National Wildlife Refuge, Everglades National Park, and the FKNMS, much of the historic juvenile smalltooth sawfish habitat in southwest Florida has remained high-quality juvenile habitat. Recovery Regions G, H, and I in southwest Florida extend from the Manatee River on the west coast of Florida south through Everglades National Park and the Florida Keys to Caesar Creek on the southeast coast of Florida. The CHEU is in Recovery Region G and the TTIEU is in Recovery Unit H. Below we estimate the percent impact the proposed action will have on the shallow, euryhaline habitat and red mangrove shoreline essential features of critical habitat within the CHEU since the USACE was unable to provide an estimated number of projects it expects to occur in the TTIEU and since we assume very few, if any, projects will occur in the TTIEU. Most of the TTIEU consists of protected areas, including protected parks, in which development is not allowed. In addition, in the few areas within the TTIEU where development can occur (e.g., Goodland or Everglades City), USACE-approved projects have been small in scale and infrequent. We believe that it is more conservative to assume that all of the loss of critical habitat features is concentrated in CHEU since so few projects are likely to occur in the few communities in TTIEU that can be developed. In addition, since the CHEU has already experienced most of the loss of critical habitat essential features of both critical habitat units, analyzing additional continued loss of critical habitat essential features to this more degraded critical habitat unit is also more conservative.

The recovery plan states that for the three recovery regions with remaining high-quality habitats (i.e., Recovery Regions G, H, and I), juvenile habitats “must be maintained over the long term at or above 95% of the acreage available at the time of listing” (NMFS, 2009). To ensure that a proposed action will not impede Recovery Objective #2, we determine whether the critical habitat unit will be able to maintain 95% of its designated critical habitat after taking into account project impacts in the context of the status of the critical habitat, the environmental baseline, and cumulative effects. While the CHEU is only a part of the larger Recovery Region G, the 95% protection threshold applies across not just Recovery Region G, but also Recovery Regions H and I, we believe it is appropriate to consider whether 95% of each of the essential features of critical habitat in the CHEU is maintained. The 95% threshold seeks to protect nursery areas and the CHEU critical habitat unit contains the only known nursery areas within Recovery Region G. Functioning critical habitat contains either one or both of the essential features (shallow, euryhaline habitat and red mangroves). Therefore, below we estimate the percent impact the proposed action will have on the shallow, euryhaline habitat and red mangrove essential features of critical habitat within the CHEU.

Shallow, Euryhaline Essential Feature Impacts
NMFS estimated that that 84,480 ac of shallow, euryhaline habitat (abbreviated SH throughout this section) was available within the CHEU at the effective date of species listing (i.e., May 1, 2003) (Table 68, Line 1). As discussed above, we must determine whether a proposed action's impact will interfere with long-term maintenance of this essential feature at or above 95% of the acreage available at the time of listing; however, loss of critical habitat was not formally monitored until the effective date of critical habitat designation (i.e., October 2, 2009). Therefore, we must estimate habitat loss that occurred during the period between the effective date of species listing and the effective date of critical habitat designation (i.e., May 1, 2003 – October 2, 2009).

To do this, we use the dataset of completed Section 7 consultations (October 3, 2009 – September 30, 2016) to generate a rate of loss that can then be used as a proxy to back-calculate the loss of SH between the effective date of species listing and the effective date of critical habitat designation. We rely on this dataset because using approximately 7 years of information helps avoid over- or under-estimating the rate of habitat loss due to any potential inter-annual variability associated with economic growth and contraction that may have occurred in that time. From October 3, 2009, to September 30, 2016 (i.e., 84 months), NMFS completed a number of Section 7 consultations on proposed actions within the CHEU that resulted in the loss of 16.73 ac of SH.

Based on these losses, we estimate a monthly loss rate of SH in the CHEU using the following equation:

$$Monthly\ loss\ rate\ of\ SH\ (CHEU) = SH\ lost\ through\ federal\ agency\ actions \div 84\ months$$
$$Monthly\ loss\ rate\ of\ SH\ (CHEU) = 16.73\ ac\ \div 84\ months$$
$$Monthly\ loss\ rate\ of\ SH\ (CHEU) = 0.20\ ac\ per\ month$$

Assuming the same monthly loss rates, we back-calculate the loss of SH in the 77 months between the effective date of species listing and the effective date of critical habitat designation (i.e., May 1, 2003 – October 2, 2009) for the CHEU using the following equation:

$$SH\ lost\ prior\ to\ critical\ habitat\ designation\ (CHEU) = 0.20\ ac\ per\ month \times 77\ months$$
$SH\ lost\ prior\ to\ critical\ habitat\ designation\ (CHEU) = 15.40\ ac$ (Table 68, Line 2)

Next, we determine the loss of SH since the effective date of critical habitat designation. From October 2, 2009, through September 30, 2017,[50] NMFS completed Section 7 consultations on projects within the CHEU that resulted in the loss of 19.72 ac of SH (Table 68, Line 3). While this number only takes into account projects with a federal nexus requiring ESA Section 7 consultation, there are very few projects without a federal nexus that could affect shallow, euryhaline habitat in the CHEU as most in-water construction projects require federal authorization.

Using this information, we calculate the SH currently available in CHEU using the following equation:

$$SH\ currently\ available\ (CHEU) = SH\ at\ time\ of\ species\ listing - (SH\ lost\ prior\ to\ critical\ habitat\ designation + SH\ lost\ since\ critical\ habitat\ designation)$$

$$SH\ currently\ available\ (CHEU) = 84,480\ ac\ - (15.40\ ac + 19.72\ ac)$$

$$SH\ currently\ available\ (CHEU) = 84{,}444.88\ ac\ \text{(Table 68 Line 4)}$$

We calculate the amount of SH that must be maintained in the CHEU using the following equation:

$$SH\ that\ must\ be\ maintained\ (CHEU) = SEH\ at\ time\ of\ species\ listing\ \times 95\%$$

$$SH\ that\ must\ be\ maintained\ (CHEU) = 84{,}480\ ac\ \times 0.95$$

$$SH\ that\ must\ be\ maintained\ (CHEU) = 80{,}256\ ac\ \text{(Table 68 Line 5)}$$

The activities anticipated to be covered under this Opinion per 5-year period would result in the permanent loss of 103,514.92 ft^2 (2.38 ac) (Table 68 Line 6). Using the above results, we estimate the impact of the proposed action in addition to the SH lost in CHEU since the effective date of species listing using the following equation:

$$\%\ SH\ lost\ since\ species\ listing\ (CHEU) = [(SH\ loss\ due\ to\ these\ projects + SH\ lost\ prior\ to\ critical\ habitat\ designation + SH\ lost\ since\ critical\ habitat\ designation) \div Total\ SH\ at\ time\ of\ species\ listing] \times 100$$

$$\%\ SH\ lost\ since\ species\ listing\ (CHEU) = [(2.38\ ac + 15.40\ ac\ + 19.72\ ac) \div 84,480\ ac] \times 100$$

$$\%\ SH\ lost\ since\ species\ listing\ (CHEU) = (37.50\ ac \div 84,480\ ac) \times 100$$

$$\%\ SH\ lost\ since\ species\ listing\ (CHEU) = 0.04\%\ (Table\ 68, Line\ 7)$$

[50] Due to the small number of monthly projects affecting smalltooth sawfish critical habitat, NMFS updates shallow, euryhaline habitat losses quarterly based on the U.S. federal fiscal year (December 31, Mar 31, June 30, September 30).

Thus, we estimate the percent of SH remaining within the CHEU as:

$$\% \, SH \, remaining \, (CHEU) = 100\% - \% \, SH \, lost \, since \, species \, listing \, (CHEU)$$
$$\% \, SH \, remaining \, (CHEU) = 100\% - 0.04\% \, (Table \, 68, Line \, 7)$$
$$\% \, SH \, remaining \, (CHEU) = 99.96\% \, (Table \, 68, Line \, 8)$$

Table 68. Summary of Impacts to the Shallow, Euryhaline Habitat Essential Feature

Shallow, Euryhaline Habitat in the CHEU		Acres
1.	Available at the time of species listing	84,480
2.	Losses prior to critical habitat designation	15.40
3.	Losses since critical habitat designation (through federal agency actions)	19.72
4.	Available as of September 30, 2017	84,444.88
5.	Area that must be maintained per Recovery Plan	80,256 (95% of 84,480)
6.	Affected by the proposed actions	2.38
7.	Affected since species listing	37.50 (0.04% of 84,480)
8.	Remaining	84,442.50 (99.96% of 84,480)

Red Mangrove Essential Feature Impacts

Remote sensing data from FWRI indicated that approximately 5,512,320 lin feet of red mangrove shoreline (abbreviated RM throughout this section) was available in the CHEU at the effective date of species listing (i.e., May 1, 2003) (Table 69 Line 1). As described above, we must determine whether project impacts will interfere with long-term maintenance of this essential feature at or above 95% of the linear feet of habitat available at the time of listing; however, as described above, loss of critical habitat was not formally monitored until the effective date of critical habitat designation (i.e., October 2, 2009). Therefore, we must estimate habitat loss that occurred during the period between the effective date of species listing and the effective date of critical habitat designation (i.e., May 1, 2003 – October 2, 2009).

To do this, we use the dataset of completed Section 7 consultations (October 3, 2009 – September 30, 2016) to generate a rate of loss that can then be used as a proxy to back-calculate the loss of RM between the effective date of species listing and the effective date of critical habitat designation. We rely on this dataset because using approximately 7 years of information helps avoid over- or under-estimating the rate of habitat loss due to any potential inter-annual variability associated with economic growth and contraction that may have occurred in that time. From October 3, 2009, to September 30, 2016 (i.e., 84 months), NMFS completed a number of Section 7 consultations on proposed actions within the CHEU that resulted in the loss of 9,142.50 lin ft of red mangrove shoreline.

Based on these losses, we estimated a monthly loss rate of RM using the following equation:

$$Monthly\ loss\ rate\ of\ RM\ (CHEU) = RM\ lost\ through\ federal\ agency\ actions \div 84\ months$$
$$Monthly\ loss\ rate\ of\ RM\ (CHEU) = 9{,}142.50\ lin\ ft \div 84\ months$$
$$Monthly\ loss\ rate\ of\ RM\ (CHEU) = 108.84\ lin\ ft\ per\ month$$

Assuming the same monthly loss rates, we back-calculate the loss of RM in the 77 months between the effective date of species listing and the effective date of critical habitat designation (i.e., May 1, 2003 – October 2, 2009) in the CHEU using the following equation:

$$RM\ loss\ prior\ to\ critical\ habitat\ designation\ (CHEU) = 108.84\ lin\ ft\ per\ month \times 77\ months$$
$$RM\ loss\ prior\ to\ critical\ habitat\ designation\ (CHEU) = 8{,}380.68\ lin\ ft\ (Table\ 69, Line\ 2)$$

Next, we determine the loss of RM since the effective date of critical habitat designation. From the October 2, 2009, through September 30, 2017,[51] NMFS completed Section 7 consultations on projects within the CHEU that resulted in the loss of 11,818.75 lin ft of red mangroves (Table 69, Line 3). While this number only takes into account projects with a federal nexus requiring ESA Section 7 consultation, there are very few projects without a federal nexus that could affect red mangrove shoreline in the CHEU as most in-water construction projects require federal authorization.

Using this information, we calculate the RM currently available in the CHEU using the following equation:

$$RM\ currently\ available\ (CHEU) = RM\ at\ time\ of\ species\ listing - (RM\ loss\ prior\ to\ critical\ habitat\ designation + RM\ loss\ since\ critical\ habitat\ designation)$$
$$RM\ currently\ available\ (CHEU) = 5{,}512{,}320\ lin\ ft - (8{,}380.68\ lin\ ft + 11{,}818.75\ lin\ ft)$$
$$RM\ currently\ available\ (CHEU) = 5{,}492{,}120.57\ lin\ ft\ (Table\ 69, Line\ 4)$$

We calculated the amount of RM that must be maintained in the CHEU using the following equation:

$$RM\ that\ must\ be\ maintained\ (CHEU) = RM\ at\ time\ of\ species\ listing \times 95\%$$
$$RM\ that\ must\ be\ maintained\ (CHEU) = 5{,}512{,}320\ lin\ ft \times 0.95$$
$$RM\ that\ must\ be\ maintained\ (CHEU) = 5{,}236{,}704\ lin\ ft\ (Table\ 69, Line\ 5)$$

[51] Due to the small number of monthly projects affecting smalltooth sawfish critical habitat, NMFS updates red mangrove shoreline losses quarterly based on the U.S. federal fiscal year (December 31, March 31, June 30, September 30).

The activities anticipated to be covered under this Opinion per 5-year period would result in the loss of 338 lin ft of the estimated 5,512,320 lin ft of RM (Table 69, Line 6). Using the above results, we estimated the impact of the proposed action in addition to the RM lost in CHEU since the effective date of species listing using the following equation:

$$\% \, RM \text{ lost in } CHEU \text{ since species listing} = [(RM \text{ loss due to these projects} + RM \text{ lost prior to critical habitat designation} + RM \text{ lost since critical habitat designation}) \div Total \; RM \text{ in } CHEU \text{ at time of species listing}] \times 100$$

$$\% \, RM \text{ lost in } CHEU \text{ since species listing} = [(338 \; lin \; ft + 8{,}380.68 \; lin \; ft + 11{,}818.75 \; lin \; ft) \div 5{,}512{,}320 \; lin \; ft] \times 100$$

$$\% \, RM \text{ lost in } CHEU \text{ since species listing} = (20{,}537.43 \; lin \; ft \; \div 5{,}512{,}320 \; lin \; ft) \times 100$$

$$\% \, RM \text{ lost in } CHEU \text{ since species listing} = 0.37 \, \% \text{ (Table 69, Line 7)}$$

Thus, we estimate the percent of RM remaining within the CHEU as:

$$\% \, RM \; remaining \; (CHEU) = 100\% - \% \, RM \; lost \; since \; species \; listing \; (CHEU)$$

$$\% \, RM \; remaining \; (CHEU) = 100\% - 0.37\% \; (Table \; 69, Line \; 7)$$

$$\% \, RM \; remaining \; (CHEU) = 99.63\% \; (Table \; 69, Line \; 8)$$

Table 69. Summary of Impacts to the Red Mangrove Essential Feature

Red Mangrove Shoreline in the CHEU		**Linear Feet**
1.	Available at the time of species listing	5,512,320
2.	Losses prior to critical habitat designation	8,380.68
3.	Losses since critical habitat designation (through federal agency actions)	11,818.75
4.	Available as of September 30, 2017	5,492,120.57
5.	Linear feet that must be maintained per Recovery Plan	5,236,704 (95% of 5,512,320)
6.	Affected by the proposed actions	338
7.	Affected since species listing	20,537.43 (0.37% of 5,512,320)
8.	Remaining	5,491,782.57 (99.63% of 5,512,320)

Summary of Impacts to the Essential Features

A very small percentage of the essential features of smalltooth sawfish designated critical habitat have been affected by in-water construction since the effective date of species listing. Including losses from this project, 99.96% of the SH essential feature (Table 68, Line 8) and 99.63% of the RM essential feature (Table 69, Line 8) available at the time of species listing remain in the CHEU. Thus, the loss of essential features associated with the proposed action, in combination with losses since we listed the species, does not provide any impediment to effectively protecting

95% of juvenile habitat in the CHEU available at the effective date of species listing, and therefore will not be an impediment to Recovery Objective #2.

8.2.2 Ensure Smalltooth Sawfish Abundance Increases (Recovery Objective #3)

In establishing Recovery Objective #3, we recognized that it was important that sufficient numbers of juvenile sawfish inhabit several nursery areas across a diverse geographic area to ensure survivorship and growth and to protect against the negative effects of stochastic events within parts of their range. To meet this objective, Recovery Region G (i.e., CHEU) and Recovery Region H (i.e., TTIEU) must support sufficiently large numbers of juvenile sawfish to ensure that the species is viable in the long-term and can maintain genetic diversity. The recovery objective requires that the relative abundance of small juvenile sawfish (< 200 cm) either increases at an average annual rate of at least 5% over a 27-year period, or juvenile abundance is at greater than 80% of the carrying capacity of the recovery region.

Assessing the effect of the proposed action on small juvenile abundance is made difficult by the state of available data. Since the designation of critical habitat and the release of the recovery plan in 2009, ongoing studies have been in place to monitor the U.S. DPS of smalltooth sawfish. The Florida Fish and Wildlife Research Institute is conducting a study in the CHEU that is supported primarily under funding provided by NMFS through the Section 6 Species Recovery Grants Program, while the NOAA Southeast Fisheries Science Center’s Panama City Laboratory and Florida State University have focused studies in the TTIEU. The intent of these studies is to determine the abundance, distribution, habitat use, and movement of juvenile sawfish. Given the limited duration of the study in CHEU (September 2009-current), there is not yet enough data to discern the trend in juvenile abundance within that Unit. Early indications are that juvenile sawfish are at least stable and likely increasing in the CHEU, due in large part to ESA-listing of the species and designation of critical habitat. While it may be too early to state definitively that juveniles within CHEU are surviving to adulthood, researchers consistently capture newborn smalltooth sawfish, particularly within “hot spots,” indicating adult smalltooth sawfish are pupping within Recovery Region G. Available data from the adjacent Recovery Region H (i.e., TTIEU) indicate that adult smalltooth sawfish are also reproducing within this recovery region and that the juvenile population trend is at least stable and possibly increasing—though variability is high (Carlson and Osborne 2012; Carlson et al. 2007). With no other data to consider, the abundance trend in TTIEU represents the best data available for assessing the population trends as a whole. Therefore, we do not believe the loss of habitat associated with activities covered under this Opinion, in combination with the losses to date, will impede the 5% annual growth objective for the juvenile population within Recovery Region G or H.

9 Conclusion

After reviewing the current status of Johnson’s seagrass, the environmental baseline, the effects of the proposed actions, and the cumulative effects, it is our opinion that the authorization of activities analyzed under this Opinion and the removal of up to 22,378.96 ft² (0.51 ac) of Johnson’s seagrass over a 5-year period will not reduce appreciably the likelihood of the species’ survival or recovery, despite permanent adverse effects. Given the nature of the project and the information provided above, we conclude that the actions, as proposed, are likely to adversely affect but are not likely to jeopardize Johnson’s seagrass.

After reviewing the current status of Johnson's seagrass critical habitat, the environmental baseline, the effects of the proposed actions, and the cumulative effects, it is our opinion that the authorization of activities analyzed under this Opinion and the removal of up to 111,041.1 ft^2 (2.56 ac), of which all but 850 ft^2 (0.02 ac) is permanent, of Johnson's seagrass critical habitat over a 5-year period will not diminish the value of the critical habitat for the conservation of the species, despite permanent adverse effects. Given the nature of the project and the information provided above, we conclude that the actions, as proposed, are likely to adversely affect but are not likely to destroy or adversely modify Johnson's seagrass critical habitat.

After reviewing the current status of smalltooth sawfish critical habitat, the environmental baseline, the effects of the proposed actions, and the cumulative effects, it is our opinion that the authorization of activities analyzed under this Opinion and the resulting removal of up to 103,514.92 ft^2 (2.38ac) of shallow, euryhaline habitat and 338 lin ft of red mangrove habitat essential features over a 5-year period will not interfere with achieving the relevant habitat-based Recovery Objectives for smalltooth sawfish. Therefore, we conclude the proposed action will not impede the critical habitat's ability to support the smalltooth sawfish's conservation, despite permanent adverse effects. Given the nature of the proposed action and the information provided above, we conclude that the action, as proposed, is likely to adversely affect, but is not likely to destroy or adversely modify, smalltooth sawfish critical habitat.

It is important to note that the conclusions drawn in this Opinion are based on a series of assumptions (see Section 2.2). Because a programmatic by nature covers future actions that have not been specifically identified, the analysis is based on the actions that occurred during the last 5 years that was used by the USACE to estimate the number of actions that may be authorized in the future using this Opinion analysis requirement. Our analysis was based on a 5-year period to account for annual variability; however, the projects covered under this Opinion will continue to be reviewed on an annual basis and every 5 years so long as the Programmatic Opinion continues to be accurate. A series of assumptions are made based on the best available data, PDCs are in place to define the limits of the proposed actions (see Section 2.2), and project-level review (Section 2.3) and programmatic review (Section 2.4) and reporting is required to evaluate that assumptions about the projects covered under this Opinion and the expected effects of those projects are consistent with the analysis in this Opinion. If the assumptions are inaccurate (for example, if the USACE authorized more projects than expected, or the projects are of a different scale) or the effects are different than those expected under this Opinion, then consultation may need to be reinitiated. This determination as to whether to reinitiate consultation will be made at the programmatic review between USACE and NMFS.

10 Incidental Take Statement

NMFS does not anticipate that the proposed actions will incidentally take any species and no take is authorized. Nonetheless, any take of ESA-listed species shall be immediately reported to takereport.nmfsser@noaa.gov. Refer to the present Biological Opinion by title (JAXBO), issuance date, NMFS tracking number (SER-2015-17616), and USACE permit number (SAJ-2015-02575). At that time, consultation reinitiation will be necessary.

11 Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed actions on listed species or critical habitat, to help implement recovery plans, or to develop information.

NMFS believes the following conservation recommendations are reasonable, necessary, and appropriate to conserve and recover Johnson's seagrass critical habitat and smalltooth sawfish critical habitat. NMFS strongly recommends that these measures be considered and adopted. In order for us to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

Smalltooth Sawfish Critical Habitat

1. Continue public outreach and education on smalltooth sawfish and smalltooth sawfish critical habitat, in an effort to minimize interactions, injury, and mortality.

2. Provide funding to conduct directed research on smalltooth sawfish that will help further our understanding about the species. In other words, implement a relative abundance monitoring program which will help define how spatial and temporal variability in the physical and biological environment influence smalltooth sawfish, in an effort to predict long-term changes in smalltooth sawfish distribution, abundance, extent, and timing of movements.

3. Conduct or support surveys to help acquire detailed bathymetry and mangrove coverage within smalltooth sawfish critical habitat.

4. Continue to request the removal of existing riprap from future seawall restoration/replacement activities within smalltooth sawfish critical habitat.

5. Provide funding to conduct directed research in an effort to develop new technology to support vertical seawalls other than riprap (e.g., living seawalls that incorporate mangroves).

Johnson's Seagrass Critical Habitat

6. NMFS recommends that USACE conduct and support monitoring to assess trends in the distribution and abundance of Johnson's seagrass. Data collected should be contributed to Florida Fish and Wildlife Conservation Commission to support ongoing GIS mapping of Johnson's and other seagrass distribution.

7. NMFS recommends that USACE, in coordination with seagrass researchers and industry, support ongoing research on light requirements and transplanting techniques to preserve and restore Johnson's seagrass.

Johnson's seagrass

8. NMFS recommends that the USACE conduct a survey on the effects of dock and vessel shading on Johnson's seagrass for docks at varying heights and decking materials.

12 Reinitiation of Consultation

As provided in 50 CFR Section 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) take occurs, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the Biological Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

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14 Appendix A: Authorities under which an Action Will Be Conducted

USACE uses multiple methods to authorize activities. Pursuant to Section 404 of the CWA (33 U.S.C. 1344) and Section 10 of the RHA of 1899 (33 U.S.C. 403), USACE has authority to issue GPs[52] (regional, programmatic, and nationwide) for any category of activities that are substantially similar in nature, and result in no more than minimal adverse effects on the environment, either individually or cumulatively. Section 10 of the RHA authorizes all structures and work in navigable waters of the United States while Section 404 of the CWA covers the discharge of dredged or fill materials in waters of the United States. USACE uses a combination of all 3 types of these GPs (regional, programmatic, and nationwide) when authorizing activities within the state of Florida and the U.S. Caribbean, provided it has been determined that the environmental consequences of the action(s) are individually and cumulatively minimal (see 33 CFR 325.2(e) and 33 CFR Part 330). PGPs are used to avoid unnecessary duplication of the regulatory control exercised by another federal, state, or local agency. All GPs are valid for a maximum of 5 years (33 CFR 325.2(e)(2)) and must be re-evaluated prior to reissuance.

As stated in the NWP Opinion (NMFS 2014a), a basic premise of the USACE's permitting program is that no discharges of dredged or fill material into waters of the United States shall be permitted if: (1) a practicable alternative exists that is less damaging to the aquatic environment, or (2) the discharge would cause the nation's waters to be significantly degraded. In order for a project to be permitted, it must be demonstrated that, to the extent practicable, steps have been taken to avoid impacts to wetlands and other aquatic resources, potential impacts have been minimized, and compensation will be provided for any remaining unavoidable impacts.

14.1.1 Current Permits Used to Authorize Projects in Florida under NMFS Jurisdiction

Below is a description of permits used by USACE to authorize activities within the state of Florida. Table 70 provides a list of all of the RGPs and PGPs used to authorize activities under NMFS jurisdiction in the USACE Jacksonville District.

1. **Nationwide permits:** NWPs are a type of GP issued for activities that occur throughout the United States. On January 6, 2017, the USACE issued its 2017 NWPs for work in streams and wetlands under Section 404 of the federal CWA and Section 10 of the RHA of 1899 (82 FR 1860). The 2017 NWPs are effective March 19, 2017, for a period of 5 years, replacing the 2012 NWPs that expired on March 18, 2017. The USACE issued Decision Documents for each of the fifty-four 2017 NWPs. The Decision Documents state that the issuance of the 2017 NWPS will have "no effect" under the ESA. The USACE reached its "no effects" determination based on General Condition 18, which requires every applicant for a permit that "might affect" an ESA-listed species or its designed critical habitat to submit a pre-construction notification, so that the USACE can determine if the action requires ESA consultation.

[52] The term "general permit" (GP) is defined at 33 CFR 322.2(f) and 33 CFR 323.2(h). Programmatic general permits are a type of general permit, and are defined at 33 CFR 325.5(c)(3).

Table 70. NWPs used by the USACE Jacksonville District

NWP	Description
NWP-1	Aids to Navigation
NWP-2	Structures in Artificial Canals
NWP-3	Maintenance
NWP-4	Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities
NWP-5	Scientific Measurement Devices
NWP-6	Survey Activities
NWP-7	Outfall Structures and Associated Intake Structures
NWP-8	Oil and Gas Structures on the Outer Continental Shelf
NWP-9	Structures in Fleeting and Anchorage Areas
NWP-10	Mooring Buoys
NWP-11	Temporary Recreational Structures
NWP-12	Utility Line Activities, Utility lines, Utility line substations, Foundations for overhead utility line towers, poles, and anchors, Access roads
NWP-13	Bank Stabilization
NWP-14	Linear Transportation Projects
NWP-15	USCG Approved Bridges
NWP-16	Return Water From Upland Contained Disposal Areas
NWP-17	Hydropower Projects
NWP-18	Minor Discharges
NWP-19	Minor Dredging
NWP-20	Response Operations for Oil and Hazardous Substances
NWP-21	Surface Coal Mining Activities
NWP-22	Removal of Vessels
NWP-23	Approved Categorical Exclusions
NWP-24	Indian Tribe or State Administered Section 404 Program
NWP-25	Structural Discharges
NWP-27	Aquatic Habitat Restoration, Establishment, and Enhancement Activities
NWP-28	Modifications of Existing Marinas
NWP-29	Residential Developments
NWP-30	Moist Soil Management for Wildlife
NWP-31	Maintenance of Existing Flood Control Facilities
NWP-32	Completed Enforcement Actions
NWP-33	Temporary Construction, Access, and Dewatering
NWP-34	Cranberry Production Activities
NWP-35	Maintenance Dredging of Existing Basins
NWP-36	Boat Ramps
NWP-37	Emergency Watershed Protection and Rehabilitation
NWP-38	Cleanup of Hazardous and Toxic Waste
NWP-39	Commercial and Institutional Developments
NWP-40	Agricultural Activities
NWP-41	Reshaping Existing Drainage Ditches

NWP-42	Recreational Facilities
NWP-43	Stormwater Management Facilities
NWP-44	Mining Activities
NWP-45	Repair of Uplands Damaged by Discrete Events
NWP-46	Discharges in Ditches
NWP-48	Existing Commercial Shellfish Aquaculture Activities
NWP-49	Coal Remaining Activities
NWP-50	Underground Coal Mining Activities
NWP-51	Land-Based Renewable Energy Generation Facilities
NWP-52	Water-Based Renewable Energy Generation Pilot Projects
NWP-53	Removal of Lowhead Dams
NWP-54	Living Shorelines

2. **Programmatic general permits:** PGPs are a type of GP issued by USACE that delegate authorization to other federal, tribal, state, or local regulatory authorities where there is duplication in their programs. The purpose of PGPs is to improve the regulatory process for applicants, enhance environmental protection, reduce unnecessary duplicative procedures and evaluations, and make more efficient use of limited resources. Each PGP is specifically defined and requires a written agreement between USACE and the entity receiving delegation authority. The agreement stipulates the review process and defines "kick-outs" (i.e., situations where the proposed activity would not meet the PGP Special Conditions and would come back to USACE for review).

   In Florida, USACE provides delegated authorization to the following agencies to permit activities under NMFS jurisdiction for these listed permits: SAJ-91 provides administrative limited authority to the City of Cape Coral; SAJ-96 provides administrative limited authority to Pinellas County; SAJ-99 delegates authority to the Florida Department of Agriculture and Consumer Services for live rock and marine bivalve aquaculture; SAJ-42 provides limited administrative authority to Miami-Dade County, and the SPGP provides limited administrative authority to FDEP (see Table 71).

   USACE retains the authority to modify, suspend, or revoke any PGP if the USACE believes that appropriate protection is not being afforded to the environment or other relevant aspects of the public interest, or when USACE concludes that adverse environmental effects are more than minimal, either individually or cumulatively. Additionally, USACE always retains its authority to require an individual permit for any particular project, even if the project otherwise meets all the requirements of the PGP. USACE exercises this authority when it concludes that the processing of an individual permit is necessary to protect the environment, public interest, or when individual or cumulative effects require a more rigorous review. Lastly, USACE retains the full range of its enforcement authority and options where it believes that a project does not comply with the terms or conditions of the PGP, regardless of whether the project has been permitted by the federal, tribal, state, or local regulatory authority.

Table 71. USACE General Permits in Florida and the U.S. Caribbean That May Affect Species within NMFS' Jursidiction

USACE RGPs/ PGPs	Permit Description
USACE Permits in Florida	
SAJ-5	Maintenance Dredging in Residential Canals in Florida
SAJ-13	Aerial Transmission Lines in Florida
SAJ-14	Subaqueous Utility and Transmission Lines in Florida
SAJ-17	Minor Structures in Florida
SAJ-20	Private Single-Family Piers in Florida
SAJ-33	Private Multi-Family or Government Piers in Florida
SAJ-34	Private Commercial Piers in Florida
SAJ-42 (PGP)	Minor Activities in Miami-Dade County
SAJ-46	Bulkheads and Backfill in Residential Canals in Florida
SAJ-72	Residential Docks in Citrus County
SAJ-82	Single-Family Shoreline Stabilization, Marginal Docks, and Boat Ramps in Monroe County
SAJ-91 (PGP)	Minor Activities in the Canal System of the City of Cape Coral
SAJ-93	Maintenance Dredging Activities for the Atlantic Intracoastal Waterway, the Intracoastal Waterway, and the Okeechobee Waterway
SAJ-96 (PGP)	Minor Activities in Pinellas County
SAJ-99 (PGP)	Live Rock and Marine Bivalve Aquaculture in Florida
SPGP (PGP)	State Programmatic General Permit for the State of Florida
USACE Permits in the U.S. Caribbean	
SAJ-81	Maintenance Dredging the Mouths of Rivers, Creeks, Streams, Canals, and/or Storm Drainage Located in Navigable Waters of the United States, in the Commonwealth of Puerto Rico
SAJ-85	Discharge of dredged or fill material in non-tidal waters for maintenance, enhancement or restoration of stream channels, conducted or supervised by the Puerto Rico Department of Natural and Environmental Resources

3. **Regional general permits:** RGPs are a type of GP specific to a given region (in this case, Florida). Within the state of Florida, USACE staff individually review permit applications to determine if it meets the terms and conditions defined by an RGP. All RGPs require an applicant to submit a preconstruction notification and cannot begin construction until they have received a written verification from USACE that their project is authorized in accordance with the terms and conditions of the RGP.

4. **Individual permits:** If a project is not authorized by the USACE under an RGP, NWP, or PGP because the effects of the action will be more than minor in nature or if the project needs an additional level of review, then it is addressed as an individual permit. Individual permits are issued following a case-by-case evaluation by USACE in accordance with the procedures detailed in 33 CFR Part 325, and a determination that the proposed structure or work is in the public interest pursuant to 33 CFR Part 320. Individual permits require Section 7 consultation with NMFS (consultation) for projects involving in-water work that may affect ESA-listed species or critical habitat under our purview.

Types of Individual Permits:

1. **Letters of Permission:** Letters of permission (LOP) are a type of individual permit issued in accordance with the abbreviated procedures located in 33 CFR 325.2(2). The procedures and standards for issuing LOPs are developed after coordination with federal and state fish and wildlife agencies, as required by the Fish and Wildlife Coordination Act, and a public interest evaluation. An LOP authorization can be issued without requesting public input. An LOP is appropriate for projects (1) subject to Section 10 of the RHA of 1899, (2) that are considered minor by the USACE District Engineer and would not have significant individual or cumulative effects on environmental values, and (3) should encounter no appreciable opposition. For example, marinas or multifamily piers with 20 or fewer boat slips may qualify for a Letter of Permission. LOPs may also be used in those cases subject to Section 404 of the CWA, after the USACE District Engineer (1) consults with federal and state agencies to develop a list of categories of activities proposed for authorization under LOP procedures, (2) issues a public notice advertising the proposed list and the LOP procedures, requesting comments and offering an opportunity for public hearing, (3) issues or waives a 401 certification, and, (4) issues a Coastal Zone Management Act consistency concurrence obtained or presumed either on a generic or individual basis. An example of a Section 404 LOP is an erosion control activity that does not to exceed 0.2 ac of fill.

2. **Standard Permits (SPs):** A project that does not qualify for GP or LOP authorization is reviewed through the standard permit process (see 33 CFR 325.5(b)(1)), which includes a public notice, public interest review, environmental documentation, and, if applicable, a Section 404(b)(1) Guidelines compliance analysis. SPs are used for projects that generally exceed 0.5 ac of impact to waters of the United States with more than a minimal impact on the environment.

3. **Modifications**: The construction window for individual permits is typically 5 years. If the permittee wishes to change the project or extend the construction window, a modification request must be submitted to the USACE. Any modification would still need to comply with the regulations discussed above for LOP and SPs. A new ESA consultation is only required for modifications if the project design has changed such that it increases the impact to listed species or critical habitat or if new species or critical habitat has been designated in the action area.

15 Appendix B: In-water Construction Noise

15.1 Glossary of Acoustic Terms

Abandonment – In reference to species' use of an area, the long-term discontinued resting, feeding, mating, or nursing areas, or other areas that are important to the species.

Avoidance – In reference to species' reaction to noise, individuals may avoid an area for the duration a noise is present.

Behavioral Zone – The distance from pile driving within which species might experience potentially adverse behavioral reactions.

Cumulative Sound Exposure Level (cSEL) – A measurement of the accumulated sound energy associated with a series of pile strikes occurring during a construction event. cSEL at a certain level can physically injure species. cSEL can be estimated from the single-strike (SEL) and the number of strikes that likely would be required to place the pile at its final depth by using the following equation:

cSEL = sSEL + 10 log(number of pile strikes) for impact pile driving
cSEL = sSEL + 10 log(time in seconds) for vibratory pile driving.

Cylindrical Spreading – Sound that spreads away from a source in the shape of a cylinder. In some environments, sound will not propagate uniformly in all directions from a source. A simple approximation for spreading loss in a medium with upper and lower boundaries, such as the ocean, can be obtained by assuming that the sound is distributed uniformly over the surface of a cylinder having a radius equal to the range r and a height H equal to the distance between the upper and lower boundary (in the example of the ocean, the depth of the ocean). Beyond some range, the sound will hit the sea surface or sea floor, or other reflective surfaces.

Dry Firing – A method of raising and dropping the pile-driving hammer with no compression of the pistons, producing a lower-intensity sound than the full power of the hammer.

Effective Quiet – The level at which a sound becomes too quiet to contribute to hearing loss from cumulative sound exposure.

Ensonified – An area where sound is present. In the Opinion, the ensonified zone refers to the area of water where the sound from the noise-generating pile driving is present.

Habituation – Becoming accustomed to noise through repeated or prolonged exposure. Habituation can occur even when negative consequences result.

Harassment Zone – The distance from a noise within which behavioral reactions or temporary threshold shift may occur.

Impact Zone – The distance from the pile encompassing the effects of interest (i.e., the physical injury zone and/or the behavior zone).

Onset of injury - The point at which a permanent threshold shift or tissue damage occurs.

Physical Injury Zone – The distance from a noise source within which physical injury is expected.

Masking – Obscuring of softer sounds of interest by louder sounds at similar frequencies. Masking of the vocalizations of conspecifics, mates, predators, and other important signals may affect marine mammals. An analogous effect in humans would be the experience of having difficulty discerning an individual person's speech at loud parties.

Mortality Zone – The distance from a noise source within which mortality may occur.

No response – Some species may exhibit no apparent response to a noise while other species exhibit strong responses. No apparent response may indicate undetectable effects (e.g., habituation, permanent threshold shift, and stress).

Peak Pressure – The loudest sound impulse at any instant in time during a strike. Peak pressure is the maximum positive pressure between zero and the greatest pressure of signals in units of dB re 1 µPa peak or 0-peak for impulsive pile-driving noise. 0-p values are not to be confused with peak-to-peak measurements (p-p). Exposure to peak pressure above a certain level can result in physical injury.

Permanent Threshold Shift – Permanent shift in the auditory threshold from exposure to loud noise over a period of time. Permanent threshold shift is considered permanent hearing loss, and such a loss may affect foraging success, mate acquisition, and other biologically important activities.

Physical Injury – Some sounds, such as pressure waves or intense noise from a source, create pressure waves or high-energy sound waves that can result in tissue damage, including swim bladder damage. When we discuss physical injury from noise, we are referring to these types of injuries (tissue damage) and permanent threshold shift.

Physiological Stress – Noise is a potential environmental stressor and physiological stress is the term for the physiological response to that stressor. For example, noise can trigger immune system responses that can affect the health of animals.

Ramp-Up – A method that involves slowly increasing the power of the hammer, and thus the noise the hammer produces, over a period of time prior to operating at full power and beginning work.

Root Mean Square (RMS) – A type of average. In the context of measuring noise in an aquatic environment, the RMS represents the total sound energy in a single strike impulse. It is a decibel measure of the square root of the mean square pressure. For impulses, the average of the squared pressures over the time that comprise that portion of the waveform containing 90% of the sound energy of the impulse. Exposure to RMS above a certain level can result in behavior effects.

Sensitization – Increased behavioral response over time as animals learn that a repeating or ongoing noise has significant consequences.

Single Strike Sound Exposure Level (sSEL) – An index of the 90% of the sound energy in a single strike. Exposure to sSEL at certain levels can result in physical injury.

Sound Exposure Level (SEL) – Sound energy associated with a pile-driving pulse (sSEL), or series of pulses (cSEL), is characterized by the SEL. SEL is calculated by summing the cumulative pressure squared over the time of the event.

Spherical Spreading – Spherical spreading describes the decrease in level when a sound wave propagates away from a source uniformly in all directions from a sound source in the shape of a sphere.

Temporary Threshold Shift – Temporary hearing loss caused by a decreased sensitivity in hearing. The analogous effect in humans is ringing in the ears and loss of hearing experienced after a loud concert. Temporary threshold shift is generally fully recoverable within hours or days and results in short-term effects.

Watch Zone – A protective buffer zone to be monitored to detect animals that are heading towards the impacted area. The watch zone radius may vary depending on the type of project and species potentially occurring in the project area.

15.2 How in-water Noise Effects to ESA-listed Species Are Evaluated

Sea turtles, smalltooth sawfish, sturgeon, and grouper are low-frequency hearing generalists (Table 72) and are able to detect the vibrations and lower frequency sound components associated with construction noise. Our current noise analysis is grouped into 2 categories, 1 for effects to fish and the other for effects to sea turtles. When looking at the effects of in-water construction noise, smalltooth sawfish are categorized under the effects to fish along with more traditional fish such as sturgeon (Atlantic, shortnose, and Gulf) and Nassau grouper. Although several different types of activities produce underwater sound, the analysis shows that the loudest noises of concern that may harm listed species result from impact pile-driving activities. Many other underwater noises are produced by construction activities that increase ambient noise levels, but are generally not harmful to sea turtles and fish. Since pile-driving activities occur in shallow, nearshore waters, our analysis does not consider the effects of this action on ESA-listed whales, which we would expect to occur in deeper waters.

Table 72. Hearing ranges of listed species

Species or Group	Hearing Range	References
sea turtles	100-2,000 Hz	Ketten and Bartol (2006); Lenhardt et al. (1996); Lenhardt (1994); McCauley et al. (2000a); McCauley et al. (2000b); Moein et al. (1994); O'Hara and Wilcox (1990)
smalltooth sawfish	<1,000 Hz	Hearing in the species has not been measured, but is based on assumed lower-frequency hearing for fish without swim bladders (e.g., (Casper et al. 2003).
sturgeon	100-2,000 Hz	(Fay and Popper 2000; Lovell et al. 2005; Meyer et al. 2003; Meyer and Popper 2002)
grouper	100-2,000 Hz	Hearing in this species has not been measured, but is based on assumed low-frequency hearing for fish with swim bladders similar to sturgeon provided above.

During impact pile-driving, noise is produced when the energy from the hammer is transferred to the pile and released into the surrounding water and sediment. We have characterized these construction activities and associated noise levels using the best available information provided by the USACE, the Florida Marine Contractors Association, and published literature. Depending on the type and location of pile-driving activity, noise can result in a spectrum of responses in species, ranging from minor to those that can disturb or injure vulnerable animals (Figure 28).

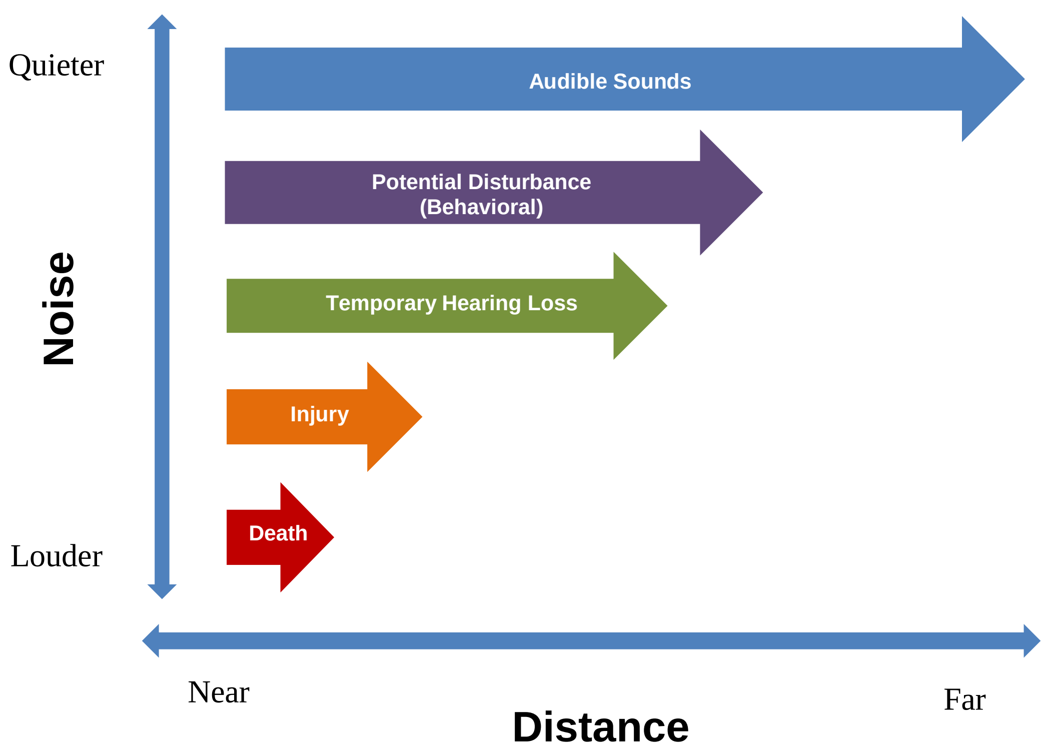


Figure 28. The relative effects to animals: distance to/from a noise source.

15.2.1 Exposure Criteria Used to Determine Potential Effects

NMFS formed a Fisheries Hydroacoustic Working Group in 2004 to evaluate the effects of in-water noise on species under NMFS's jurisdiction. This team consists of biologists from NMFS West Coast Region, USFWS, Federal Highway Administration, and the California, Washington and Oregon Department of Transportations, supported by national experts on sound propagation activities that affect fish and wildlife species of concern. In June 2008, the agencies signed a memorandum of understanding documenting interim criteria for assessing physiological effects of pile driving on fish, until more information was available to reassess these threshold criteria. The criteria were developed for the acoustic levels at which physiological effects to fish could be expected (the onset level), referred to as interim threshold standards below. It should be noted that these onset levels for physiological effects are not the levels at which fish are necessarily mortally damaged and that some physiological effects are minor and recoverable.

These interim threshold standards are used by all of the NMFS regional offices:

- Peak pressure from a single strike: 206 decibels relative to 1 micro-Pascal (dB re 1 μPa).
- cSEL: 187 decibels relative to 1 micro-Pascal-squared second (dB re 1μPa2-s) for fishes above 2 grams (0.07 ounces).
- cSEL: 183 dB re 1μPa2-s for fishes below 2 grams (0.07 ounces).

For purposes of assessing behavioral effects of pile driving at several West Coast projects, NMFS has employed a 150 dB re 1 μPa RMS sound pressure level threshold above which it estimates fish species will experience behavioral effects at several sites including the San Francisco-Oakland Bay Bridge and the Columbia River Crossings. This behavioral threshold is also currently used by the NMFS's Greater Atlantic Regional Office and the Southeast Regional Office. NMFS's Southeast Regional Office considers the threshold for behavioral noise effects to sea turtles to be 160 dB re 1 μPa RMS sound pressure level (Skalski et al. 1992). The thresholds used by NMFS's Southeast Regional Office are summarized in Tables 73 and 74 below.

Table 73. Impact pile-driving threshold noise levels for fish and sea turtles

Effect	Animal	Threshold Level (dB re 1 μPa)[e]
Physical Injury (peak pressure)	Fish[a,b] and Sea Turtles	206 (peak pressure)
Physical Injury (Cumulative exposure)	Fish less than 2 grams	183 cSEL
Behavior	Fish[c]	150 (RMS)
	Sea Turtles[d]	160 (RMS)

[a] FHA (2012). Fish are considered more sensitive to physical injury than sea turtles; therefore, fish thresholds are used for both fish and sea turtles as conservative interim criteria.
[b] (Halvorsen et al. 2012a; Halvorsen et al. 2012b)
[c] (McCauley et al. 2000b)
[d] Skalski et al. (1992)
[e] See glossary for definitions of different decibel (dB) levels.

Table 74. Continuous noise threshold levels for fish and turtles from exposure to vibratory pile-driving noise

Effect	Animal	Threshold Level (dB re 1 µPa)
Physical Injury (peak pressure)[a]	Sturgeon, Sawfish, and Sea Turtles	206 (peak pressure)
Physical Injury (Cumulative exposure)	Fish larger than 102 grams	234 cSEL
Behavior	Fish	150 (RMS)
	Sea Turtles	160 (RMS)

[a] Injury criteria from Hastings (2010). There are no SEL criteria for sea turtles for continuous noises. Fish are considered more sensitive to physical injury than sea turtles; therefore, fish thresholds are used for sea turtles as conservative interim criteria

Research continues on the effects of in-water construction on fish, marine mammals, and other aquatic species. Studies by researchers indicate that the threshold of noise impacts to fish may be higher than the interim NMFS thresholds established by the Fisheries Hydroacoustic Working Group in 2008. NMFS is working to review continued research to determine if new guidance and thresholds are warranted. For instance, Halvorsen et al. (2012b) exposed 3 species of fish to pile driving noise in a laboratory setting. Following testing, fish were euthanized and examined for external and internal signs of barotrauma. Halvorsen et al. (2012b) classified the types of fish tested by differences in their anatomy that result in different physiological changes to these groups of fish from pile driving, as described below:

- Fish without swim bladders: Halvorsen et al. (2012b) tested hogchoker fish, a flat bodied fish, for this category of fish. In the southeast region, the only ESA-listed species without a swim bladder is the smalltooth sawfish.

- Physostomous (fish with open swim bladders): Halvorsen et al. (2012b) describes these fish as more evolutionarily ancestral than fish with a closed swim bladders (described below). Physostomous fish have a swim bladder that is connected to the gut via a pneaumatic duct that allows them to gulp air from the water surface and expel air quickly to adjust the volume of air within the swim bladder. They tested the lake sturgeon in their experiment for this category of fish. ESA-listed physostomous fish in the southeast region include Gulf, Atlantic, and shortnose sturgeon.

- Physoclistous (fish with closed swim bladders: Halvorsen et al. (2012b) describes these fish as recently evolved fish species. Physoclistous fish have a gas gland that provides gas exchange by diffusion between the swim bladder and blood. They tested Nile tilapia in their study for this category of fish. The only ESA-listed physostomous fish in the southeast region is the Nassau grouper.

All 3 categories of fish were exposed to a series of 5 trials beginning with a cSEL of 216 to a cSEL of 204 dB re 1uPa2-s (derived from 960 pile strikes and 186 dB re 1uPa2-s sSEL). In this and subsequent studies by Halvorsen et al. (2012a); Halvorsen et al. (2012b), injuries were categorized by a response weighted index to categorize injuries as mild, moderate, or mortal. The authors defined mild injuries response weighted index 1 as those that were non-life threatening. Based on this and similar studies, the authors made recommendations for cumulative noise exposure thresholds to be raised from the current 187 dB cSEL to 210 dB cSEL, because only mild injuries were observed up to 210 dB cSEL. Because we consider even mild injuries to be physical injury and we are concerned about the potential starting point/onset of physical injury and not the mean of when only mild injuries were observed, NMFS will continue to use the injury thresholds summarized in Tables 73 and 74 above to be conservative and protective of ESA-listed species, while acknowledging that the cumulative sound exposure threshold may be adjusted as new research becomes available.

One potentially important result of the Halvorsen et al. (2012b) study is that the hogchoker (fish without a swim bladder) did not suffer visible external or internal injuries at lower cSEL levels tested, while the swim bladder fish still suffered mild internal injuries. The fish with open swim bladders also suffered fewer internal injuries than the fish with closed swim bladders. As more research continues, this may lead to policy changes for different species of ESA-listed fish such as the smalltooth sawfish that also lacks a swim bladder. Although, another consideration for bottom-dwelling elasmobranchs such as the smalltooth sawfish is that they are often in contact with the substrate (Casper et al. 2012). The vibrations within the sediment from pile driving could also be damaging, especially when considering the body shape of sawfish. Many of the organs of these dorsoventrally flattened fishes are in close proximity to the bottom surface of the body, providing little protection from pile-driving vibrations. It is unclear if the Halvorsen et al. (2012b) study took into consideration the secondary effects of noise from vibrations within the sediment.

15.3 Calculations of Noise Thresholds for Pile Driving

Assumptions of the Analyses

The calculations in this document are based on a series of assumptions. These assumptions and resulting key points are provided in the list below and discussed further in this section:

- The number of piles necessary to complete construction varies by the size and intent of the project. For example, typical residential dock with an average of 15 piles requires approximately 10 hours of pile driving and can take 2 or more days to complete. Some larger residential docks can use up to 70 piles or more and noise could be produced over a period of 2 weeks or longer. Pile driving for common minor activities does not occur at night.

- Pile types considered include:
    - vinyl piles and sheet piles
    - wood piles (round timber)
    - concrete piles (in a variety of shapes including round and square)
    - metal boat lift I-beams (steel or marine-grade aluminum)
    - metal piles used for docks and seawalls
    - metal sheet piles (steel or marine-grade aluminum).

- Noise spreads cylindrically in coastal waters and noise transmission is characterized by 15 logR spreading loss.

- Strike rates for dock construction with wood piles have been reported to occur once or twice per minute (CALTRANS 2007). The average number of strikes per pile is estimated as 45, calculated as an average of 1.5 times per minute for 30 minutes.

- Concrete pile installation is estimated to take 160 strikes per pile.

- Sheet piles and I-beams can be installed by impact hammer in no more than 12 to 15 minutes, with pile strikes about once every 1.4 seconds or 43 to 44 strikes per minute (660 strikes per pile) (CALTRANS 2007).

- Daily exposure limits are based on the installation of 10 wood or concrete piles per day.

- Vibratory pile driving may take up to 30 minutes per pile.

- Installing vinyl piles is expected to produce noise similar to that produced by the installation of wood piles. We will use the available measurements for wood piles to estimate vinyl pile noise until additional information and measures from the installation of vinyl piles is available.

- For this analysis, we considered an impact pile driver as a combustion driven device used to install piles. There are 2 main classes of impact hammers: external combustion and internal combustion. External combustion hammers use cables, steam, compressed air, or pressurized hydraulic fluid to raise the ram, which is then dropped by gravity (e.g., a drop hammer). Internal combustion hammers do not rely on gravity and force the ram into the pile (e.g., a diesel hammer). During impact pile driving, noise is produced when the energy from the hammer is transferred to the pile and released into the surrounding water and sediment as the pile makes contact with the area into which it is being driven.

- Hand installation of any type of pile was determined to not result in noise at levels that would cause physical injury from peak pressure or cumulative sound exposure or cause behavioral effects and does not require mitigation.

- The noise analysis also evaluates effects of projects occurring in both open-water and confined space settings. This differentiation is important because if a project occurs in a confined space, the animal may not be able to avoid the physical injury zone or behavioral zone or may become trapped in an area (e.g., the terminal end of a canal) due to those zones blocking the only escape route. For our noise analysis, a *confined space* is defined as any area that has a solid object (e.g., shorelines or seawalls) that creates a constricted passage area such that species attempting to move through the area would be forced to pass through the cumulative injurious zone, which is the zone in which species could be exposed to injurious noise levels if they remained in the area over a period of time. To allow species to move through the project areas without being exposed to noise at levels that could be injurious over time, the PDCs limit certain pile types and installation methods in these confined spaces to ensure that the cumulative injurious zone is limited to a maximum of half the width of the confined area.

In Florida, we consider the confined space to be any area that has a solid object (e.g., shorelines or seawalls) within 150 ft of the pile installation site and in the U.S. Caribbean we consider confined space to be any area that has a solid object within 260 ft of the pile installation site. These confined space distances were calculated by doubling the cumulative injurious zone for large fish found in Florida and smaller fish found in the U.S. Caribbean (calculations provided in Tables 75 and 76, and an example of a confined space shown in Figure 29). Again, this ensures that a fish or sea turtle would have at least half the width of the channel free from cumulative injurious noise so that they could move through the area as needed without being exposed. Docks or other pile-supported structures do not stop or reflect noise do not create confined spaces. Conversely, in an open-water environment, the animal would be able to move away from the noise without passing through an area with injurious noise levels.

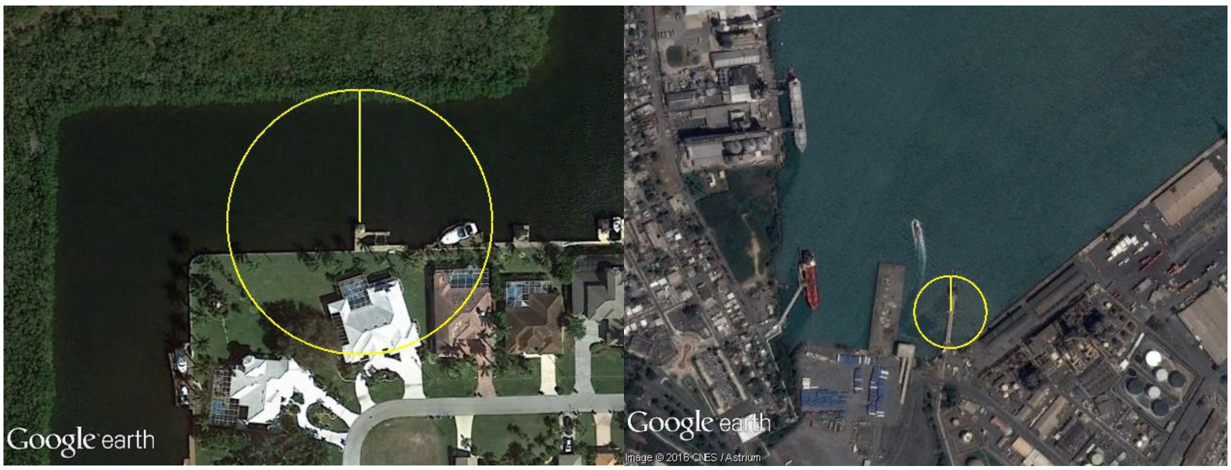


Figure 29. Example of a confined space for a noise analysis. The left image shows a 150 ft radius in a channel resulting in the channel not being wide enough to ensure more than half the channel was free from cumulative injurious noise levels. The right image shows a portion of San Juan Harbor and a 260 ft radius that would not block movement of species if piles were installed at this location because species would be able to move along the left side of the image between the 2 structures.

15.3.1 Pile-Driving Noise Calculations

Tables 75 and 76 below provide a summary of the noise calculation results for each of the pile types installed by each of the pile installation methods. All calculations were completed using the formulas and methods described further in this section. Pile-driving source noise data was derived from CALTRANS (2009). Source levels were back-calculated from the reported measurement distance to the pile using 15 logR cylindrical spreading loss. These calculations assume that single strike sSEL less than 150 dB does not accumulate to cause physical injury meaning the sound level has decreased sufficiently at a distance from the sound source and has reached the effective quiet (explained in more detail below).

Table 75. Impact Hammer sound source levels and impact radius distances

	Source Level (dB re 1 μPa[53])	Radius for Fish less than 2 grams	Radius for Fish over 2 grams	Radius for Sea Turtles
14-in wood pile and vinyl sheet Calculated 10 piles installed per day with 45 strikes per pile = 450 strikes per day				
Physical Injury (peak pressure)	195 dB Peak	0 m (1 ft)	0 m (1 ft)	0 m (1 ft)
Physical Injury (Cumulative exposure)	cumulative	1 pile = 4 m (12 ft) 5 piles = 11 m (36 ft) 10 piles = 17 m (56 ft)	1 pile = 2 m (7 ft) 5 piles = 6 m (20 ft) 10 piles = 9 m (30 ft)	1 pile = 2 m (7 ft) 5 piles = 6 m (20 ft) 10 piles = 9 m (30 ft)
Behavior (Root Mean Square [RMS])	185 dB RMS	215 m (705 ft)	215 m (705 ft)	46 m (151 ft)
24-in concrete pile Calculated 10 piles installed per day with 160 strikes per pile = 1,600 strikes per day				
Physical Injury (peak pressure)	200 dB Peak	0 m (1 ft)	0 m (1 ft)	0 m (1 ft)
Physical Injury (Cumulative exposure)	cumulative	1 pile = 9 m (28 ft) 5 piles = 25 m (83 ft) 10 piles = 40 m (131 ft)	1 pile = 5 m (16 ft) 5 piles = 14 m (46 ft) 10 piles = 22 m (72 ft)	1 pile = 5 m (16 ft) 5 piles = 14 m (46 ft) 10 piles = 22 m (72 ft)
Behavior (RMS)	185 dB	215 m (705 ft)	215 m (705 ft)	46 m (151 ft)
Two 12-in metal boat lift I-beam (H-pile) [54] Calculated 2 piles installed per day with 660 strikes per pile = 1,320 strikes per day				
Physical Injury (peak pressure)	205 dB Peak	1 m (3 ft)	1 m (3 ft)	1 m (3 ft)
Physical Injury (Cumulative exposure)	cumulative	1 pile = 22 m (72 ft) 2 piles = 35 m (115 ft)	1 pile = 12 m (39 ft) 2 piles = 19 m (62 ft)	1 pile = 12 m (39 ft) 2 piles = 19 m (62 ft)
Behavior (RMS)	190 dB RMS	465 m (1,526 ft)	465 m (1,526 ft)	100 m (328 ft)
24-in metal sheet pile Calculated 10 sheet piles installed per day with 660 strikes per pile = 6,600 strikes per day				
Physical Injury (peak pressure)	220 dB Peak	9 m (30 ft)	9 m (30 ft)	9 m (30 ft)
Physical Injury (Cumulative exposure)	cumulative	1 pile = 410 m (1,345 ft) 10 piles = 858 m (2,815 ft)	1 pile = 223 m (732 ft) 10 piles = 858 m (2,815 ft)	1 pile = 223 m (732 ft) 10 piles = 858 m (2,815 ft)
Behavior (RMS)	204 dB RMS	858 m (2,8215 ft)	858 m (2,8215 ft)	185 m (607 ft)

[53] dB re 1 μPa is a unit of measurement of sound in decibels relative to 1 micro-Pascal-squared second

[54] Noise levels not believed to be accurate based on the installation method used. Boatlift I-beams only penetrate loose sediment until they reach the top of, or first few inches of, hard substrate to stabilize the structure on the hard substrate versus penetrating it.

Table 76. Vibratory Hammer sound source levels and impact radius distances

	Source Level (dB re 1 µPa)	Radius for Fish ≥ 102 grams	Radius for Sea Turtles
36-in wood, concrete, vinyl, or metal piles Calculated installation of piles for 8 hours per day (no limit on the number of piles per day)			
Physical Injury (peak pressure)	186 dB Peak	0 m (0 ft)	0 m (0 ft)
Physical Injury (Cumulative exposure)	cumulative	0 m (0 ft)	0 m (0 ft)
Behavior (RMS)	170 dB RMS	215 m (705 ft)	46 m (151 ft)
Two 12-in metal boat lift I-beam (H-pile) [55] Calculated 2 piles installed per day for 30 minutes (1,800 seconds) per pile = 3,600 seconds per day			
Physical Injury (peak pressure)	165 dB Peak	0 m (0 ft)	0 m (0 ft)
Physical Injury (Cumulative exposure)	cumulative	0 m (0 ft)	0 m (0 ft)
Behavior (RMS)	150 dB RMS	0 m (0 ft)	0 m (0 ft)
24-in metal sheet pile Calculated installation of sheet piles for 8 hours per day (no limit on the number of sheet piles per day)			
Physical Injury (peak pressure)	192 dB Peak	0 m (0 ft)	0 m (0 ft)
Physical Injury (Cumulative exposure)	cumulative	0 m (0 ft)	0 m (0 ft)
Behavior (RMS)	178 dB RMS	74 m (243 ft)	16 m (52 ft)

Underwater Construction Noises below the Threshold Levels for Physical Injury or Behavioral Effects

During our calculations, we determined that auger, drop punch, jetting, installation by land-based equipment, and hand installation did not result in noise levels that would cause physical injury or behavioral effects on listed species. These activities can temporarily increase ambient noise levels in an area, but we do not expect them to result in physical injury or behavioral effects to listed species, and thus we believe they will have no effect on the species.

1. **Auger:** When installing piles into hard substrates, sometimes a pilot hole is created using an auger, or by drop punching. Noise levels from small-scale drilling operations that are representative of dock construction methods have been measured to be no more than 107 dB re 1 µPa (0-peak) at 7.5 m from the source (Willis et al. 2010). Our back-calculation resulted in an approximate source level no greater than 120 dB re 1 µPa (0-peak). Noise associated

[55] Noise levels are not believed to be accurate based on the installation method used. The impact radii are estimated based on typical installation of a metal pile in hard substrate, which requires a number of strikes to penetrate the substrate. Boatlift I-beams only penetrate loose sediment until they reach the top of, or first few inches of, hard substrate to stabilize the structure on the hard substrate. Thus, installing boatlift I-beams by impact hammer is likely to result in less noise than installing other metal piles by impact hammer in hard substrate.

with augering is below the behavioral and injury thresholds used in this analysis, and is discountable.

2. **Drop punching** is a method that uses a 12- to 24-in-diameter steel punch dropped repeatedly from a barge-mounted crane. After the pilot hole is created, the pile is inserted then driven to resistance using an impact hammer. Noise generated during drop punching has either not been measured or is unreported in the available literature. The best available information on construction equipment striking the sea bottom comes from measurements of bucket dredge noise. The noise produced from the heavy bucket dropped onto the channel bottom was measured to be 124 dB re 1 µPa (RMS) at 150 m from the work site (Dickerson et al. 2001). Back-calculating the noise attenuation 150 m results in a potential source level of 156 dB re 1 µPa (RMS), 6 dB above the behavioral threshold for fish. However, drop punch noise falls below 150 dB re 1 µPa (RMS) within a few feet of the installation site, and is well below the potential injury thresholds used in this analysis. In addition, the PDCs in this Opinion require crews to shut down construction equipment if protected species are observed within 50 ft of the project.

3. **Jetting** uses high-pressure water sprayed beneath the pile to excavate sediment and sand layers, and is often used in conjunction with other pile-driving methods to assist penetration of the pile into the substrate. Jetting results in much lower noise levels than either impact or vibratory pile driving alone and minimizes the amount of hammering necessary. Noise measurements taken with water jetting turned on or off during pile driving resulted in no additional noise recorded above that of the pile-driving noise (CALTRANS 2007). For complete pile replacement in the existing footprint, with no new piles driven, the source levels for jetting could be up to 170.5 dB re 1 µPa (peak) (Molvaer and Gjestland 1981) or about 160 dB (RMS), which would result in small behavioral zone for smalltooth sawfish and sturgeon (about 10-15 m) and no behavioral disturbance for sea turtles. Water jetting noise has an associated behavioral zone up to 15 m for fish, but this zone is within the same distance that construction is likely occurring and is too small to have any significant effect on fish behavior or habitat and is insignificant.

4. **Land-based equipment** does not generate noise in the marine environment that reach levels high enough to exceed the behavioral and physical injury thresholds used in this analysis. Because the air-water interface is an almost perfect reflector of acoustic waves, the noise generated by land-based mechanical excavators, generators, or other machinery will reflect off the surface and will not be transmitted into the water at levels expected to affect the species.

5. **Hand installation** of any type of pile was determined to not result in injurious or behavioral noise impacts and does not require mitigation.

15.3.2 Noise Control Measures to Reduce Injury

There has been a fair amount of work performed in reducing noise from pile driving, which is summarized in Table 77. For coastal waters, 'bubble curtains' have been the primary focus of noise control efforts based on their sound attenuation capabilities (when properly designed) and cost effectiveness. Recently, confined bubble curtains and TNAPs (also referred to as pile isolation casings) have shown consistently good results as noise-reducing measures. This section evaluates the effectiveness of these noise abatement measures and others.

Table 77. Effectiveness and cost of noise control measures for pile driving

Sound Treatment	Description	Effectiveness		Cost
		Reduction	Metric	
Bubble curtain or bubble tree	Air bubbles used to block sound	5-20+ dB	RMS, Peak, SEL	$50-200
Confined bubble curtain	A fabric, solid, or tubular curtain is used to confine bubbles	9-22 dB	RMS, Peak, Particle velocity	$100-200
Pile caps	Micarta caps used between the impact piling head and the pile to reduce noise	1-8 dB	RMS, Peak, SEL	Low material cost. May increase time to install pile.
Wood pile cushions	A block of wood used between the pile head and pile to reduce noise (often used with a pile cap).	11-26 dB	RMS, Peak, SEL	Low material cost. May increase time to install pile.
Temporary Noise Attenuation Pile	A physical barrier lined with foam or other materials	8-14 dB	RMS, Peak, SEL	Unknown.
Dewatered cofferdam	Removal of water around pile	15 dB 3-35 dB	RMS, Peak	Unknown. Assumed more than bubble curtains
Vibratory hammers	Alternative to impact hammers	10-20+ dB	RMS, Peak, SEL	2-3 times cost of impact hammers
Suction piles	Replacement for existing techniques	Very large reduction	All	Potential cost savings
Press-in piles	Piles are pressed into place	Very large reduction	All	Unknown

Table modified from Pile Driving Treatments table found in Spence et al. (2007) and updated with data by Laughlin (2010).

TNAPs or pile casings consist of a steel casing lined with noise insulating foam that is placed over the pile during installment. For smaller piles associated with docks, use of polyvinyl chloride (PVC) piles may be a viable alternative to steel piles, but they have not yet been tested.

A TNAP design is a hollow walled (air-filled) metal pile casing or foam-lined metal casing placed around the pile being driven. This method is best applied to vertical, non-interlocking piles. Noise levels with a TNAP can be reduced by an average of 11 dB (8 to 14 dB) (Laughlin 2010), but have been reported in previous studies to have an even greater capacity to reduce noise. In the latest report (Laughlin 2010), a double-wall TNAP was constructed using 2 concentric pipes with outside diameters of 60 in and 48 in with and a wall thickness of 1 in. The 5-in space between the inner and outer steel tubes was partially filled with a 4-in-thick, sound-absorbing material. Tests were conducted both with and without bubbles between the pile and the hollow tube via a bubble ring at the bottom of the TNAP. Bubbles resulted in a slightly greater reduction of 1-3 dB than TNAPs without bubbles. Laughlin (2010) recommended that TNAPs could be used as an alternative to the bubble curtain as an underwater noise mitigation device since the average noise reduction is about the same. New designs of TNAPs and confined bubble curtain designs are still being investigated to improve noise reduction capabilities.

Because of their shape, TNAPs cannot be used on sheet piles so a confined bubble curtain may be used to reduce noise levels. Confined bubble curtains consist of some type of aquatic barrier around a pile that is filled with bubbles. The bubbles are created by forcing compressed air through small holes drilled in PVC or steel pipe. The bubble curtain disrupts the sound waves as they passes through, thereby reducing noise levels transmitted beyond the curtain. In order to be effective, the bubble curtain must fully enclose the pile through the entire water column; the ring emitting the bubbles must be seated properly on the sea floor to avoid suspension or sinking of the PVC pipe. Reductions in peak pressure, RMS pressure, and energy are typically on the order of 5-20 dB or more (though we consider an average reduction of 11 dB for bubble curtains). Although the effectiveness of confined bubble curtains is more variable than TNAPs, the average noise reduction is about the same. Based on the best case scenario of a 20 dB reduction in noise, our estimates of the amount of noise reduction required to reduce the injury distance to less than 50 ft indicate that steel sheet piles may still have an associated injury zone even when confined bubble curtains are used. Yet, the actual noise levels will be largely dependent upon the type of sheet pile, the power of the impact hammer, the substrate hardness, and water depth.

The installation of metal sheet pile with an impact hammer requires an individual analysis for each project to determine the appropriate noise abatement needed to adequately reduce injurious and behavioral noise levels; therefore, activities involving metal sheet pile installation with an impact hammer are not covered under this Programmatic Opinion. These activities will require separate Section 7 consultation to address the increased risk of injury from noise. Projects requiring sheet piles that produce injurious noise levels will likely need to employ confined bubble curtain designs, as well as additional mitigation measures when possible, such as working at low tide, to reduce the amount of noise transmitted into the water.

It is important to note that vibratory piling-driving methods may be a reasonable solution for reducing the peak noise levels and removing impulsive sounds in certain applications. Vibratory methods have been measured to be significantly quieter than impact pile driving methods. In many cases, the reduction in noise levels can eliminate any risk of injury and minimize the area of behavioral disturbance. The Florida Marine Contractor’s Association has indicated that vibratory hammers are a viable option for the installation of I-beam used for in some boatlift designs; however, flexibility is needed for using a variety of pile driver types depending on the location and sediment layers encountered during pile driving.

15.3.3 Bubble Curtain Specifications for Pile Driving

When using an impact hammer to drive or proof concrete or metal piles, use 1 of the following sound attenuation methods:

1) If water velocity is equal to or less than 1.6 ft per second (1.1 miles per hour) for the entire installation period, surround the pile being driven by a confined or unconfined bubble curtain that will distribute small air bubbles around 100% of the pile perimeter for the full depth of the water column.
   a) General - An unconfined bubble curtain is composed of an air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipe, and a frame. The frame facilitates transport and placement of the system, keeps the aeration pipes stable, and provides ballast to counteract the buoyancy of the aeration pipes in operation.
   b) The aeration pipe system shall consist of multiple layers of perforated pipe rings, stacked vertically in accordance with the following:

Water Depth (m)	**Number of Layers**
0 to less than 5	2
5 to less than 10	4
10 to less than 15	7
15 to less than 20	10
20 to less than 25	13

   c) The pipes in all layers shall be arranged in a geometric pattern which shall allow for the pile being driven to be completely enclosed by bubbles for the full depth of the water column and with a radial dimension such that the rings are no more than 0.5 m from the outside surface of the pile.

      i. The lowest layer of perforated aeration pipe shall be designed to ensure contact with the substrate without burial and shall accommodate sloped conditions.
      ii. Air holes shall be 1.6 millimeter (mm) (1/16-in) in diameter and shall be spaced approximately 20 mm (3/4 in) apart. Air holes with this size and spacing shall be placed in 4 adjacent rows along the pipe to provide uniform bubble flux.
      iii. The system shall provide a bubble flux 3.0 m^3 per minute per linear meter of pipe in each layer (32.91 ft^3 per minute per lin ft of pipe in each layer). The total volume of air per layer is the product of the bubble flux and the circumference of the ring:

V_t = 3.0 cubic meter/minute/meter x Circumference of the aeration ring in m

or

V_t = 32.91 cubic feet/minute/feet x Circumference of the aeration ring in ft

      iv. Meters shall be provided as follows:

- Pressure meters shall be installed at all inlets to aeration pipelines and at points of lowest pressure in each branch of the aeration pipeline.
- Flow meters shall be installed in the main line at each compressor and at each branch of the aeration pipelines at each inlet. In applications where the feed line from the compressor is continuous from the compressor to the aeration pipe inlet, the flow meter at the compressor can be eliminated.
- Flow meters shall be installed according to the manufactures recommendation based on either laminar flow or non-laminar flow.

2) If water velocity is greater than 1.6 ft per second (1.1 miles per hour) at any point during installation or you are constructing a seawall, surround the pile or area being driven by a confined bubble curtain (e.g., a bubble ring surrounded by a fabric or non-metallic sleeve). The confined bubble curtain will distribute air bubbles around 100% of the pile perimeter for the full depth of the water column, according to specifications below.
   a) General - A confined bubble curtain is composed of an air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipe(s), and a means of confining the bubbles.
   b) The confinement shall extend from the substrate to a sufficient elevation above the maximum water level expected during pile installation such that when the air delivery system is adjusted properly, the bubble curtain does not act as a water pump (i.e., little or no water should be pumped out of the top of the confinement system).
   c) The confinement shall contain resilient pile guides that prevent the pile and the confinement from coming into contact with each other and do not transmit vibrations to the confinement sleeve and into the water column (e.g., rubber spacers, air filled cushions).
   d) In water less than 15 m deep, the system shall have a single aeration ring at the substrate level. In waters greater than 15 m deep, the system shall have at least 2 rings: 1 at the substrate level and the other at mid-depth.
   e) The lowest layer of perforated aeration pipe shall be designed to ensure contact with the substrate without sinking into the substrate and shall accommodate for sloped conditions.
   f) Air holes shall be 1.6 mm (1/16-in) in diameter and shall be spaced approximately 20 mm (3/4 in) apart. Air holes with this size and spacing shall be placed in 4 adjacent rows along the pipe to provide uniform bubble flux.
   g) The system shall provide a bubble flux of 2.0 m^3 per minute per linear meter of pipe in each layer (21.53 ft^3 per minute per lin ft of pipe in each layer). The total volume of air per layer is the product of the bubble flux and the circumference of the ring:
   Vt = 2.0 cubic meter/minute/meter x Circumference of the aeration ring in m
   or
   Vt = 21.53 cubic feet/minute/feet x Circumference of the aeration ring in ft

   (h) Flow meters shall be provided as follows:
      i. Pressure meters shall be installed at all inlets to aeration pipelines and at points of lowest pressure in each branch of the aeration pipeline.

ii. Flow meters shall be installed in the main line at each compressor and at each branch of the aeration pipelines at each inlet. In applications where the feed line from the compressor is continuous from the compressor to the aeration pipe inlet, the flow meter at the compressor can be eliminated.

iii. Flow meters shall be installed according to the manufacturer's recommendation based on either laminar flow or non-laminar flow.

15.4 How to Calculate Noise Impacts

15.4.1 Calculation Steps for Pile Driving

a. Review the Project for Needed Information

The basic information on the pile driving activity required to conduct an effects analysis is:

- the material composition of the piles (vinyl, wood, concrete, metal)
- the type of piles (e.g., sheet, H, tubular, square, etc.)
- the diameter of the piles
- the number of piles driven
- the number of hammer strikes per pile
- the duration to drive a single pile
- the number of piles driven per day
- the time of year of the activity
- the type of pile-driving method (e.g., hydraulic, diesel, vibratory hammer)
- other pile driving methods (e.g., drilling, jetting)
- the total duration of the project
- depth, bottom, type, and habitat characteristics
- a map of the project area

b. Choose a Spreading Loss Model

The decrease in noise level with distance from the source (also called attenuation or spreading loss) can be estimated using a spreading loss model. A general equation to be used for planning and assessment purposes to predict noise at some distance from a pile is:

$TL(R) = SL - N \log R$; where

TL is the threshold level in Table 73 at a distance R from the pile in meters,
SL is the source level,
N is a coefficient for geometric spreading (e.g., spherical or cylindrical), and
R is a distance from the source.

For pile-driving projects, geometric spreading (N) can range between 10 and 20, but usually takes the form of 2 equations based on water depth.

Spherical spreading in deep water is expressed as: $TL(R) = SL - 20 \log R$
Intermediate spreading in shallower water is expressed as: $TL(R) = SL - 15 \log R$

A general assessment rule in determining which spreading loss model to use is to compare your impact zone distance to the water depth in the project area. Use spherical spreading (20 logR) if your impact zone is shorter than the water depth, and cylindrical (10 logR) or intermediate spreading (15 logR) if your impact zone is longer than the water depth. This is explained by the fact a sound wave will not generally travel further than the depth of the water column before being reflected. In deep water, surface reflection does not occur as quickly. Pile driving in deeper water is best modeled using spherical spreading where there are few reflections of the sound waves off hard surfaces such as the sea bottom. In shallow water, surface reflections result in non-uniform or cylindrical spreading of the sound waves (see Figure 30).

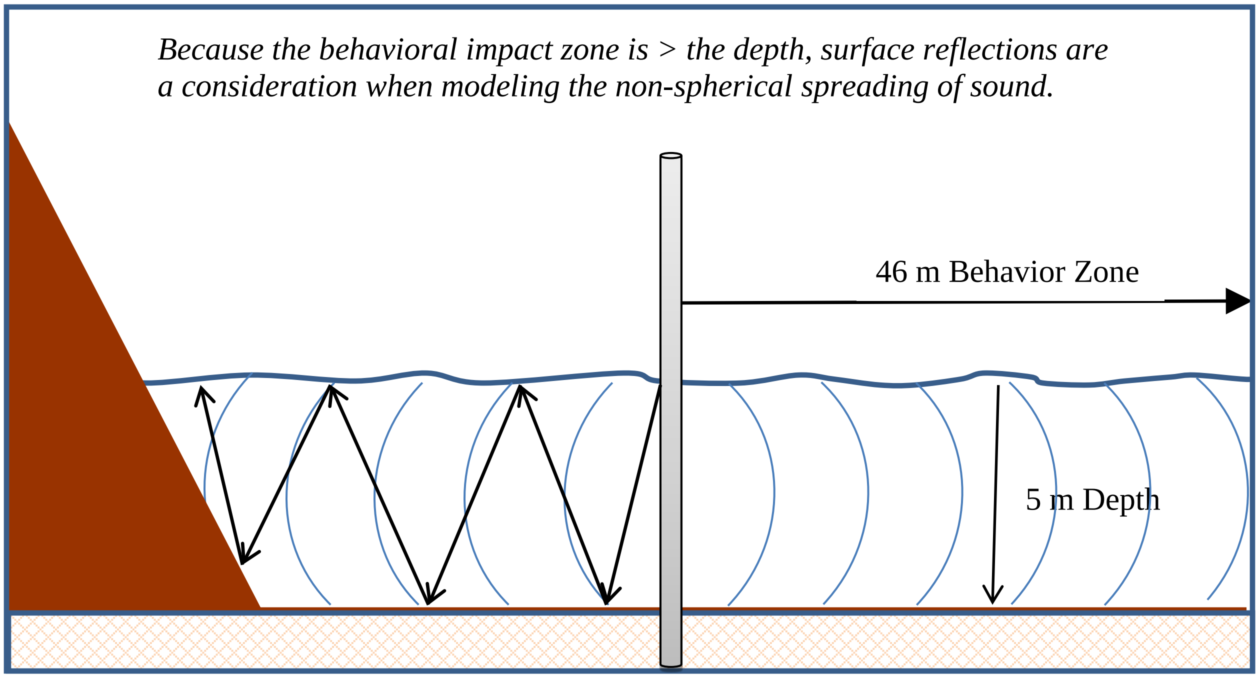


Figure 30. An example of intermediate spreading loss where surface reflections result in non-uniform spreading of sound waves

Sound propagation can range between 10 logR and 15 logR in shallow water. For planning purposes, the use of the 15 logR spreading loss model is recommended unless project-specific data are available. Aside from offshore energy projects, most pile driving occurs in shallow, coastal areas so intermediate spreading loss is the most common model used for coastal areas. To find the distance of the threshold level TL(R) to determine your impact zone use the Spreading Loss Calculator explained below in Step f.

c. Determine the Noise Reference Levels

Noise levels produced from pile-driving noise can be estimated from similar projects reported in technical papers and peer reviewed literature. Typically, the pile size, type, and pile-driving method are used to characterize noise levels. A particularly useful reference is CALTRANS (2009). The source level will need to be determined on a project-by-project basis through information provided by the applicant or through reference levels reported in the literature. Report the noise levels in the effects analysis. The noise levels used in the effects analysis should be tabulated for easy reference.

It is important to note the distance of the reported noise level. Many reference levels are reported at 10 m from the pile. We can back-calculate noise levels from 10 m to the pile by adding 10 dB for 10 logR cylindrical loss, 15 dB for 15 log intermediate spreading loss, and 20 dB for 20 logR spherical spreading loss. Other reference level distances can easily be back-calculated by determining the dB loss for the distance using the Spreading Loss Calculator.

d. Determine Source Level: Cumulative Sound Exposure Level

Cumulative sound exposure is based on the amount of time an animal may be exposed to noise from repeated strikes of impact hammers (or the amount of time for vibratory piling). For any given set of conditions (source level, type of transmission loss, strikes/pile) over some period of time, cumulative sound exposure (cSEL) may result in some risk of hearing loss even if the sSEL (single exposure level) is below the threshold for physical injury. This calculation is important if animals may be expected to be repeatedly exposed to noise over time (e.g., nursery or developmental areas, preferred feeding or resting areas, or semi-enclosed areas in which animals may remain).

NOTE: cSEL assumes constant exposure, and does not account for the movement of fish and sea turtles. Movements must be monitored during the activity, modeled, or considered qualitatively in the analysis.

For dock and seawall construction, which only occurs during daylight hours in residential areas, the cSEL can be calculated on a daily basis:

Daily cSEL Source Level = sSEL Source Level + 10 log(number of strikes/ pile)(number of piles/day)

As a general guideline, consider the cumulative effects of noise exposure over a 24-hr period, as long as there is sufficient "quiet" recovery time between exposures. We believe that limiting construction to only daylight hours provides sufficient quiet time for activities covered under this Opinion. The effects of repeated daily exposures over days, weeks, or months may be considered qualitatively or quantitatively if the different noise sources and exposure levels are present over time.

Another important consideration in calculating cSEL in the context of pile driving is the "effective quiet" level. For fish, the effective quiet level has been set at 150 dB (CALTRANS 2009). For sea turtles, we are applying the same level. For animals exposed to levels at or less than the effective quiet level, noise impacts will not accumulate to cause injury. Therefore, we need to calculate the distance from the source at which noise levels will attenuate below this effective quiet level. Only within this range will potentially injurious cSEL accumulate.

For example, if a pile has a 180 dB sSEL source level, the maximum cumulative sound exposure injury range is at 100 m from the pile. This is determined by finding the difference between the single-strike source level and effective quiet (180 dB – 150 dB = 30 dB). A 30 dB loss occurs at 100 m from a pile using the 15 logR spreading loss. Therefore, animals beyond 100 m would not accumulate potentially injurious cSEL and 100 m would be the limit of the physical injury zone from cumulative sound exposure.

e. Determine the Impact Zones by Calculating Threshold Distances: Using the Spreading Loss Calculator

In previous steps, you will have already calculated the source level for both a single strike and for cumulative daily strikes. In Step 4, you have chosen the spreading loss model appropriate for a project. A quick and effective method to calculate impact zone distances with the model is to first calculate the difference in dB (-dB) between the source level and threshold level, then determine what distance that dB difference occurs with the Spreading Loss Calculator.

For example, to determine the distance of the daily cumulative sound exposure level of injury, first subtract the threshold levels for each animal group in Table 73 from the cSEL source level.

<u>Calculate the Difference (-dB) Between Source Level and Injury Threshold Levels</u>
fish ≥ 2 grams and sea turtles = Source Level (cSEL) – 187 dB
fish < 2 grams = Source Level (cSEL) – 183 dB

<u>Calculate the Difference (-dB) Between Source Level and Behavioral Threshold Levels</u>
for all fish sizes = Source Level (RMS) – 150 dB
sea turtles = Source Level (RMS) – 160 dB

After determining the dB difference between source level and threshold level, use the Spreading Loss Calculator to input different ranges in the first column (Range) to find the distance that the -dB difference would occur. The calculator uses 3 spreading loss formulas to allow for quick calculations of several ranges (see Figure 31). The equations solve for any range input by the user by automatically calculating noise reduction at those distances from a pile (-dB) using 3 spreading loss equations for any range input by the user.

A graphical representation of the impact zones is provided below to help visualize the area where project impacts will occur within the species' habitat (Figure 32).

Spherical (20 logR) and Cylindrical (10 and 15 logR) Spreading Loss				
Instructions: Input range from source to obtain spherical and cylindrical spreading loss (- dB)				
Range (m)	log (R)	20 logR Spherical Spreading Loss (- dB)	10 log R Cylindrical Spreading Loss (- dB)	15 log R Cylindrical Spreading Loss (- dB)
1	0	0	0	0
2	0.301029996	6.020599913	3.010299957	4.515449935
4	0.602059991	12.04119983	6.020599913	9.03089987
8	0.903089987	18.06179974	9.03089987	13.5463498
10	1	20	10	15
25	1.397940009	27.95880017	13.97940009	20.96910013
50	1.698970004	33.97940009	16.98970004	25.48455007
100	2	40	20	30
1000	3	60	30	45
2000	3.301029996	66.02059991	33.01029996	49.51544993
10000	4	80	40	60
100000	5	100	50	75
500000	5.698970004	113.9794001	56.98970004	85.48455007
1000000	6	120	60	90

Figure 31. Screenshot of the Spreading Loss Calculator. The dB loss over any range can be determined for 3 types spreading loss models (10 logR, 15 logR, and 20 logR). For example, at 50 m, there is a 25.5 dB reduction in noise from a pile due to intermediate transmission loss (15 logR).

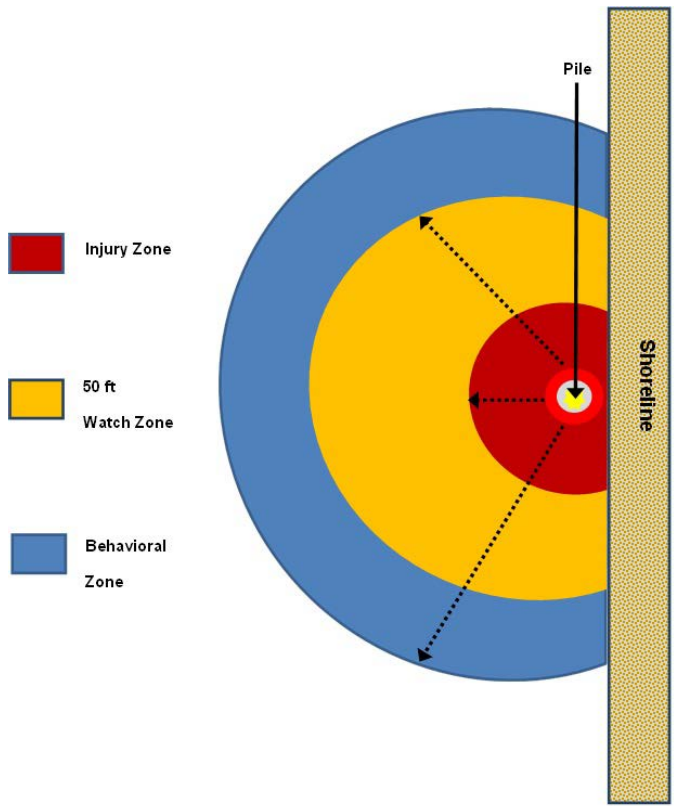


Figure 32. An example graphic visualizing impact zones for a pile-driving project. Graphical representations of the impact zones are useful analytical tools in visualizing the area where project impacts will occur within the species' habitat.

15.4.2 Example Noise Calculation for a Single Family Dock

Step 1. Gather project details.
In the following example, a federal agency is proposing to issue a permit for the construction of a single family dock in Florida.

The applicant provided project details including the following:

- 16 piles will be driven by impact hammer
- all piles are 12-in-diameter wood piles
- each pile takes 30 minutes to install
- plan to install 10 piles per day
- pile installation is continuous, but only during daylight hours
- the hammer strikes at an average rate of 1.5 strikes per minute (45 strikes per pile)
- water depth ranges from 0-5 m
- sea turtles and smalltooth sawfish may be in the project area

Step 2. Determine noise reference levels and choose a spreading loss model.
Referencing the noise levels reported for a 12-in wood pile in CALTRANS (2009), the source level is estimated to be 180 dB Peak Pressure, 160 dB sSEL, and 170 dB RMS at a distance of 10 m from the pile. Because the project is in shallow water, the 15 logR intermediate spreading loss model will be used. To back-calculate the source level from the reported level measured 10 m from the pile, we added 15 dB to each of the literature values (Table 78).

Table 78. Back-Calculation of Source Levels

Type of Noise Impact	Measured Source Level (10 m from Source)	Back-Calculation to Source (15 logR)	Final Source Level
Peak Pressure	180	15	195
Single strike (sSEL)	160	15	175
RMS (behavioral)	170	15	185

Step 3. Calculate the cumulative exposure level (cSEL).
To address the sound exposure level over the course of a day, the SEL from exposure to a single pile strike (sSEL) was converted to cSEL for exposure to the total pile strikes per day. This is calculated using the following formula:

Daily cSEL Source Level = sSEL Source Level + 10 log(number of strikes/ pile)(number of piles/day)

= 175 + 10 log(45)(10)
= 175 + 26.5
= 201.5 (rounded to 202)

Step 4. Calculate the difference between project noise levels and threshold values.
To determine if noise associated with pile installation reaches a level loud enough to disturb or injure protected species, we compare project source levels to the literature threshold values (Table 79).

Table 79. Calculations of Threshold Exceedances

Effect	Animal	Threshold Level (dB re 1 µPa)	Project Levels (dB re 1 µPa)	Difference in dB
Physical Injury	All fish and turtles	206 (peak pressure)	195 (peak pressure)	Not exceeded
	Fish ≥ 2 grams	187 (SEL)	175 (sSEL)	Not exceeded
			202 (cSEL)	15
Behavior	Fish	150 (RMS)	185 (RMS)	35
	Sea turtles	160 (RMS)	185 (RMS)	25

Step 5. Use the Spreading Loss Calculator to determine the zone of impact in cases where source levels exceed threshold values.
Change the values in column 1 (Range) of the Spreading Loss Calculator (Figure 33) to calculate noise attenuation over specific distances. Alter the values in column 1 as necessary to find dB levels in the last column (15 logR model) that most closely match those calculated in Step 4 above (Table 79 "Difference in dB"). We demonstrate this in Figure 34 below where the arrows represent the ranges that we modified in column 1 and the resulting changes in dB loss calculated in the last column. By changing the values in column 1 (10, 46, and 215 m) we were able to match the dB of loss calculated in Table 79 above (15, 25, and 35 dB respectively). The ranges (i.e., distances) associated with the arrows correspond with the radii to which noise source levels exceed threshold levels at the project site (impact radius, Table 80).

Spherical (20 logR) and Cylindrical (10 and 15 logR) Spreading Loss

Instructions: Input range from source to obtain spherical and cylindrical spreading loss (- dB)

Range (m)	log (R)	20 logR Spherical Spreading Loss (- dB)	10 log R Cylindrical Spreading Loss (- dB)	15 log R Cylindrical Spreading Loss (- dB)
1	0	0	0	0
2	0.301029996	6.020599913	3.010299957	4.515449935
4	0.602059991	12.04119983	6.020599913	9.03089987
8	0.903089987	18.06179974	9.03089987	13.5463498
10	1	20	10	15
25	1.397940009	27.95880017	13.97940009	20.96910013
50	1.698970004	33.97940009	16.98970004	25.48455007
100	2	40	20	30
1000	3	60	30	45
2000	3.301029996	66.02059991	33.01029996	49.51544993
10000	4	80	40	60
100000	5	100	50	75
500000	5.698970004	113.9794001	56.98970004	85.48455007
1000000	6	120	60	90

Figure 33. Screenshot of original Spreading Loss Calculator prior to any modifications

Spherical (20 logR) and Cylindrical (10 and 15 logR) Spreading Loss				
Instructions: Input range from source to obtain spherical and cylindrical spreading loss (- dB)				
Range (m)	log (R)	20 logR Spherical Spreading Loss (- dB)	10 log R Cylindrical Spreading Loss (- dB)	15 log R Cylindrical Spreading Loss (- dB)
1	0	0	0	0
2	0.301029996	6.020599913	3.010299957	4.515449935
4	0.602059991	12.04119983	6.020599913	9.03089987
8	0.903089987	18.06179974	9.03089987	13.5463498
10	1	20	10	15
25	1.397940009	27.95880017	13.97940009	20.96910013
46	1.662757832	33.25515663	16.62757832	24.94136748
100	2	40	20	30
215	2.33243846	46.6487692	23.3243846	34.9865769
2000	3.301029996	66.02059991	33.01029996	49.51544993
10000	4	80	40	60
100000	5	100	50	75
500000	5.698970004	113.9794001	56.98970004	85.48455007
1000000	6	120	60	90

Figure 34. Screenshot of the Spreading Loss Calculator after the first column was modified

Table 80. Calculations of Impact Zones Based on Source Levels for the Project

Effect	Animal	Threshold Level (dB re 1 µPa)	Project Levels (dB re 1 µPa)	Difference in dB	Impact Zone Radius (m)
Physical Injury	All fish and turtles	206 (peak pressure)	195 (peak pressure)	Not exceeded	0
	Fish ≥ 2 grams	187 (SEL)	175 (sSEL)	Not exceeded	0
			202 (cSEL)	15	10
Behavior	Fish	150 (RMS)	185 (RMS)	35	215
	Sea turtles	160 (RMS)	185 (RMS)	25	46

Step 6. Compare the calculated cSEL impact zone to the maximum impact zone limited by effective quiet.

Now we need to determine whether the amount of accumulated noise exposure and the corresponding cSEL impact zone would be limited by the noise reaching effective quiet. First, calculate the difference between the source level (sSEL) and the effective quiet level (150 dB sSEL).

In this example:
175 dB sSEL (source level) – 150 dB sSEL (effective quiet level) = 25 dB

Next, consult the Spreading Loss Calculator to find the distance over which sound would attenuate by that amount.

25 dB spreading loss occurs at 46 m using 15 logR (see Figure 34)
46 m is the maximum range of the physical injury zone from cumulative sound exposure before reaching effective quiet

Last, compare the calculated cSEL impact zone radius from Step 5 (10 m) to the maximum impact zone limited by effective quiet, calculated in this step (46 m). Use the smaller of the 2 values as the cumulative sound exposure impact radius. In this case, the originally calculated 10 m is the impact zone radius for daily cumulative sound exposure.

Summary

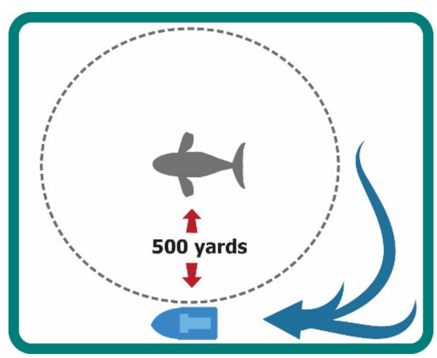
Interpretations of the noise impact zones associated with the project shown in Table 80 are as follows:

- Potential injury for fish and sea turtles from single pile strikes (sSEL) is not measurable as the source levels do not exceed the threshold values for injury.
- Potential injury to fish from cumulative sound exposure (cSEL) each day is possible within 10 m from the pile. For the purpose of this example, fish includes sturgeon and smalltooth sawfish. Since threshold values for sea turtles are not currently known we assume the thresholds used for fish also apply to sea turtles. Therefore we assume the 10 m cumulative sound exposure injury zone also applies to sea turtles.
- Behavioral responses of sea turtles may occur up to 46 m (150 ft) from the project.
- Behavioral responses of fish may occur up to 215 m (705 ft) from the project.

16 Appendix C: North Atlantic Right Whale Information Form

Federal Regulations Governing the Approach to North Atlantic Right Whales

1. Federal regulations governing the approach to North Atlantic right whales can be found at 50 CFR 224.103(c). It is illegal to approach and remain within 500 yards of right whales; 500 yards is equal to the distance of 5 football fields.



   Prohibitions on approaching right whales are as follows (Excerpts from 50 CFR 224.103(c), available at www.ecfr.gov): Unless otherwise lawfully allowed or unless doing so would create an imminent and serious threat to a person or vessel, it is unlawful to:

   (i) *Approach (including by interception) within 500 yards (460 m) of a right whale by vessel*

   (ii) *Fail to undertake required right whale avoidance measures. If underway, a vessel must steer a course away from the right whale and immediately leave the area at a slow safe speed.*

2. Updates can be downloaded from:
   a. http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/rightwhale_northatlantic.htm, or
   b. www.ecfr.gov

17 Appendix D: Frac-Out Plan Example

Proposed Methods for Protection of Water Quality for Directional Bored Water Crossings (best management practices [BMPs] and Frac-out Plan)

BMPs
[The APPLICANT] and [the Contractor] will implement the following BMPs to minimize the potential for adverse environmental impacts during horizontal directional drilling activities:

- BMPs for erosion control within the staging area shall be implemented and maintained at all times during the drilling and back-reaming operations to prevent siltation and turbid discharges in excess of State Water Quality Standards pursuant to Rule 62-302, F.A.C. Methods shall include, but are not limited to the immediate placement of turbidity containment devices such as turbidity screen, silt containment fence, hay bales, and earthen berms, etc. to contain the drilling mud. Earthen berms shall not be utilized as to impact wetlands or other surface waters.

Frac-out Plan
To provide an additional level of resource protection, the following measures shall be taken to monitor any potential releases of drilling fluid:

- Measures used to prevent frac-out during the drilling operation include maintaining the proper depth for the soil conditions along the drilling route as well as proper management of drilling fluids circulation pressure. Under the waterway, the minimum distance between the pipe and the bottom of the waterway will be __[#]__ ft as shown on the cross section. This is expected to be sufficient to prevent frac-out when drilling under the waterway.
- Non-toxic fluorescent dyes will be added to the drilling lubricant as a method for monitoring bentonite releases in the underwater portions of this drilling. Details of the fluorometry monitoring method shall be submitted to the USACE prior to the pre-construction meeting.
- The volume of bentonite in the drill string will be monitored at all times during the directional drilling operation. Should a drop in volume of bentonite occur, immediately conduct a visual inspection of both terrestrial and subaqueous portions of the horizontal directional drilling corridor.
- Should the detection of dye or a drop in volume of bentonite occur, the Contractor will follow the Release Procedures outlined below.
- The Contractor will identify prior to commencement of construction an environmental scientist/biologist with experience in-water quality monitoring and habitat protection to be used in the event of a frac-out. The biologist will supervise the implementation of the Frac-Out Plan, Release Procedure, and Containment Plan outlined below. Divers shall be present during drilling operations in order to respond to a potential frac-out release.
- All drilling fluids associated with the horizontal directional drilling operation will be contained on site. The volume of the drilling fluids recirculation/solids settlement pit will be determined by the Contractor at the Pre-Construction meeting. Periodically during the drilling process settled solids will be removed from the pit by a backhoe and disposed of

at a site of the Contractor's choice in accordance with applicable regulations. At the conclusion of drilling operations, drilling fluid remaining in the pit will be settled and hauled to a disposal site of the Contractor's choice in accordance with applicable regulations. After back-reaming, drilling materials will be removed from the inside of the pipeline by pigging it from the exit point towards the rig area.

- At all times, adequate protection will be taken to avoid impacts to the Aquatic Preserve/Outstanding Florida Waters and contiguous wetlands. This shall include, but is not limited to halting of construction/drilling and/or placement of turbidity containment devices.
- A Vactor Truck shall be onsite and available at all times.
- A Spill Kit (i.e., absorbent pads/brooms, goggles, gloves) shall be on-site and available at all times.

Release Procedure:

- If a frac-out is confirmed, all construction activity contributing to the frac-out shall cease immediately.
- If the return drilling mud/fluid is less than the projected amount to be recovered, divers shall begin their search for the missing material within 1 hour of potential release. Once the drilling mud and frac-out is located, then the drilling mud containment plan shall be immediately implemented.
- If a frac-out has occurred during construction activities, the permittee shall notify the USACE of Engineers, Palm Beach Gardens Regulatory office, within 24 hours of the occurrence. The notification shall include the time of the frac-out, the response time of the underwater diver, and the environmental conditions of the affected area.

Drilling Mud Containment Plan:

- Should the release of drilling materials occur on land, a sediment fence shall be constructed around the site and the material shall be removed by vacuum truck.
- Should the release of drilling materials occur in-water, clean-up with a vacuum system shall commence within 24 hours.
- The scientist/biologist underwater divers will guide the suction hose of the pump to minimize both the removal of natural bottom material and the disturbance of any existing vegetation.
- Any escaped drilling lubricant must be pumped into filter bags or directly into a vactor truck.
- A barge company will be contacted to transport a vactor truck should it be needed to respond "in-water."
- Once the spill is contained, the escaped drilling lubricant shall be properly disposed of in an approved upland disposal site.
- Clean-up with a vacuum system shall commence within 24 hours.
- After containment/recovery of the drilling material/resources, a detailed written report shall be submitted to the USACE, within 10 business days, indicating the location of the frac-out, amount of drilling material discharged and the amount of drilling mud recovered, the process in which the drilling mud was recovered, and the area that was affected by the drilling discharge.