

# DEPARTMENT OF THE ARMY PERMIT

**Permittee:** OKALOOSA COUNTY  
Attn: Alex Fogg, Coastal Resource Manager  
1250 North Eglin Parkway, Suite 100  
Shalimar, Florida 32579

**Permit No:** SAJ-2021-01854

**Issuing Office:** U.S. Army Engineer District, Jacksonville

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the U.S. Army Corps of Engineers (Corps) having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

**Project Description:** Establishment of three artificial reef deployment sites, referred to as Fish Haven 20, Fish Haven 21, and Fish Haven 22. Numerous individual patch reefs will be created at each of the three sites. Each deployment site will be approximately one (1) square nautical mile. A minimum 250-foot buffer will be maintained between reef materials and the boundary of each site to ensure deployed materials remain within the permitted areas. Reef materials will consist of clean concrete or rock, heavy gauged ferrous and steel products (1/4-inch thickness or greater), clean ferrous and steel metal hulled vessels and barges, and prefabricated structures made of heavy gauge steel and/or concrete. Material deployed will have a maximum profile height of no more than half the distance from the seafloor to the elevation of Mean Lower Low Water (MLLW). Reef materials will be transported to the sites by barge and deployment will occur only during daylight hours. Buoys will be temporarily installed along the perimeter of individual patch reefs prior to placement of materials to ensure accurate placement at each site.

The work described above is to be completed in accordance with the six (6) pages of drawings (**Attachment 1**) and eight attachments affixed at the end of this permit instrument.

**Project Location:** The three artificial reef deployment sites are located within the Gulf of Mexico, south of Okaloosa County, Florida. The center point of Fish Haven 20 is approximately 1.74 nautical miles south of Okaloosa Island and approximately 6.65 nautical miles southwest of East Pass in Destin, Florida. The center point of Fish Haven 21 is approximately 8.14 nautical miles due south of East Pass and

approximately 1.54 nautical miles south of the East-West Safety Fairway. The center point of Fish Haven 22 is approximately 2.20 nautical miles south of Okaloosa Island and approximately 4.27 nautical miles southeast of East Pass.

**Directions to site:** The three sites are located within the Gulf of Mexico, off the coast of Okaloosa County, Florida, and are accessible by water.

**Project Coordinates:**

<b>Table 1 – Fish Haven 20 Location</b>				
<b>Fish Haven 20</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Latitude</b>	<b>Longitude</b>
	<b>Degrees, Decimal, Minutes</b>	<b>Degrees, Decimal, Minutes</b>	<b>Decimal Degrees</b>	<b>Decimal Degrees</b>
Northwest Corner	30°22.4881'	-86°38.8436'	30.3748°	-86.6474°
Northeast Corner	30°22.4880'	-86°37.6880'	30.3748°	-86.6281°
Southeast Corner	30°21.4850'	-86°37.6881'	30.3581°	-86.6281°
Southwest Corner	30°21.4850'	-86°38.8437'	30.3581°	-86.6474°
Center Point	30°21.9865'	-86°38.2658'	30.3664°	-86.6378°

<b>Table 2 – Fish Haven 21 Location</b>				
<b>Fish Haven 21</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Latitude</b>	<b>Longitude</b>
	<b>Degrees, Decimal, Minutes</b>	<b>Degrees, Decimal, Minutes</b>	<b>Decimal Degrees</b>	<b>Decimal Degrees</b>
Northwest Corner	30°15.2329'	-86°31.1125'	30.2539°	-86.5185°
Northeast Corner	30°15.2327'	-86°29.9570'	30.2539°	-86.4993°
Southeast Corner	30°14.2297'	-86°29.9572'	30.2372°	-86.4993°
Southwest Corner	30°14.2298'	-86°31.1127'	30.2372°	-86.5185°
Center Point	30°14.7313'	-86°30.5348'	30.2455°	-86.5089°

<b>Table 3 – Fish Haven 22 Location</b>				
<b>Fish Haven 22</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Latitude</b>	<b>Longitude</b>
	<b>Degrees, Decimal, Minutes</b>	<b>Degrees, Decimal, Minutes</b>	<b>Decimal Degrees</b>	<b>Decimal Degrees</b>
Northwest Corner	30°21.2852'	-86°26.9263'	30.3548°	-86.4488°
Northeast Corner	30°21.2852'	-86°25.7708'	30.3548°	-86.4295°
Southeast Corner	30°20.2821'	-86°25.7708'	30.3380°	-86.4295°
Southwest Corner	30°20.2821'	-86°26.9263'	30.3380°	-86.4488°
Center Point	30°20.7837'	-86°26.3485'	30.3464°	-86.4391°

## **Permit Conditions**

### **General Conditions:**

1. The time limit for completing the work authorized ends on **April 14, 2033**. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature and the mailing address of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions (**Attachment 2**).

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

### **Special Conditions:**

1. **Reporting Addresses:** The Permittee shall reference this permit number, SAJ-2021-01854, on all correspondence. Unless specifically notified to the contrary, the Permittee shall use the following addresses for transmitting correspondence to the referenced agencies:

a. U.S. Army Corps of Engineers

For electronic mail (preferred): SAJ-RD-Enforcement@usace.army.mil  
(not to exceed 15 MB).

For standard mail: U.S. Army Corps of Engineers, Regulatory Division,  
Enforcement Section, P.O. Box 4970, Jacksonville, FL 32232-0019.

b. National Oceanic and Atmospheric Administration

Marine Chart Division  
Office of Coast Survey, N/CS26, Sta. 7317  
1315 East-West Highway  
Silver Springs, MD 20910-3282

or email (preferred) at: ocs.ndb@noaa.gov

c. Commander, U.S. Coast Guard (USCG)

Eighth Coast Guard District  
Hale Boggs Federal Building  
500 Poydras Street  
New Orleans, LA 70130

d. Florida Fish and Wildlife Conservation Commission

Artificial Reef Program  
1875 Orange Avenue East  
Tallahassee, FL 32311

Or email at: artificialreefdeployments@MyFWC.com

2. **Initial Agency Notification:** The Permittee shall provide to the U.S. Army Corps of Engineers (Corps), National Oceanic and Atmospheric Administration (NOAA), and U.S. Coast Guard (USCG) written notification of the planned deployment start date at least 2 weeks prior to the initial deployment on the authorized artificial reef site.
3. **Permit Availability:** The Permittee shall provide all contractors associated with construction of the authorized activities a copy of the permit, drawings, and attachments. A copy of the permit shall be available on the work vessels and at the construction site at all times.



4. **Authorized Reef Materials:** No reef materials or module will weigh less than 500 pounds. Reef materials shall be clean and free from asphalt, petroleum, other hydrocarbons and toxic residues, 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. The Permittee shall deploy only the following authorized reef materials:
  - a. Prefabricated artificial reef modules composed of ferrous and/or steel metals, ¼ inch or more in thickness, concrete, rock, or a combination of these materials.
  - b. Natural rock boulders and other pre-cast concrete material such as culverts, stormwater junction boxes, power poles, railroad ties, jersey barriers, or other similar concrete material.
  - c. Clean steel and concrete bridge or large building demolition materials such as slabs or pilings with all steel reinforcement rods cut at the base of the concrete so no rebar or metal protrudes from the concrete.
  - d. Heavy gauge ferrous and steel metal material components or structures, ¼ inch or more in thickness, such as utility poles, antenna towers and chicken transport devices.
  - e. Heavy gauge ferrous and/or steel metal hulled vessels which equal or exceed 60 feet hull length prepared and deployed in accordance with all applicable U.S. Coast Guard, U.S. Environmental Protection Agency, Florida Fish and Wildlife Conservation Commission, or other applicable state or federal agency regulations or policies. The vessel shall not be deployed until all necessary inspections and clearances have been obtained or waived and a stability analysis has been completed demonstrating the vessel will be stable during a 50-year storm event based on vessel and deployment site characteristics. The Permittee shall follow the national guidance regarding preparation of vessels for deployment as artificial reefs which are available at <http://www.epa.gov/owow/oceans/habitat/artificialreefs/index.html>. The Permittee shall provide a record of all inspections, clearances or waivers to the Corps along with the pre-deployment notification.
5. **Reef Construction:** Reef structures, materials, and installation methods shall be designed and deployed to prevent entanglement and entrapment of listed

species. Open-bottom prefabricated reef modules may not be used unless the module also has a top opening sufficiently large to allow a turtle to escape.

Approved open-bottom modules include:

- a. Triangular (pyramidal) and square (cube/cuboid) modules where each side of the top opening is at least 48 inches in length along its edge.
  - b. Modules with a round or oval opening with a diameter of at least 48 inches. For oval openings, the diameter of the shortest part of the oval must be at least 48 inches.
  - c. Modules that are approved by the Florida Fish & Wildlife Conservation Commission Artificial Reef Program as being turtle friendly.
  - d. No open-bottom modules are allowed that include additional modules, discs, or other materials stacked or placed on or immediately adjacent to the top opening, as they may prevent turtles from easily escaping.
  - e. Any deviations from the above must comply with the parameters described in the Entanglement Prevention construction condition in Section 2.1.2 of NMFS' Biological Opinion, SERO-2022-01316, dated March 10, 2023.
  - f. Open-bottom fabricated artificial reef modules shall not include any additional sub-components or other material within the interior or obstructing the top opening that could impair the egress of a sea turtle.
- 6. Explosives:** Use of explosives to construct projects or to deploy reef materials are not authorized.
- 7. Reef Parameters:** The Permittee shall deploy all reef materials within the established limits and 250-foot deployment buffers of the Fish Havens 20, 21, and 22 artificial reef sites, as defined on the attached permit drawings, sheets 2, 3, and 4 of 6. Minimum clearances from the top of the deployed reef materials relative to Mean Lower Low Water (MLLW) at the three reef sites shall be maintained, as follows:
- a. Fish Haven 20. Reported depths range from -60 feet to -66 feet, relative to MLLW. Clearance between reef materials and MLLW shall be no less than 30 feet within Fish Haven 20 and the height of reef material shall not exceed 50% of the distance between the seafloor and MLLW.

- b. Fish Haven 21. Reported depths range from -72 feet to -96 feet, relative to MLLW. Clearance between reef materials and MLLW shall be no less than 36 feet within Fish Haven 21 and the height of reef material shall not exceed 50% of the distance between the seafloor and MLLW.
  - c. Fish Haven 22. Reported depths range from -69 feet to -75 feet, relative to MLLW. Clearance between reef materials and MLLW shall be no less than 34.5 feet within Fish Haven 22 and the height of reef material shall not exceed 50% of the distance between the seafloor and MLLW.
8. **Emergency Reef Parameters Notification:** In the event reef material is deployed in a location or manner contrary to the **Reef Parameters Special Condition**, the Permittee shall immediately notify the USCG Station and provide information as requested by the station. The Permittee shall notify NOAA, USCG and Corps in writing within 24 hours of the occurrence. The written notification shall include but is not limited to a timeline of events leading to the unanticipated deployment, a description of the material, a description of the vessel traffic in the area, the deployment location in nautical miles at compass bearing from obvious landmarks, the location of the unauthorized material in latitude and longitude coordinates (degree, minute, decimal minute format to the third decimal place), and the water depth above the material relative to MLLW. The document will list the information provided by telephone to the USCG as noted above and include the time of the call and the name of the USCG personnel receiving the information.
9. **Protection of Existing Resources:** The Permittee shall not deploy artificial reef materials until an assessment of the bottom conditions have been accomplished by diver, submersible video camera, fathometer, depth/bottom sounder (e.g. "fish finder"), or side-scan sonar. The inspection of the deployment area may occur at the time of deployment, but no more than 1 year prior to deployment.
- a. The Permittee shall maintain a deployment buffer of at least 200 feet from any submerged beds of seagrasses, coral reefs, live bottom, areas supporting growth of sponges, sea fans, soft corals, and other sessile macroinvertebrates generally associated with rock outcrops, oyster reefs, scallop beds, clam beds, or areas where there are unique or unusual concentrations of bottom-dwelling marine organisms.
  - b. Siting of any vessel, aircraft, or large and high-relief material (e.g., bridge spans) may not occur within 1,500 feet of any documented coral colonies.

- c. Any vessel used in the deployment of an artificial reef may not anchor or moor within 1,500 feet of any documented coral colonies.
- d. Should the assessment find any evidence of cultural/archaeological resources such as sunken vessels, ballast, historic refuse piles, or careenage areas, the Permittee shall also maintain a deployment buffer of at least 200 feet from any of these resources.
- e. No artificial reef material will be deployed in any area within 1,100 feet off any identified sea turtle nesting beach that predominantly consists of sandy benthic habitat.

The Permittee shall provide of the information obtained from the assessment to the Corps no less than 14 days prior to deployment of material on an artificial reef in conjunction with the pre-deployment notification.

10. **Pre-Deployment Notification:** No less than 14 days prior to deployment of material on an artificial reef, the Permittee shall transmit by electronic mail (“email”) a complete and signed “*Florida Artificial Reef Materials Cargo Manifest and Pre-Deployment Notification*” form (**Attachment 3**), to the Corps and Florida Fish and Wildlife Conservation Commission (FWC) to allow inspection of the proposed reef materials, as deemed necessary by the agencies. Inspection is allowable at the staging area. By signing the Pre-Deployment Notification the Permittee certifies all materials are free from asphalt, petroleum, other hydrocarbons and toxic residues. The Permittee shall not deploy material if notified by the Corps or FWC that the material is questionable. The material needs to be evaluated before it is released for deployment. Any material deemed unacceptable for reef material will be disposed in an approved upland disposal site.

Deployment of the material shall not occur until after the end of the 14-day inspection period. The Permittee shall ensure both a copy of this permit and the signed “*Florida Artificial Reef Materials Cargo Manifest and Pre-Deployment Notification*” form are maintained aboard the deployment vessel at all times during loading, transit, and deployment.

11. **Post-Deployment Placement Report/As-Built Drawing:** Within 30 days after deployment of materials, the Permittee shall transmit by email to the Corps, FWC, and NOAA a complete and signed “*Florida Artificial Reef Materials Placement Report and Post-Deployment Notification*” form (**Attachment 4**).

Please note, the Corps requires the latitude and longitude to be accurate within 5 meters horizontal distance on the post-deployment report. The report shall include an as-built drawing containing the approximate deployment configurations and the height of the material after placement. Depth shall be verified utilizing fathometer, depth sounder, or similar device accurate to within 1 meter. Also, include information on the condition of the material at the time of deployment. The report and drawing shall be limited to a few pages per deployment. Representative photographs and/or video, if available, should be submitted.

12. **Ownership/Maintenance/Liability:** By signing this permit, the Permittee certifies and acknowledges ownership of all artificial reef materials deployed on the reef, accepts responsibility for maintenance of the artificial reef, and possesses the ability to assume liability for all damages that may arise with respect to the artificial reef.
  
13. **Biological Opinion:** This permit does not authorize the Permittee to take an endangered species, in particular the green sea turtle (North Atlantic DPS and South Atlantic DPS), Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle. In order to legally take a listed species, the Permittee must have separate authorization under the Endangered Species Act (ESA) (e.g., an ESA Section 10 permit, or a BO under ESA Section 7, with "incidental take" provisions with which you must comply). The enclosed Biological Opinion (BO) from the National Marine Fisheries Service, tracking number SERO-2022-01316, dated April 10, 2023 (**Attachment 5**), contains mandatory terms and conditions to implement the reasonable and prudent measures that are associated with the incidental take statement set forth in the BO. Authorization under this permit is conditional upon compliance with all of the mandatory terms and conditions and reasonable and prudent measures associated with the incidental take statement in the enclosed BO, which are incorporated by reference in this permit. Failure to comply with the terms and conditions and reasonable and prudent measures associated with the incidental take statement set forth in the BO, would constitute noncompliance with this permit. In addition, failure to comply with the terms and conditions and reasonable and prudent measures associated with the incidental take statement set forth in of the BO, where a take of the listed species occurs, would constitute an unauthorized take. The National Marine Fisheries Service is the appropriate authority to determine compliance with the terms and conditions of its BO, and with the ESA.

14. **Protected Species Construction Conditions:** The Permittee shall comply with National Marine Fisheries Service's "Protected Species Construction Conditions, NOAA Fisheries Southeast Regional Office" dated May 2021 (**Attachment 6**).
15. **Vessel Strike Avoidance Measures:** The Permittee shall comply with the "Vessel Strike Avoidance Measures and Reporting for Mariners", revised May 2021 (**Attachment 7**), for marine turtles and marine mammals.
16. **Daylight Hours:** All activities must be completed during daylight hours.
17. **Manatee Conditions:** The Permittee shall comply with the "Standard Manatee Conditions for In-Water Work – 2011" (**Attachment 8**). The most recent version of the Manatee Conditions must be utilized.
18. **Monitoring:** The Permittee shall conduct yearly monitoring on the artificial reefs deployed during the previous 12 months to verify material location and condition and compare to the location specified in the Post-Deployment Report to distinguish changes in either. The monitoring report shall be submitted to the Corps annually and include a spreadsheet representation of the site inspected and data gained with a written narrative and submitted in accordance with Special Condition 1. The Permittee is responsible for maintenance associated with the site, including the removal of entanglement hazards and other such assessments to ensure safe operation.
19. **Assurance of Navigation and Maintenance:** The Permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structures or work herein authorized, or if in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the Permittee will be required, upon due notice from the Corps, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.
20. **Agency Changes/Approvals:** Should any other agency require and/or approve changes to the work authorized or obligated by this permit, the Permittee is advised a modification to this permit instrument is required prior to initiation of those changes. It is the Permittee's responsibility to request a modification of this permit from the Pensacola Permits Section. The Corps reserves the right to fully evaluate, amend, and approve or deny the request for modification of this permit.

## 21. Cultural Resources/Historic Properties:

- a. No structure or work shall adversely affect impact or disturb properties listed in the *National Register of Historic Places* (NRHP) or those eligible for inclusion in the NRHP.
- b. If, during permitted activities, items that may have historic or archaeological origin are observed the Permittee shall immediately cease all activities adjacent to the discovery that may result in the destruction of these resources and shall prevent his/her employees from further removing, or otherwise damaging, such resources. The applicant shall notify both the choose an item and the Corps, of the observations within the same business day (8 hours). Examples of submerged historical, archaeological or cultural resources include shipwrecks, shipwreck debris fields (such as steam engine parts, or wood planks and beams), anchors, ballast rock, concreted iron objects, concentrations of coal, prehistoric watercraft (such as log "dugouts"), and other evidence of human activity. The materials may be deeply buried in sediment, resting in shallow sediments or above them, or protruding into water. The Corps shall coordinate with the choose an item State Historic Preservation Officer Choose an item to assess the significance of the discovery and devise appropriate actions. Project activities shall not resume without verbal and/or written authorization from the Corps.
- c. Additional cultural resources assessments may be required of the permit area in the case of unanticipated discoveries as referenced in accordance with the above Special Condition ; and if deemed necessary by the SHPO, THPO(s), or Corps, in accordance with 36 CFR 800 or 33 CFR 325, Appendix C (5). Based, on the circumstances of the discovery, equity to all parties, and considerations of the public interest, the Corps may modify, suspend or revoke the permit in accordance with 33 CFR Part 325.7. Such activity shall not resume on non-federal lands without written authorization from the SHPO for finds under his or her jurisdiction, and from the Corps.
- d. In the unlikely event that unmarked human remains are identified on non-federal lands, they will be treated in accordance with Section 872.05 Florida Statutes. All work and ground disturbing activities within a 100-meter diameter of the unmarked human remains shall immediately cease

and the Permittee shall immediately notify the medical examiner, Corps, and State Archeologist within the same business day (8-hours). The Corps shall then notify the appropriate SHPO and THPO(s). Based, on the circumstances of the discovery, equity to all parties, and considerations of the public interest, the Corps may modify, suspend or revoke the permit in accordance with 33 CFR Part 325.7. Such activity shall not resume without written authorization from the State Archeologist and from the Corps.

**Further Information:**

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

(X) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403)

(X) Section 404 of the Clean Water Act (33 U.S.C. 1344)

( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413)

( ) Section 14 of the Rivers and Harbors Act of 1899 (33 U.S.C. 408)

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, State, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal projects.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.



b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. **Reliance on Applicant's Data:** The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. **Reevaluation of Permit Decision:** This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (see 4 above).


c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. **Extensions:** General Condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

PERMIT NUMBER: SAJ-2021-01854  
PERMITTEE: Okaloosa County  
PAGE 14 of 16


Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

  
\_\_\_\_\_  
(PERMITTEE)

4/14/2023  
\_\_\_\_\_  
(DATE)

Alex Fogg  
\_\_\_\_\_  
(PERMITTEE NAME-PRINTED)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

for   
JAMES L. BOOTH  
Colonel, U.S. Army  
District Commander

Date: 14 April 2023  
\_\_\_\_\_

PERMIT NUMBER: SAJ-2021-01854  
PERMITTEE: Okaloosa County  
PAGE 15 of 16

### Permit Transfer Request

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

\_\_\_\_\_  
(TRANSFEREE-SIGNATURE)

\_\_\_\_\_  
(DATE)

\_\_\_\_\_  
(NAME-PRINTED)

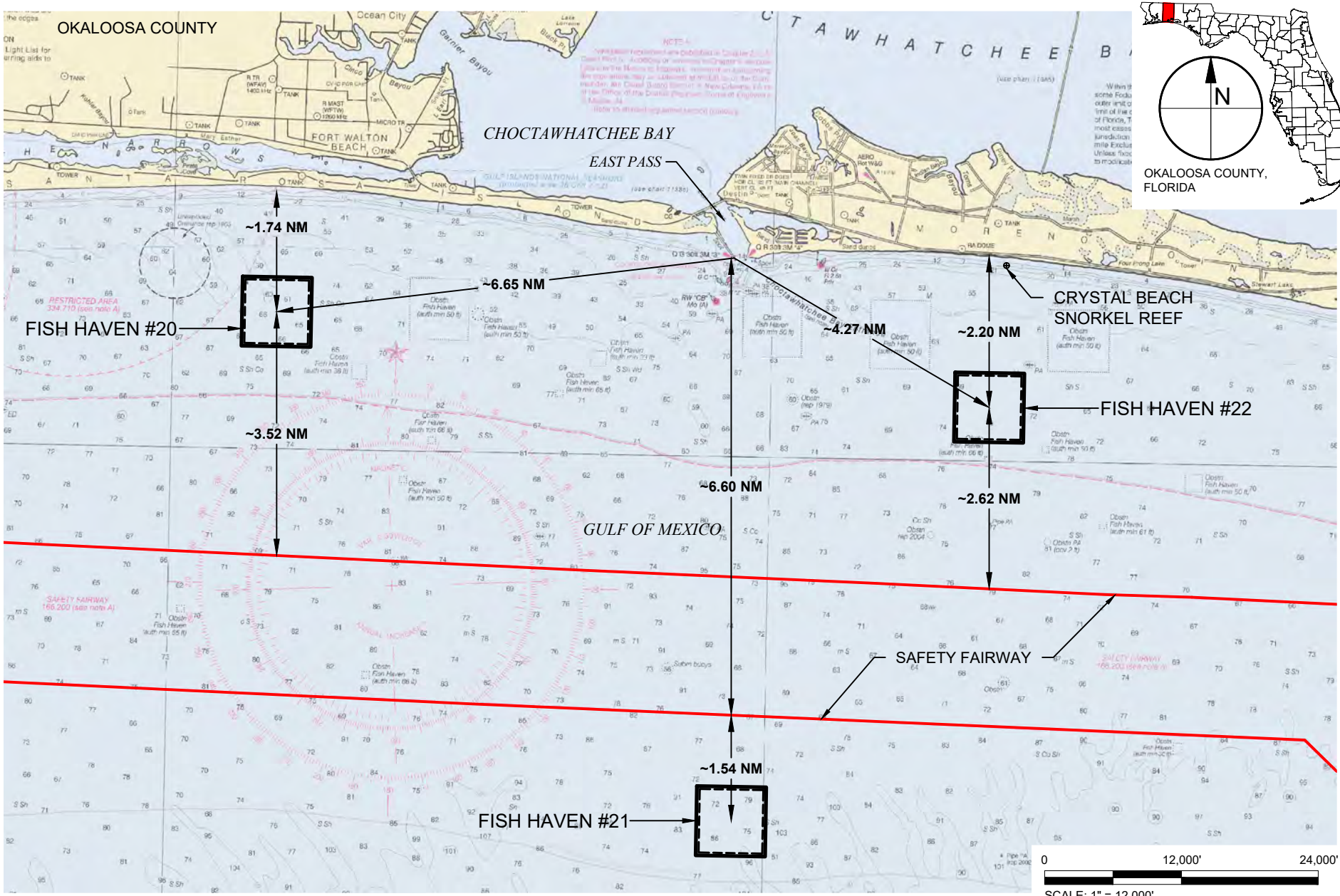
\_\_\_\_\_  
(ADDRESS)

\_\_\_\_\_  
(CITY, STATE, AND ZIP CODE)

***Attachments to Department of the Army  
Permit Number SAJ-2021-01854***

1. PERMIT DRAWINGS: Drawings by Taylor Engineering, Inc., dated October 2021. 6 pages.
2. WATER QUALITY CERTIFICATION: Specific Conditions of the water quality permit/certification in accordance with General Condition number 5 on page 2 of this DA permit. FDEP permit 0404845-001-EI/46 issued on December 22, 2021. 16 pages.
3. FLORIDA ARTIFICIAL REEF MATERIALS CARGO MANIFEST AND PRE-DEPLOYMENT NOTIFICATION. 2 pages.
4. FLORIDA ARTIFICIAL REEF MATERIALS PLACEMENT REPORT AND POST-DEPLOYMENT NOTIFICATION. 2 pages.
5. BIOLOGICAL OPINION: National Marine Fisheries Service Biological Opinion, SERO-2022-01316, dated March 10, 2023. 106 pages.
6. PROTECTED SPECIES CONSTRUCTION CONDITIONS, NOAA FISHERIES SOUTHEAST REGIONAL OFFICE. 2 pages.
7. VESSEL STRIKE AVOIDANCE MEASURES: Vessel Strike Avoidance Measures, NOAA Fisheries Southeast Regional Office, revised May 2021. 3 pages.
8. MANATEE CONDITIONS: Standard Manatee Conditions for In-Water Work, 2011. 2 pages.

CATHY SHELL X:\SIS\PROJECTS\C2014-004-03-OK REEF FH20-22\PERMIT\C2014-004-03-LOC-LOCATION.DWG 10/11/2021 4:55:28 PM



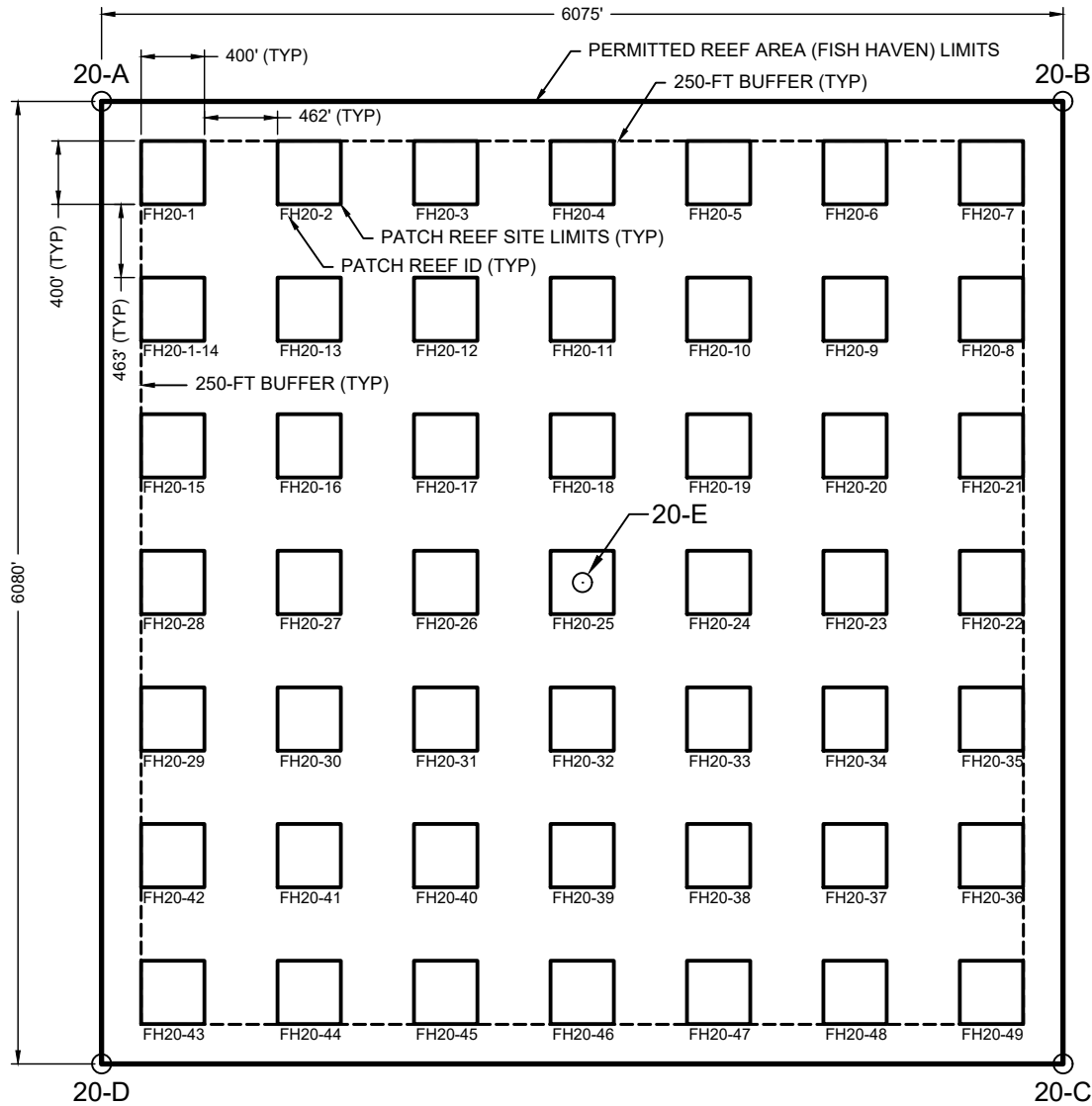
**TAYLOR ENGINEERING INC.**  
 4300 LEGENDARY DRIVE  
 SUITE C246  
 DESTIN, FLORIDA 32541  
 REGISTRY # 4815

**FIGURE 1**  
**LOCATION MAP**  
 OKALOOSA COUNTY ARTIFICIAL REEFS FH20, FH21, AND FH22  
 OKALOOSA COUNTY, FLORIDA

PROJECT	C2014-004-03
DRAWN BY	CAS
SHEET	1 of 6
DATE	OCT 2021

SEAL	
DUNCAN GREER P.E. #83306	
DATE	

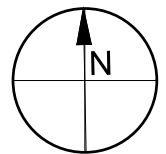
CATHY SHELL X:\S\PROJECTS\C2014-004-03 OK REEF FH20-22\PERMIT\C2014-004-03-P-REEF PLANS.DWG 10/11/2021 4:55:33 PM



PROPOSED REEF LIMITS				
POINT ID	LAT (DD)	LONG (DD)	NORTHING	EASTING
20-A	N30.3748	W86.6474	506,356	1,291,371
20-B	N30.3748	W86.6281	506,242	1,297,443
20-C	N30.3581	W86.6281	500,163	1,297,329
20-D	N30.3581	W86.6474	500,277	1,291,256
20-E	N30.3664	W86.6378	503,259	1,294,350

**NOTES:**

- REEF AREA REFERS TO THE ENTIRE PERMITTED BOUNDARY OF THE PROPOSED FISH HAVEN.
- PATCH REEF/PATCH REEF SITE REFERS TO INDIVIDUAL DEPLOYMENTS OF ARTIFICIAL REEF MATERIAL WITHIN THE PERMITTED REEF AREA.
- ALL PATCH REEF SITES WILL BE INSPECTED BY DIVER SURVEY PRIOR TO DEPLOYMENT OF ARTIFICIAL REEF MATERIALS AND ANY NATURAL OR HISTORIC RESOURCES WILL BE AVOIDED BY A MINIMUM 150' BUFFER.



**TAYLOR ENGINEERING INC.**

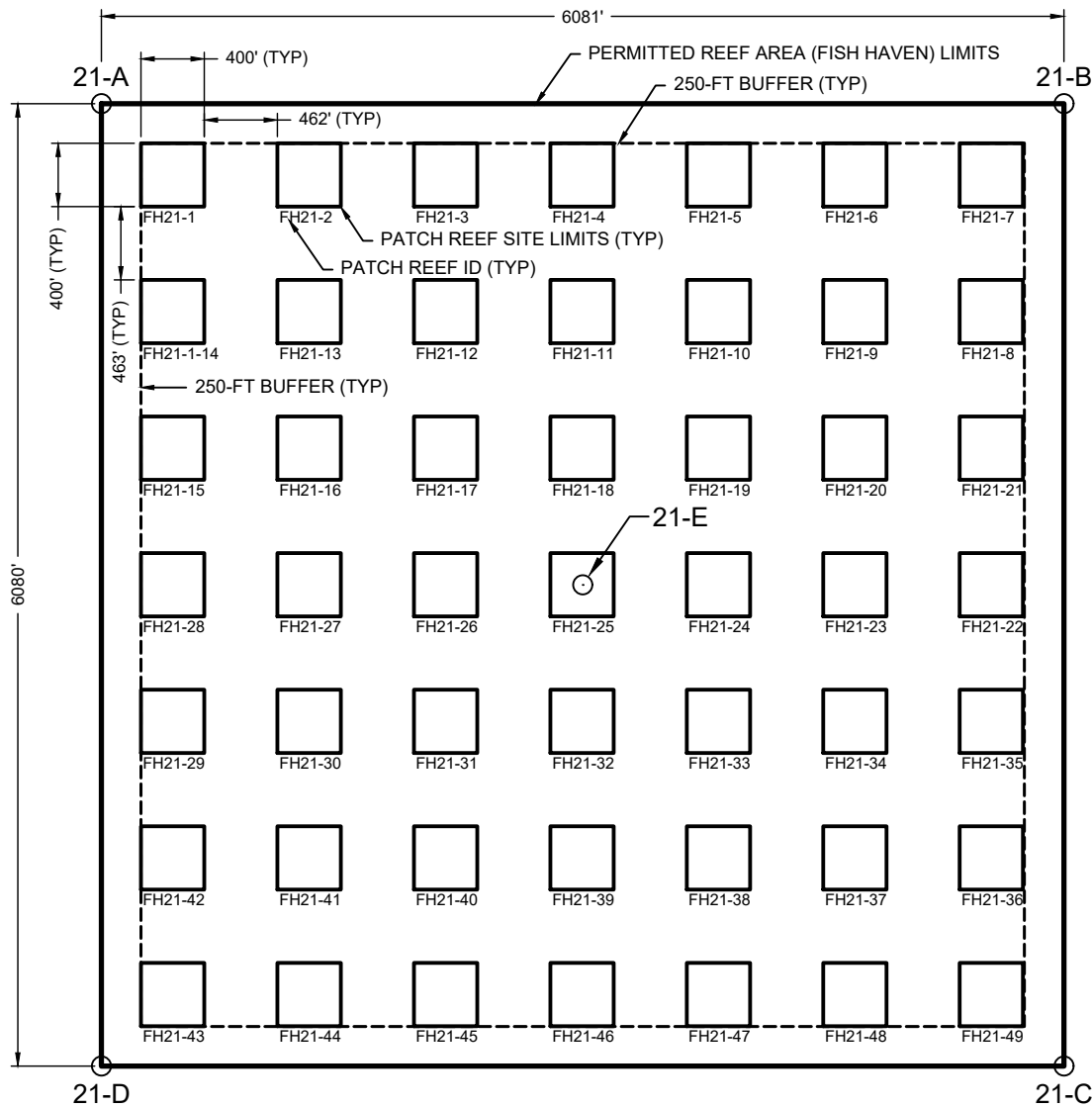
4300 LEGENDARY DRIVE  
SUITE C246  
DESTIN, FLORIDA 32541  
REGISTRY # 4815

FIGURE 2  
FISH HAVEN 20  
OKALOOSA COUNTY ARTIFICIAL REEFS FH20, FH21, AND FH22  
OKALOOSA COUNTY, FLORIDA

PROJECT	C2014-004-03
DRAWN BY	CAS
SHEET	2 of 6
DATE	OCT 2021

SEAL	
DUNCAN GREER P.E. #83306	
DATE	

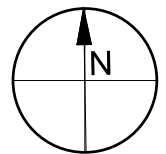
CATHY SHELL X:\S\PROJECTS\C2014-004-03 OK REEF FH20-22\PERMIT\C2014-004-03-P-REEF PLANS.DWG 10/11/2021 4:55:34 PM



PROPOSED REEF LIMITS				
POINT ID	LAT (DD)	LONG (DD)	NORTHING	EASTING
21-A	N30.2539	W86.5185	461,643	1,331,218
21-B	N30.2539	W86.4993	461,535	1,337,297
21-C	N30.2372	W86.4993	455,456	1,337,190
21-D	N30.2372	W86.5185	455,564	1,331,109
21-E	N30.2455	W86.5089	458,550	1,334,204

**NOTES:**

1. REEF AREA REFERS TO THE ENTIRE PERMITTED BOUNDARY OF THE PROPOSED FISH HAVEN.
2. PATCH REEF/PATCH REEF SITE REFERS TO INDIVIDUAL DEPLOYMENTS OF ARTIFICIAL REEF MATERIAL WITHIN THE PERMITTED REEF AREA.
3. ALL PATCH REEF SITES WILL BE INSPECTED BY DIVER SURVEY PRIOR TO DEPLOYMENT OF ARTIFICIAL REEF MATERIALS AND ANY NATURAL OR HISTORIC RESOURCES WILL BE AVOIDED BY A MINIMUM 150' BUFFER.



**TAYLOR ENGINEERING INC.**

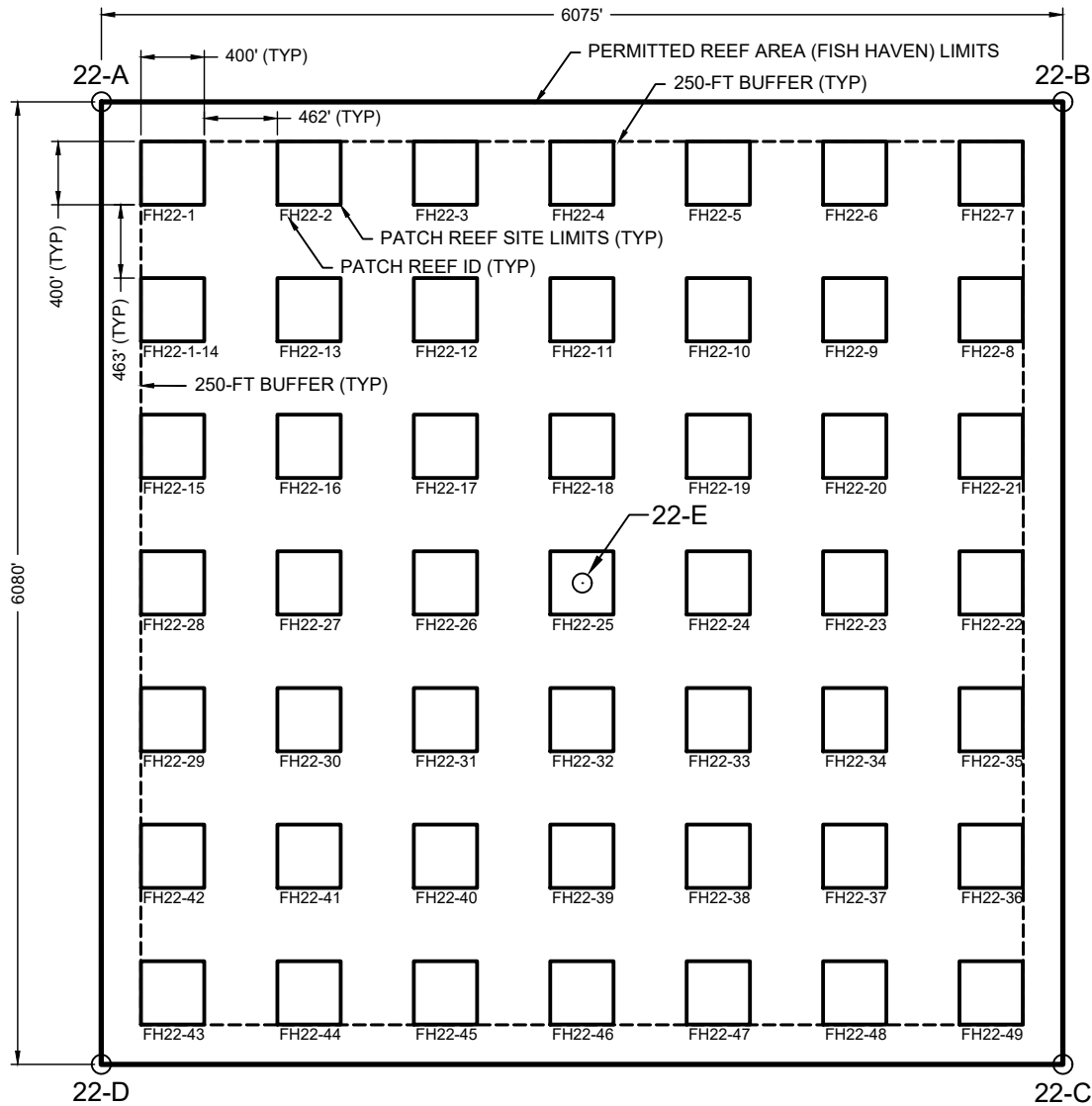
4300 LEGENDARY DRIVE  
SUITE C246  
DESTIN, FLORIDA 32541  
REGISTRY # 4815

FIGURE 3  
FISH HAVEN 21  
OKALOOSA COUNTY ARTIFICIAL REEFS FH20, FH21, AND FH22  
OKALOOSA COUNTY, FLORIDA

PROJECT	C2014-004-03
DRAWN BY	CAS
SHEET	3 of 5
DATE	OCT 2021

SEAL	
DUNCAN GREER P.E. #83306	
DATE	

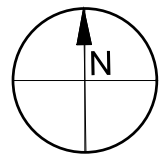
CATHY SHELL X:\S\PROJECTS\C2014-004-03 OK REEF FH20-22\PERMIT\C2014-004-03-P-REEF PLANS.DWG 10/11/2021 4:55:35 PM



PROPOSED REEF LIMITS				
POINT ID	LAT (DD)	LONG (DD)	NORTHING	EASTING
22-A	N30.3548	W86.4488	497,941	1,353,870
22-B	N30.3548	W86.4295	497,837	1,359,944
22-C	N30.3380	W86.4295	491,758	1,359,841
22-D	N30.3380	W86.4488	491,861	1,353,766
22-E	N30.3464	W86.4391	494,849	1,356,855

**NOTES:**

- REEF AREA REFERS TO THE ENTIRE PERMITTED BOUNDARY OF THE PROPOSED FISH HAVEN.
- PATCH REEF/PATCH REEF SITE REFERS TO INDIVIDUAL DEPLOYMENTS OF ARTIFICIAL REEF MATERIAL WITHIN THE PERMITTED REEF AREA.
- ALL PATCH REEF SITES WILL BE INSPECTED BY DIVER SURVEY PRIOR TO DEPLOYMENT OF ARTIFICIAL REEF MATERIALS AND ANY NATURAL OR HISTORIC RESOURCES WILL BE AVOIDED BY A MINIMUM 150' BUFFER.



**TAYLOR ENGINEERING INC.**

4300 LEGENDARY DRIVE  
SUITE C246  
DESTIN, FLORIDA 32541  
REGISTRY # 4815

FIGURE 4  
FISH HAVEN 22  
OKALOOSA COUNTY ARTIFICIAL REEFS FH20, FH21, AND FH22  
OKALOOSA COUNTY, FLORIDA

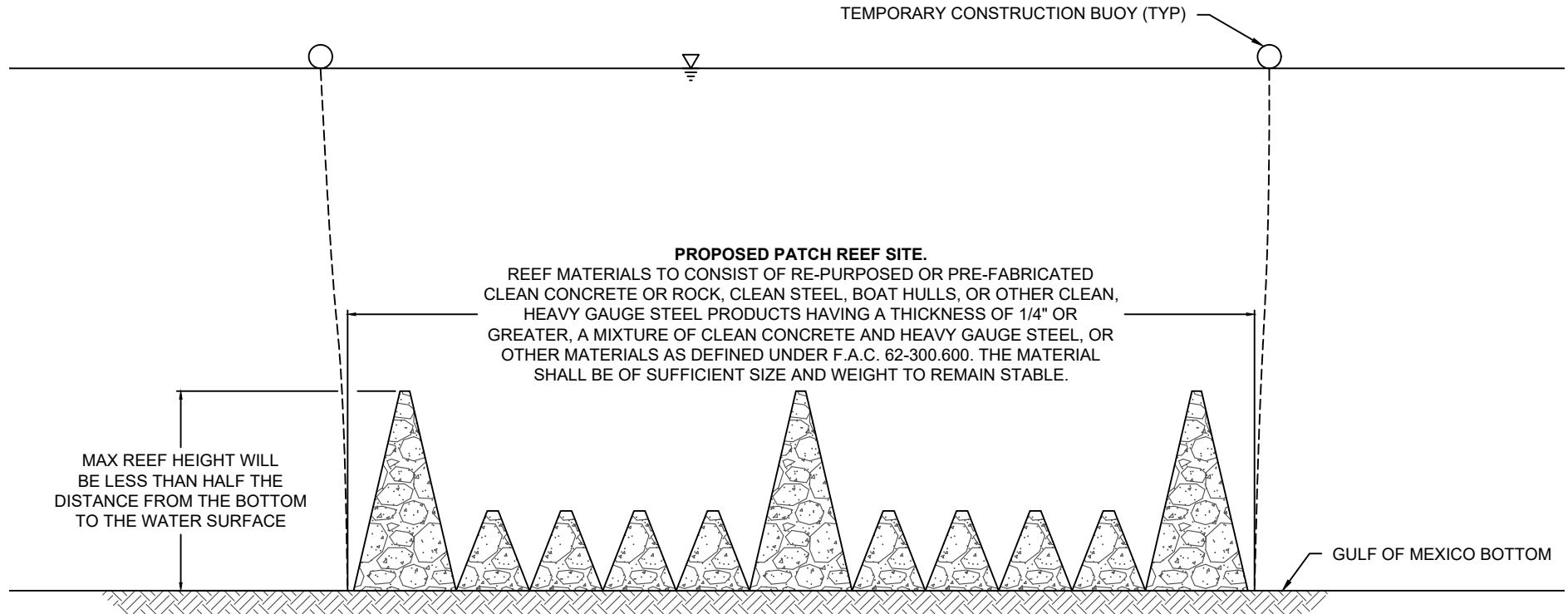
PROJECT	C2014-004-03
DRAWN BY	CAS
SHEET	4 of 6
DATE	OCT 2021

SEAL	
DUNCAN GREER P.E. #83306	
DATE	



**NOTES:**

1. MARKER BUOYS WILL BE SECURED ALONG THE PERIMETER OF THE PATCH REEF SITES PRIOR TO MATERIAL PLACEMENT TO DEFINE THE DROP AREA AND TO ENSURE ACCURATE PLACEMENT WITHIN THE APPROVED SITE.
2. QUALITY CONTROL DIVES SHALL BE PERFORMED AS NECESSARY TO ENSURE PROPER MATERIAL PLACEMENT AND RELIEF.



**TYPICAL PATCH REEF SITE SECTION**  
NOT TO SCALE

CATHY SHELL X:\S\PROJECTS\C2014-004-03 OK REEF FH20-22\PERMIT\C2014-004-03-P-TYPICAL\_SECTION.DWG 10/11/2021 4:55:40 PM



**TAYLOR ENGINEERING INC.**

4300 LEGENDARY DRIVE  
SUITE C246  
DESTIN, FLORIDA 32541  
REGISTRY # 4815

FIGURE 5  
TYPICAL PATCH REEF SITE SECTION  
OKALOOSA COUNTY ARTIFICIAL REEFS FH20, FH21, AND FH22  
OKALOOSA COUNTY, FLORIDA

PROJECT	C2014-004-03	SEAL
DRAWN BY	CAS	
SHEET	5 of 6	
DATE	OCT 2021	

DUNCAN GREER P.E. #83306

DATE

CATHY SHELL X:\S\PROJECTS\C2014-004-03 OK REEF FH20-22\PERMIT\C2014-004-03-P-REEF PLANS.DWG 10/11/2021 4:55:47 PM

REEF POINT SUMMARY								
POINT ID	NORTHING	EASTING	LAT (DD)	LONG (DD)	LAT (DDM)	LONG (DDM)	LAT (DMS)	LONG (DMS)
20-A	506,356	1,291,371	N30.3748	W86.6474	N030°22.4881'	W086°38.8436'	N030°22'29"	W086°38'51"
20-B	506,242	1,297,443	N30.3748	W86.6281	N030°22.4880'	W086°37.6880'	N030°22'29"	W086°37'41"
20-C	500,163	1,297,329	N30.3581	W86.6281	N030°21.4850'	W086°37.6881'	N030°21'29"	W086°37'41"
20-D	500,277	1,291,256	N30.3581	W86.6474	N030°21.4850'	W086°38.8437'	N030°21'29"	W086°38'51"
20-E	503,259	1,294,350	N30.3664	W86.6378	N030°21.9865'	W086°38.2658'	N030°21'59"	W086°38'16"
21-A	461,643	1,331,218	N30.2539	W86.5185	N030°15.2329'	W086°31.1125'	N030°15'14"	W086°31'07"
21-B	461,535	1,337,297	N30.2539	W86.4993	N030°15.2327'	W086°29.9570'	N030°15'14"	W086°29'57"
21-C	455,456	1,337,190	N30.2372	W86.4993	N030°14.2297'	W086°29.9572'	N030°14'14"	W086°29'57"
21-D	455,564	1,331,109	N30.2372	W86.5185	N030°14.2298'	W086°31.1127'	N030°14'14"	W086°31'07"
21-E	458,550	1,334,204	N30.2455	W86.5089	N030°14.7313'	W086°30.5348'	N030°14'44"	W086°30'32"
22-A	497,941	1,353,870	N30.3548	W86.4488	N030°21.2852'	W086°26.9263'	N030°21'17"	W086°26'56"
22-B	497,837	1,359,944	N30.3548	W86.4295	N030°21.2852'	W086°25.7708'	N030°21'17"	W086°25'46"
22-C	491,758	1,359,841	N30.3380	W86.4295	N030°20.2821'	W086°25.7708'	N030°20'17"	W086°25'46"
22-D	491,861	1,353,766	N30.3380	W86.4488	N030°20.2821'	W086°26.9263'	N030°20'17"	W086°26'56"
22-E	494,849	1,356,855	N30.3464	W86.4391	N030°20.7837'	W086°26.3485'	N030°20'47"	W086°26'21"



# TAYLOR ENGINEERING INC.

4300 LEGENDARY DRIVE  
SUITE C246  
DESTIN, FLORIDA 32541  
REGISTRY # 4815

FIGURE 6  
REEF POINT SUMMARY TABLE  
OKALOOSA COUNTY ARTIFICIAL REEFS FH20, FH21, AND FH22  
OKALOOSA COUNTY, FLORIDA

PROJECT	C2014-004-03
DRAWN BY	CAS
SHEET	6 of 6
DATE	OCT 2021

SEAL

DUNCAN GREER P.E. #83306

DATE



# FLORIDA DEPARTMENT OF Environmental Protection

Northwest District  
160 W. Government Street, Suite 308  
Pensacola, Florida 32502-5740

**Ron DeSantis**  
Governor

**Jeanette Nuñez**  
Lt. Governor

**Shawn Hamilton**  
Secretary

## **Permittee/Authorized Entity:**

Okaloosa County Board of County Commissioners  
c/o Alexander Fogg  
1250 North Eglin Parkway  
Suite 100  
Shalimar, Florida 32579, Okaloosa County  
[afogg@myokaloosa.com](mailto:afogg@myokaloosa.com)

## **Fish Havens 20, 21, & 22**

### **Authorized Agent:**

Taylor Engineering, Inc.  
c/o Duncan Greer  
4300 Legendary Drive  
Destin, Florida 32541  
[dgreer@taylorengeering.com](mailto:dgreer@taylorengeering.com)

## **Environmental Resource Permit State-owned Submerged Lands Authorization – Granted**

## **U.S. Army Corps of Engineers Authorization – Separate Corps Authorization Required**

Okaloosa County  
Permit No.: 0404845-001-EI/46

**Permit Issuance Date: December 22, 2021**  
**Permit Construction Phase Expiration Date: December 22, 2031**

# **Consolidated Environmental Resource Permit and Sovereignty Submerged Lands Authorization**

**Permittee/Grantee: Okaloosa County Board of County Commissioners**  
**Permit No: 0404845-001-EI/46**

## **PROJECT LOCATION**

The activities authorized by this permit and sovereignty submerged lands authorization are located at three locations offshore of Okaloosa County, Florida. Fish Haven 20 is located approximately 1.74 nautical miles offshore, west of the East Pass at 30.3664 N, 86.6378 W. Fish Haven 21 is located approximately 8.14 nautical miles offshore, south of the East Pass at 30.2455 N, 86.5089 W. Fish Haven 22 is located approximately 2.20 nautical miles offshore, east of the East Pass at 30.3464 N, 86.4391 W. Exact location coordinates are depicted in the attached project drawings.

## **PROJECT DESCRIPTION**

The permittee is authorized to construct three artificial reefs, each approximately one square nautical mile and 847.5 acres, totaling three square nautical miles and 2544.6 acres, within the Gulf of Mexico, a Class III Florida Waterbody, Unclassified Shellfish Harvesting Area. Authorized activities are depicted on the attached exhibits.

## **AUTHORIZATIONS**

### **Fish Havens 20, 21, & 22**

#### Environmental Resource Permit

The Department has determined that the activity qualifies for an Environmental Resource Permit. Therefore, the Environmental Resource Permit is hereby granted, pursuant to Part IV of Chapter 373, Florida Statutes (F.S.), and Chapter 62-330, Florida Administrative Code (F.A.C.).

#### Sovereignty Submerged Lands Authorization

The activity is located on sovereignty submerged lands owned by the State of Florida. It therefore also requires authorization from the Board of Trustees of the Internal Improvement Trust Fund (Board of Trustees), pursuant to Article X, Section 11 of the Florida Constitution, and Section 253.77, F.S. As staff to the Board of Trustees of the Internal Improvement Trust Fund (Board of Trustees) under Sections 253.002, F.S., the Department has determined that the activity qualifies for and requires a Letter of Consent, as long as the work performed is located within the boundaries as described and is consistent with the terms and conditions herein.

During the term of this Letter of Consent you shall maintain satisfactory evidence of sufficient upland interest as required by paragraph 18-21.004(3)(b), F.A.C. If such interest is terminated or the Board of Trustees determines that such interest did not exist on the date of issuance of this Letter of Consent, this Letter of Consent may be terminated by the Board of Trustees at its sole option. If the Board of Trustees terminates this Letter of Consent, you agree not to assert a claim or defense against the Board of Trustees arising out of this Letter of Consent.

### Federal Authorization

Your proposed activity as outlined in your application and attached drawings **does not qualify** for Federal authorization pursuant to the State Programmatic General Permit VI-R1.

**SEPARATE permit(s)** or authorization **will be required** from the U.S. Army Corps of Engineers (USACOE).

Authority for review - an agreement with the USACOE entitled “Coordination Agreement Between the U. S. Army Corps of Engineers (Jacksonville District) and the Florida Department of Environmental Protection (or Duly Authorized Designee), State Programmatic General Permit”, Section 10 of the Rivers and Harbor Act of 1899, and Section 404 of the Clean Water Act.

### Coastal Zone Management

Issuance of this authorization also constitutes a finding of consistency with Florida’s Coastal Zone Management Program, as required by Section 307 of the Coastal Zone Management Act.

### Water Quality Certification

This permit also constitutes a water quality certification under Section 401 of the Clean Water Act, 33 U.S.C. 1341.

### Other Authorizations

You are advised that authorizations or permits for this activity may be required by other federal, state, regional, or local entities including but not limited to local governments or municipalities. This permit does not relieve you from the requirements to obtain all other required permits or authorizations.

The activity described may be conducted only in accordance with the terms, conditions and attachments contained in this document. Issuance and granting of the permit and authorizations herein do not infer, nor guarantee, nor imply that future permits, authorizations, or modifications will be granted by the Department.

## **PERMIT / SOVEREIGNTY SUBMERGED LANDS CONDITIONS**

The activities described must be conducted in accordance with:

- **The Specific Conditions**
- **The General Conditions**
- **The Special Consent Conditions**
- **The General Conditions for Sovereignty Submerged Lands Authorization**
- **The limits, conditions and locations of work shown in the attached drawings**
- **The term limits of this authorization**

You are advised to read and understand these conditions and drawings prior to beginning the authorized activities, and to ensure the work is conducted in conformance with all the terms, conditions, and drawings herein. If you are using a contractor, the contractor also should read and understand these conditions and drawings prior to beginning any activity. Failure to comply with these conditions, including any mitigation requirements, shall be grounds for the

Department to revoke the permit and authorization and to take appropriate enforcement action. Operation of the facility is not authorized except when determined to be in conformance with all applicable rules and this permit and sovereignty submerged lands authorization, as described.

### **SPECIFIC CONDITIONS – ADMINISTRATIVE/EMERGENCIES**

1. The construction phase expires at 11:59 p.m. on the date indicated on the cover page of this permit.
2. For emergencies involving a serious threat to the public health, safety, welfare, or environment, the emergency telephone contact number is (800) 320-0519 (State Warning Point). The Department telephone number for reporting nonthreatening problems or system malfunctions is (850) 595-0663, day or night.
3. The mailing address for submittal of forms for the “Construction Commencement Notice”, “As-Built Certification ...”, “Request for Conversion of Stormwater Management Permit Construction Phase to Operation and Maintenance Phase”, or other correspondence is FDEP, SLERP, 160 West Government Street, Suite 308, Pensacola, Florida 32502.

### **SPECIFIC CONDITIONS – CONSTRUCTION ACTIVITIES**

4. Construction equipment shall not be repaired or refueled in wetlands or elsewhere within waters of the state.
5. Any damage to wetlands outside of the authorized impact areas as a result of construction shall be immediately reported to the Department at (850)595-8300 and repaired by reestablishing the pre-construction elevations and replanting vegetation of the same species, size, and density as that in the adjacent areas. The restoration shall be completed within 30 days of completion of construction, and the Department shall be notified of its completion within that same 30-day period.
6. The material to be used shall be clean concrete or rock, clean steel boat hulls, other clean, heavy gauge steel products with a thickness of 1/4 inch or greater, and prefabricated structures that are a mixture of clean concrete and heavy gauge steel.
7. The material shall be free of soils, oils and greases, debris, litter, putrescible substances or other pollutants.
8. The material shall be firmly anchored to the bottom and shall not be indiscriminately dumped.
9. The substrate on which the activities occur shall not consist of submerged grassbed communities, shellfish or other hardbottom communities, or corals.
10. There shall be no “white goods” (inoperative and discarded refrigerators, freezers, ranges, water heaters, washers, and other similar domestic and commercial appliances), asphalt material, tires, or other polluting materials used in construction of the reef.
11. Deployment of any vessel as artificial reef material is prohibited unless written authorization has first been obtained from the USACOE. The Permittee must first submit a project-specific

deployment plan to the USACOE to request such authorization to deploy vessels, and the plan must include the following information:

- a. Detailed description of the proposed deployment including vessel material type, deployment depth, intended orientation of the vessel (e.g., upright, on its side, upside down), navigational clearance with the material in all orientations, and the weight and dimensions of the selected vessel;
  - b. Stability analysis of the proposed vessel at the depth and location proposed for deployment;
  - c. A pre-deployment preparation plan describing how compliance with the EPA and MARAD “National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs” has been followed. This document is available at: <https://www.epa.gov/sites/production/files/2015-09/documents/artificialreefguidance.pdf>;
  - d. Tow and anchoring plan describing how the vessel will be towed to and anchored at the deployment site;
  - e. Sink Plan describing the methods used to deploy the vessel. If the use of explosives is requested, a detailed explosive and detonation plan including justification documenting the need for the use of explosives as the only deployment alternative, and a marine mammal monitoring and vessel security plan must be provided;
  - f. A monitoring plan describing on-water and pre-deployment monitoring, immediate post-deployment monitoring, and annual monitoring activities to document that the vessel is deployed/located within the permitted area including coordinates, orientation of vessel (e.g., upright, side, upside down), structural integrity status (i.e., is the vessel in one piece, are pieces being disassociated from the structure), and documentation that the vessel meets USCG navigational requirements;
  - g. A copy of the proposed project budget, and documentation that the permittee has approved funding adequate to procure, clean, deploy, and conduct monitoring of the selected vessel once it has been deployed.
12. The site shall be marked with perimeter buoys during construction to ensure that no material is deposited outside of the site.
13. The artificial reef site shall not be established within any shipping lanes or navigation safety fairways.
14. There shall be a minimum of 250-foot buffer between the deployment site and the outer boundary of the permitted reef site.

### **SPECIFIC CONDITIONS – OTHER LISTED SPECIES**

15. This permit does not authorize the permittee to cause any adverse impact to or “take” of state listed species and other regulated species of fish and wildlife. Compliance with state laws regulating the take of fish and wildlife is the responsibility of the owner or applicant associated with this project. Please refer to Chapter 68A-27 of the Florida Administrative Code for definitions of “take” and a list of fish and wildlife species. If listed species are observed onsite, FWC staff are available to provide decision support information or assist in obtaining the appropriate FWC permits. Most marine endangered and threatened species are statutorily protected and a “take” permit cannot be issued. Requests for further information or review can be sent to [FWCConservationPlanningServices@MyFWC.com](mailto:FWCConservationPlanningServices@MyFWC.com).

### **SPECIFIC CONDITIONS – CONSTRUCTION COMPLETION**

16. Following deployment of reef materials, please provide the depth to the top of the reef (i.e. using a depth finder) to ensure the minimum clearance requirements are met.

### **SPECIFIC CONDITIONS – OPERATION AND MAINTENANCE ACTIVITIES**

17. The material shall be placed so that the top of the reef does not exceed 1/2 the distance from the bottom to the surface of the water unless a greater distance from the surface is required for safe navigation. At no time shall the distance between the top of the reef and the surface of the water be less than 6 feet.

### **SPECIFIC CONDITIONS – CARGO MANIFEST**

18. Pursuant to Section 379.249, F.S., the transport and deployment of all artificial reef materials off Florida require a cargo manifest. The Permittee shall fill out a “Florida Artificial Reef Materials Cargo Manifest and Pre-Deployment Notification” form and maintain the cargo manifest onboard the vessel listing the materials onboard, during the transport and deployment of artificial reef materials. The completed form shall be submitted to the FWC Artificial Reef Program at least 7 days prior to the anticipated deployment via email at [artificialreefdeployments@myfwc.com](mailto:artificialreefdeployments@myfwc.com). The form is available online at: <http://myfwc.com/media/131594/FWCArtificialReefCargoManifest.pdf>.

### **SPECIFIC CONDITIONS – PLACEMENT AND POST-DEPLOYMENT**

19. The permittee shall notify the National Ocean Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Rockville, Maryland, and the Florida Fish and Wildlife Conservation Commission (FWC), Division of Marine Fisheries Management, via e-mail at [artificialreefdeployments@myfwc.com](mailto:artificialreefdeployments@myfwc.com) of the precise location of the reef within 30 days of placement of the reef material.

20. The permittee shall fill out a “Florida Artificial Reef Materials Placement Report and Post-Deployment notification form and submit it to the FWC within 30 days of completion for each date of deployment or separate deployment location. The completed form shall be submitted to the FWC Artificial Reef Program via email at [artificialreefdeployments@myfwc.com](mailto:artificialreefdeployments@myfwc.com). The form is available online at: <http://myfwc.com/media/131597/FWCArtificialReefMaterialPlacementReport.pdf>.



## **GENERAL CONDITIONS FOR INDIVIDUAL PERMITS**

The following general conditions are binding on all individual permits issued under chapter 62-330, F.A.C., except where the conditions are not applicable to the authorized activity, or where the conditions must be modified to accommodate project-specific conditions.

1. All activities shall be implemented following the plans, specifications and performance criteria approved by this permit. Any deviations must be authorized in a permit modification in accordance with Rule 62-330.315, F.A.C. Any deviations that are not so authorized may subject the permittee to enforcement action and revocation of the permit under Chapter 373, F.S.
2. A complete copy of this permit shall be kept at the work site of the permitted activity during the construction phase, and shall be available for review at the work site upon request by the Agency staff. The permittee shall require the contractor to review the complete permit prior to beginning construction.
3. Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards. Performance-based erosion and sediment control best management practices shall be installed immediately prior to, and be maintained during and after construction as needed, to prevent adverse impacts to the water resources and adjacent lands. Such practices shall be in accordance with the *State of Florida Erosion and Sediment Control Designer and Reviewer Manual* (Florida Department of Environmental Protection and Florida Department of Transportation June 2007), and the *Florida Stormwater Erosion and Sedimentation Control Inspector's Manual* (Florida Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008), which are both incorporated by reference in subparagraph 62-330.050(9)(b)5., F.A.C., unless a project-specific erosion and sediment control plan is approved or other water quality control measures are required as part of the permit.
4. At least 48 hours prior to beginning the authorized activities, the permittee shall submit to the Agency a fully executed Form 62-330.350(1), "Construction Commencement Notice," [October 1, 2013], which is incorporated by reference in paragraph 62-330.350(1)(d), F.A.C., indicating the expected start and completion dates. A copy of this form may be obtained from the Agency, as described in subsection 62-330.010(5), F.A.C. If available, an Agency website that fulfills this notification requirement may be used in lieu of the form.
5. Unless the permit is transferred under Rule 62-330.340, F.A.C., or transferred to an operating entity under Rule 62-330.310, F.A.C., the permittee is liable to comply with the plans, terms and conditions of the permit for the life of the project or activity.
6. Within 30 days after completing construction of the entire project, or any independent portion of the project, the permittee shall provide the following to the Agency, as applicable:
  - a. For an individual, private single-family residential dwelling unit, duplex, triplex, or quadruplex – "Construction Completion and Inspection Certification for Activities Associated With a Private Single-Family Dwelling Unit" [Form 62-330.310(3)]; or
  - b. For all other activities – "As-Built Certification and Request for Conversion to Operational Phase" [Form 62-330.310(1)].

- c. If available, an Agency website that fulfills this certification requirement may be used in lieu of the form.
7. If the final operation and maintenance entity is a third party:
  - a. Prior to sales of any lot or unit served by the activity and within one year of permit issuance, or within 30 days of as- built certification, whichever comes first, the permittee shall submit, as applicable, a copy of the operation and maintenance documents (see sections 12.3 thru 12.3.3 of Volume I) as filed with the Department of State, Division of Corporations and a copy of any easement, plat, or deed restriction needed to operate or maintain the project, as recorded with the Clerk of the Court in the County in which the activity is located.
  - b. Within 30 days of submittal of the as- built certification, the permittee shall submit “Request for Transfer of Environmental Resource Permit to the Perpetual Operation Entity” [Form 62-330.310(2)] to transfer the permit to the operation and maintenance entity, along with the documentation requested in the form. If available, an Agency website that fulfills this transfer requirement may be used in lieu of the form.
8. The permittee shall notify the Agency in writing of changes required by any other regulatory agency that require changes to the permitted activity, and any required modification of this permit must be obtained prior to implementing the changes.
9. This permit does not:
  - a. Convey to the permittee any property rights or privileges, or any other rights or privileges other than those specified herein or in Chapter 62-330, F.A.C.;
  - b. Convey to the permittee or create in the permittee any interest in real property;
  - c. Relieve the permittee from the need to obtain and comply with any other required federal, state, and local authorization, law, rule, or ordinance; or
  - d. Authorize any entrance upon or work on property that is not owned, held in easement, or controlled by the permittee.
10. Prior to conducting any activities on state-owned submerged lands or other lands of the state, title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund, the permittee must receive all necessary approvals and authorizations under Chapters 253 and 258, F.S. Written authorization that requires formal execution by the Board of Trustees of the Internal Improvement Trust Fund shall not be considered received until it has been fully executed.
11. The permittee shall hold and save the Agency harmless from any and all damages, claims, or liabilities that may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any project authorized by the permit.
12. The permittee shall notify the Agency in writing:
  - a. Immediately if any previously submitted information is discovered to be inaccurate; and
  - b. Within 30 days of any conveyance or division of ownership or control of the property or the system, other than conveyance via a long-term lease, and the new owner shall request transfer of the permit in accordance with Rule 62-330.340, F.A.C. This does not apply to the sale of lots or units in residential or commercial subdivisions or condominiums where the stormwater management system has been completed and converted to the operation phase.

13. Upon reasonable notice to the permittee, Agency staff with proper identification shall have permission to enter, inspect, sample and test the project or activities to ensure conformity with the plans and specifications authorized in the permit.

14. If any prehistoric or historic artifacts, such as pottery or ceramics, stone tools or metal implements, dugout canoes, or any other physical remains that could be associated with Native American cultures, or early colonial or American settlement are encountered at any time within the project site area, work involving subsurface disturbance in the immediate vicinity of such discoveries shall cease. The permittee or other designee shall contact the Florida Department of State, Division of Historical Resources, Compliance and Review Section, at (850) 245-6333 or (800) 847-7278, as well as the appropriate permitting agency office. Such subsurface work shall not resume without verbal or written authorization from the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and notification shall be provided in accordance with Section 872.05, F.S.

15. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under Rule 62-330.201, F.A.C., provides otherwise.

16. The permittee shall provide routine maintenance of all components of the stormwater management system to remove trapped sediments and debris. Removed materials shall be disposed of in a landfill or other uplands in a manner that does not require a permit under Chapter 62-330, F.A.C., or cause violations of state water quality standards.

17. This permit is issued based on the applicant's submitted information that reasonably demonstrates that adverse water resource-related impacts will not be caused by the completed permit activity. If any adverse impacts result, the Agency will require the permittee to eliminate the cause, obtain any necessary permit modification, and take any necessary corrective actions to resolve the adverse impacts.

18. A Recorded Notice of Environmental Resource Permit may be recorded in the county public records in accordance with subsection 62-330.090(7), F.A.C. Such notice is not an encumbrance upon the property.

### **SPECIAL CONSENT CONDITIONS**

1. The applicant agrees to indemnify, defend and hold harmless the Board of Trustees and the State of Florida from all claims, actions, lawsuits and demands in any form arising out of the authorization to use sovereignty submerged lands or the applicant's use and construction of structures on sovereignty submerged lands. This duty to indemnify and hold harmless will include any and all liabilities that are associated with the structure or activity including special assessments or taxes that are now or in the future assessed against the structure or activity during the period of the authorization.

2. Failure by the Board of Trustees to enforce any violation of a provision of the authorization or waiver by the Board of Trustees of any provision of the authorization will not invalidate the provision not enforced or waived, nor will the failure to enforce or a waiver prevent the Board of

Trustees from enforcing the unenforced or waived provision in the event of a violation of that provision.

3. Applicant binds itself and its successors and assigns to abide by the provisions and conditions set forth in the authorization. If the applicant or its successors or assigns fails or refuses to comply with the provisions and conditions of the authorization, the authorization may be terminated by the Board of Trustees after written notice to the applicant or its successors or assigns. Upon receipt of such notice, the applicant or its successors or assigns will have thirty (30) days in which to correct the violations. Failure to correct the violations within this period will result in the automatic revocation of this authorization.

4. All costs incurred by the Board of Trustees in enforcing the terms and conditions of the authorization will be paid by the applicant. Any notice required by law will be made by certified mail at the address shown on page one of the authorization. The applicant will notify the Board of Trustees in writing of any change of address at least ten days before the change becomes effective.

5. This authorization does not allow any activity prohibited in a conservation easement or restrictive covenant that prohibits the activity.

#### **GENERAL CONDITIONS FOR SOVEREIGNTY SUBMERGED LANDS AUTHORIZATION**

Any use of sovereignty submerged lands is subject to the following general conditions, which are binding upon the applicant and are enforceable under Chapter 253, F.S.

1. Sovereignty submerged lands may be used only for the specified activity or use. Any unauthorized deviation from the specified activity or use and the conditions for undertaking that activity or use will constitute a violation. Violation of the authorization will result in suspension or revocation of the applicant's use of the sovereignty submerged lands unless cured to the satisfaction of the Board of Trustees.

2. Authorization under Rule 18-21.005, F.A.C., conveys no title to sovereignty submerged lands or water column, nor does it constitute recognition or acknowledgment of any other person's title to such land or water.

3. Authorizations under Rule 18-21.005, F.A.C., may be modified, suspended or revoked in accordance with its terms or the remedies provided in Sections 253.04, F.S. and Chapter 18-14, F.A.C.

4. Structures or activities will be constructed and used to avoid or minimize adverse impacts to resources.

5. Construction, use, or operation of the structure or activity will not adversely affect any species which is endangered, threatened or of special concern, as listed in Rules 68A-27.003, 68A-27.004, and 68A-27.005, F.A.C.

6. Structures or activities will not unreasonably interfere with riparian rights. When a court of competent jurisdiction determines that riparian rights have been unlawfully affected, the structure or activity will be modified in accordance with the court's decision.

7. Structures or activities will not create a navigational hazard.

8. Structures will be maintained in a functional condition and will be repaired or removed if they become dilapidated to such an extent that they are no longer functional.

9. Structures or activities will be constructed, operated, and maintained solely for water dependent purposes.

10. The applicant agrees to indemnify, defend and hold harmless the Board of Trustees and the State of Florida from all claims, actions, lawsuits and demands in any form arising out of the authorization to use sovereignty submerged lands or the applicant's use and construction of structures on sovereignty submerged lands. This duty to indemnify and hold harmless will include any and all liabilities that are associated with the structure or activity including special assessments or taxes that are now or in the future assessed against the structure or activity during the period of the authorization.

11. Failure by the Board of Trustees to enforce any violation of a provision of the authorization or waiver by the Board of Trustees of any provision of the authorization will not invalidate the provision not enforced or waived, nor will the failure to enforce or a waiver prevent the Board of Trustees from enforcing the unenforced or waived provision in the event of a violation of that provision.

12. Applicant binds itself and its successors and assigns to abide by the provisions and conditions set forth in the authorization. If the applicant or its successors or assigns fails or refuses to comply with the provisions and conditions of the authorization, the authorization may be terminated by the Board of Trustees after written notice to the applicant or its successors or assigns. Upon receipt of such notice, the applicant or its successors or assigns will have thirty (30) days in which to correct the violations. Failure to correct the violations within this period will result in the automatic revocation of this authorization.

13. All costs incurred by the Board of Trustees in enforcing the terms and conditions of the authorization will be paid by the applicant. Any notice required by law will be made by certified mail at the address shown on page one of the authorization. The applicant will notify the Board of Trustees in writing of any change of address at least ten days before the change becomes effective.

14. This authorization does not allow any activity prohibited in a conservation easement or restrictive covenant that prohibits the activity.

## **NOTICE OF RIGHTS**

This action is final and effective on the date filed with the Clerk of the Department unless a petition for an administrative hearing is timely filed under Sections 120.569 and 120.57, F.S., before the deadline for filing a petition. On the filing of a timely and sufficient petition, this

action will not be final and effective until a subsequent order of the Department. Because the administrative hearing process is designed to formulate final agency action, the subsequent order may modify or take a different position than this action.

#### Petition for Administrative Hearing

A person whose substantial interests are affected by the Department's action may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, F.S. Pursuant to Rules 28-106.201 and 28-106.301, F.A.C., a petition for an administrative hearing must contain the following information:

- (a) The name and address of each agency affected and each agency's file or identification number, if known;
- (b) The name, address, and telephone number of the petitioner; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests are or will be affected by the agency determination;
- (c) A statement of when and how the petitioner received notice of the agency decision;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A concise statement of the ultimate facts alleged, including the specific facts that the petitioner contends warrant reversal or modification of the agency's proposed action;
- (f) A statement of the specific rules or statutes that the petitioner contends require reversal or modification of the agency's proposed action, including an explanation of how the alleged facts relate to the specific rules or statutes; and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wishes the agency to take with respect to the agency's proposed action.

The petition must be filed (received by the Clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, or via electronic correspondence at [Agency\\_Clerk@FloridaDEP.gov](mailto:Agency_Clerk@FloridaDEP.gov). Also, a copy of the petition shall be mailed to the applicant at the address indicated above at the time of filing.

#### Time Period for Filing a Petition

In accordance with Rule 62-110.106(3), F.A.C., petitions for an administrative hearing by the applicant and persons entitled to written notice under Section 120.60(3), F.S., must be filed within 14 days of receipt of this written notice. Petitions filed by any persons other than the applicant, and other than those entitled to written notice under Section 120.60(3), F.S., must be filed within 14 days of publication of the notice or within 14 days of receipt of the written notice, whichever occurs first. You cannot justifiably rely on the finality of this decision unless notice of this decision and the right of substantially affected persons to challenge this decision has been duly published or otherwise provided to all persons substantially affected by the decision. While you are not required to publish notice of this action, you may elect to do so pursuant to Rule 62-110.106(10)(a).

The failure to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the

presiding officer upon the filing of a motion in compliance with Rule 28-106.205, F.A.C. If you do not publish notice of this action, this waiver will not apply to persons who have not received written notice of this action.

#### Extension of Time

Under Rule 62-110.106(4), F.A.C., a person whose substantial interests are affected by the Department's action may also request an extension of time to file a petition for an administrative hearing. The Department may, for good cause shown, grant the request for an extension of time. Requests for extension of time must be filed with the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, or via electronic correspondence at [Agency\\_Clerk@FloridaDEP.gov](mailto:Agency_Clerk@FloridaDEP.gov), before the deadline for filing a petition for an administrative hearing. A timely request for extension of time shall toll the running of the time period for filing a petition until the request is acted upon.

#### Mediation

Mediation is not available in this proceeding.

#### FLAWAC Review

The applicant, or any party within the meaning of Section 373.114(1)(a) or 373.4275, F.S., may also seek appellate review of this order before the Land and Water Adjudicatory Commission under Section 373.114(1) or 373.4275, F.S. Requests for review before the Land and Water Adjudicatory Commission must be filed with the Secretary of the Commission and served on the Department within 20 days from the date when this order is filed with the Clerk of the Department.

#### Judicial Review

Once this decision becomes final, any party to this action has the right to seek judicial review pursuant to Section 120.68, F.S. by filing a Notice of Appeal pursuant to Florida Rules of Appellate Procedure 9.110 and 9.190 with the Clerk of the Department in the Office of General Counsel (Station #35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000) and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice must be filed within 30 days from the date this action is filed with the Clerk of the Department.

Thank you for applying to the Submerged Lands and Environmental Resource Permit Program. If you have any questions regarding this matter, please contact Joseph Winston at the letterhead address, at (850)595-0559, or at [Joseph.Winston@FloridaDEP.gov](mailto:Joseph.Winston@FloridaDEP.gov).

**EXECUTION AND CLERKING**

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION



---

For Kimberly R. Allen  
Permitting Program Administrator

KRA:jbw

**Attachments:**

Standard Manatee Construction Conditions 2011, 2 pages  
Project Drawings and Design Specs., 6 pages

Copies of 62-330 forms may be obtained at: <https://floridadep.gov/water/submerged-lands-environmental-resources-coordination/content/forms-environmental-resource>

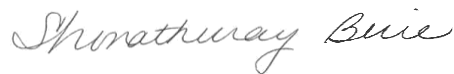
**CERTIFICATE OF SERVICE**

The undersigned duly designated deputy clerk hereby certifies that this document and all attachments were sent on the filing date below to the following listed persons:

Kimberly R. Allen, DEP, [Kim.Allen@FloridaDEP.gov](mailto:Kim.Allen@FloridaDEP.gov)  
Jennifer Waltrip, DEP, [Jennifer.Waltrip@FloridaDEP.gov](mailto:Jennifer.Waltrip@FloridaDEP.gov)  
Blake Chapman, DEP, [Blake.A.Chapman@FloridaDEP.gov](mailto:Blake.A.Chapman@FloridaDEP.gov)  
Okaloosa County, [mmartinez@co.okaloosa.fl.us](mailto:mmartinez@co.okaloosa.fl.us), [jautrey@co.okaloosa.fl.us](mailto:jautrey@co.okaloosa.fl.us),  
[sbitterman@co.okaloosa.fl.us](mailto:sbitterman@co.okaloosa.fl.us)  
Kierstin Masse, Agent, [kmasse@taylorengeering.com](mailto:kmasse@taylorengeering.com)

**FILING AND ACKNOWLEDGMENT**

FILED, on this date, pursuant to Section 120.52, F.S., with the designated Department Clerk, receipt of which is hereby acknowledged.



---

Clerk

December 22, 2021

Date



## STANDARD MANATEE CONDITIONS FOR IN-WATER WORK

2011

The permittee shall comply with the following conditions intended to protect manatees from direct project effects:

- a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.
- b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.
- c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.
- d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.
- e. Any collision with or injury to a manatee shall be reported immediately to the Florida Fish and Wildlife Conservation Commission (FWC) Hotline at 1-888-404-3922. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-731-3336) for north Florida or Vero Beach (1-772-562-3909) for south Florida, and to FWC at [ImperiledSpecies@myFWC.com](mailto:ImperiledSpecies@myFWC.com)
- f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Temporary signs that have already been approved for this use by the FWC must be used. One sign which reads *Caution: Boaters* must be posted. A second sign measuring at least 8 ½" by 11" explaining the requirements for "Idle Speed/No Wake" and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities. These signs can be viewed at [MyFWC.com/manatee](http://MyFWC.com/manatee). Questions concerning these signs can be sent to the email address listed above.

**CAUTION: MANATEE HABITAT**

**All project vessels**

**IDLE SPEED / NO WAKE**

When a manatee is within 50 feet of work  
all in-water activities must

**SHUT DOWN**

Report any collision with or injury to a manatee:



**Wildlife Alert:**

**1-888-404-FWCC(3922)**

cell \*FWC or #FWC



# FLORIDA ARTIFICIAL REEF MATERIALS CARGO MANIFEST AND PRE-DEPLOYMENT NOTIFICATION (Issued pursuant to Ch. 370.25(6)(b), Florida Statutes)



I, \_\_\_\_\_  
 Name of individual managing reef deployment (print) Signature Date

whose address is \_\_\_\_\_, (\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_  
 Street City State Zip Code Phone

declare that I am staging and transporting the following artificial reef construction materials allowable pursuant to the U.S. Army Corps of Engineers Artificial Reef Permit referenced below and agree to comply with all permit conditions in the permit listed below and attached to this manifest. I understand this artificial reef site is open to public access and this authorization does not provide any rights or exclusive private use over those rights or uses to the general public.

The address of the land based reef materials staging area is: \_\_\_\_\_

Transporting Vessel Registration Number: \_\_\_\_\_

Vessel Owner: \_\_\_\_\_ Vessel Operator: \_\_\_\_\_

**The following items are to be deployed as reef material (attach additional sheets when more than four locations):**

MATERIAL TAG ID NUMBER(S), if applicable	Descriptions of material (number of pieces, type, dimension, weight)	GPS Coordinates degrees, minutes, decimal minutes (DD°MM.mmm')
		Lat: _____ ° _____ ' _____ Lon: _____ ° _____ ' _____
		Lat: _____ ° _____ ' _____ Lon: _____ ° _____ ' _____
		Lat: _____ ° _____ ' _____ Lon: _____ ° _____ ' _____
		Lat: _____ ° _____ ' _____ Lon: _____ ° _____ ' _____

**A copy of the below referenced permit(s) and all associated conditions is attached to this manifest and shall be carried on board the vessel during loading, storing, or transporting artificial reef material.**

<p><b>-- OFFICIAL USE ONLY --</b>            (TO BE COMPLETED BY PERMIT HOLDER, OR AUTHORIZED ARTIFICIAL REEF INSPECTOR)</p>	
Permit Holder: _____ Name of U.S. Department of the Army, Corps of Engineers (ACOE) Permit Holder	
ACOE permit number _____, permitted site name _____	
issued on _____ and has an expiration date of _____.	
Local tracking number (if applicable): _____	
_____ (Name of FWC authorized Artificial Reef Inspector, printed)	
_____ (Signature)	_____ (Date)

# EXPLANATION SHEET FOR THE ARTIFICIAL REEF MATERIALS CARGO MANIFEST FORM

The attached artificial reef cargo manifest has been developed in compliance with subsection 370.25 (6)(b), Florida Statutes, which states that:

“It is unlawful for any person to: store, possess or transport on or across state waters any materials reasonably suited for artificial reef construction and stored in such a manner providing ready access for use and placement as an artificial reef, unless a valid cargo manifest issued by the commission or a commission-certified inspector is onboard the transporting vessel. The manifest will serve as authorization to use a valid permitted site or land-based staging area, which will validate that the type of artificial reef construction material being transported is permissible for use at the permitted site, and will describe and quantify the artificial reef material being transported. The manifest will also include the latitude and longitude coordinates of the proposed deployment location, the valid permit number, and the copy off the permit conditions for the permitted site. The manifest must be available for inspection by any authorized law enforcement officer or commission employee.”

This requirement for a cargo manifest became part of the statutory revision of the artificial reef program statute Section 370.25 Florida Statutes (F.S.), modified during the 2000 State of Florida Legislature. The statutory language allows a “commission certified inspector” to complete and approve the artificial reef materials cargo manifest. Therefore, we are providing the attached cargo manifest form to all local coastal government artificial reef coordinators and eligible non-profit corporations who may physically construct artificial reefs with the approval of the permit holders.

## **INSTRUCTIONS**

**A separate cargo manifest form is to be completed for each load to be transported offshore (i.e., one manifest per voyage). The manifest is to list all, and only, the reef materials onboard.**

**The top of the form is to be filled out by the reef builder with his/her contact information and the information about the proposed reef materials to be deployed written into the boxes. If several materials are identical but have different tag numbers, please write “SAME” in the box for the other materials. Also put “SAME” under additional coordinates if all materials are going to the same deployment site.**

**The shaded portion of the form at the bottom is to be filled out by the materials inspector. The cargo manifest must be completed by an entity representing the holder of the applicable artificial reef permit to assure that all materials meet the requirements of the permit.**

### **Completion of the artificial reef materials cargo manifest is required for all construction activities.**

The requirement to complete this document is not intended to be an undue burden on entities wishing to legally construct artificial reefs within permitted sites, but is a tool to assist law enforcement personnel in preventing the illegal construction of artificial reefs without the knowledge of the permit holder or in areas outside of legally permitted sites. It is intended to allow law enforcement staff to determine whether or not a load of materials is legal under the permit conditions. Without a properly completed Cargo Manifest Form on board, reef builders will be returned to port pursuant to Chapter 370.25 (6) (b). It is not necessary to send a copy of the Cargo Manifest Form to the FWC artificial reef section in Tallahassee. Documentation of the reef building activity should be maintained by the entity issuing the manifest in the event of any FWC inquiries.

**Reminder:** the placement of all public artificial reefs in state or adjacent federal waters requires the submittal of a Materials Placement Report to the FWC artificial reef program within 30 days of public reef deployment in accordance with s. 370.25 F.S.



# FLORIDA ARTIFICIAL REEF MATERIALS PLACEMENT REPORT AND POST-DEPLOYMENT NOTIFICATION



## To Be Completed For Each Deployment Location or Date of Deployment

County or Municipality: \_\_\_\_\_

Date of Placement: \_\_\_\_\_

Grant No. FWC - \_\_\_\_\_  
(if applicable)

U.S. Army Corps Permit No.: \_\_\_\_\_

Total project cost: \$ \_\_\_\_\_

Funding Source(s) and Amount(s): FWC \$ \_\_\_\_\_ Local \$ \_\_\_\_\_ Other \$ \_\_\_\_\_

Name of Permitted Reef Site: \_\_\_\_\_

Location Name for This Deployment: \_\_\_\_\_

Latitude: \_\_\_\_\_ ° \_\_\_\_\_ ' North  
(degrees, minutes, decimal minutes (DD°MM.mmm'))

Longitude: \_\_\_\_\_ ° \_\_\_\_\_ ' West  
(degrees, minutes, decimal minutes (DD°MM.mmm'))

GPS Brand and Model Number: \_\_\_\_\_

Geographical Location: \_\_\_\_\_ at \_\_\_\_\_ degrees from \_\_\_\_\_  
(nautical miles) (bearing) (reference inlet)

Water Depth: \_\_\_\_\_ feet - Maximum Material Height: \_\_\_\_\_ feet = Minimum Vertical Clearance: \_\_\_\_\_ feet

**TYPE AND AMOUNT OF MATERIAL DEPLOYED AT THE LOCATION DESCRIBED ABOVE:**  
(ATTACH A PHOTOGRAPH OF THE MATERIAL ON THE BARGE IMMEDIATELY PRIOR TO DEPLOYMENT)

Primary Type of Material: \_\_\_\_\_ Number of Pieces: \_\_\_\_\_

Dimensions: \_\_\_\_\_

Secondary Type of Material: \_\_\_\_\_ Number of Pieces: \_\_\_\_\_

Dimensions: \_\_\_\_\_

TOTAL TONNAGE FOR THIS DEPLOYMENT: \_\_\_\_\_

**I DO HEREBY CERTIFY THAT THE ABOVE INFORMATION IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE**

Observer's Name: \_\_\_\_\_ Title: \_\_\_\_\_  
(PLEASE PRINT) (PLEASE PRINT)

Observer's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Observer's Remarks: \_\_\_\_\_

**I DO HEREBY CERTIFY THAT THE ABOVE INFORMATION COMPLIES WITH THE ABOVE REFERENCED PERMIT CONDITIONS**

Permittee's Staff Name: \_\_\_\_\_ Title: \_\_\_\_\_  
(PLEASE PRINT) (PLEASE PRINT)

Permittee's Staff Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Local Tracking number \_\_\_\_\_ FWC Tracking number \_\_\_\_\_ Entered by \_\_\_\_\_ on \_\_\_\_\_ date  
FWC initials

Second page to contain instructions....

**FOR GRANT-FUNDED REEFS, the following data will be recorded at the staging area prior to and after the deployment. This formula represents an average, single rake barge and may not represent the exact tonnage of materials placed.**

**USING THIS FORMULA FOR PAYMENT OF TRANSPORTATION COSTS SHOULD BE AGREED UPON IN ADVANCE WITH A CONTRACTOR.**

**Barge Length:\_\_\_\_\_ feet Barge Width:\_\_\_\_\_ feet Loaded Draft:\_\_\_\_\_ feet Unloaded Draft:\_\_\_\_\_ feet**

**(Length X Width X Loaded Draft X 0.93 X 65) = 2,000 = \_\_\_\_\_ (Loaded barge weight in tons)  
SUBTRACT**

**(Length X Width X Unloaded Draft X 0.93 X 65) = 2,000 = \_\_\_\_\_ (Unloaded barge weight in tons)**

**TOTAL TONNAGE FOR THIS DEPLOYMENT = \_\_\_\_\_**



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

03/10/2023

F/SER31:SG  
SERO-2022-01316

Terry Hayes  
Chief, Pensacola Section  
Jacksonville District Corps of Engineers  
Department of the Army  
41 North Jefferson Street, Suite 301  
Pensacola, Florida 32502

Ref.: SAJ-2021-01854, Okaloosa County, High-relief Artificial Reef Deployment, Gulf of Mexico, Okaloosa County, Florida

Dear Terry Hayes,

The enclosed Biological Opinion responds to your request for consultation with us, the National Marine Fisheries Service (NMFS), pursuant to Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 et seq.) for the above-referenced action. The Opinion has been given the NMFS tracking number SERO-2022-01316. Please use the NMFS tracking number in all future correspondence related to this action.

The Opinion considers the effects of the U.S. Army Corps of Engineers (USACE) authorization of the deployment of artificial reef materials by the Okaloosa County Board of County Commissioners (the applicant) into the Gulf of Mexico off Okaloosa County, Florida on the following listed species: green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), leatherback sea turtle, hawksbill sea turtle, Gulf sturgeon, and giant manta ray. It is based on information provided by the USACE, the applicant, and the published literature cited within. NMFS concludes that the proposed action is not likely to adversely affect hawksbill sea turtle, Gulf sturgeon, and giant manta ray. NMFS also concludes that the proposed action is not likely to jeopardize the continued existence of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), and leatherback sea turtle.

NMFS is providing an Incidental Take Statement with this Opinion. The Incidental Take Statement describes Reasonable and Prudent Measures that NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The Incidental Take Statement also specifies Terms and Conditions, including monitoring and reporting requirements with which the USACE and applicant must comply, to carry out the Reasonable and Prudent Measures.



We look forward to further cooperation with you on other projects to ensure the conservation of our threatened and endangered marine species and critical habitat. If you have any questions regarding this consultation, please contact Sarah Garvin, Consultation Biologist, by phone at (727) 342-0249, or by email at Sarah.Garvin@noaa.gov.

Sincerely,

AMENDOLA.KIMBE RLY.BARBARA.136 5830769  
Digitally signed by AMENDOLA.KIMBERLY.BARBARA.1365830769  
Date: 2023.03.10 16:28:56 -05'00'

for Andrew J. Strelcheck  
Regional Administrator

Enclosure:  
NMFS Biological Opinion SERO-2022-01316  
cc: Stephen Andrews, USACE Project Manager  
File: 1514-22.f.4



**Endangered Species Act - Section 7 Consultation  
Biological Opinion**

**Action Agency:** U.S. Army Corps of Engineers  
Permit number: SAJ-2021-01854

**Applicant:** Okaloosa County Board of County Commissioners

**Activity:** Deployment of Artificial Reef Materials

**Location:** Gulf of Mexico off Okaloosa County, Florida

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

Tracking Number: SERO-2022-01316

**Approved by:** for AMENDOLA.KIMBERLY.BARBARA.1365830769 Digitally signed by AMENDOLA.KIMBERLY.BARBARA.1365830769 Date: 2023.03.10 16:38:58 -05'00'

---

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

**Date Issued:** 03/10/2023

## TABLE OF CONTENTS

---

Table of Contents.....	4
List of Figures	4
List of Tables	4
Acronyms, Abbreviations, and Units of Measure.....	5
1 INTRODUCTION .....	7
2 PROPOSED ACTION.....	8
3 EFFECTS DETERMINATIONS .....	15
4 STATUS OF ESA-LISTED SPECIES CONSIDERED FOR FURTHER ANALYSIS ...	18
5 ENVIRONMENTAL BASELINE.....	51
6 ADVERSE EFFECTS OF THE ACTION .....	58
7 CUMULATIVE EFFECTS .....	65
8 JEOPARDY ANALYSIS .....	65
9 CONCLUSION.....	79
10 INCIDENTAL TAKE STATEMENT .....	80
11 CONSERVATION RECOMMENDATIONS.....	84
12 REINITIATION OF CONSULTATION.....	84
13 LITERATURE CITED .....	85

## LIST OF FIGURES

---

Figure 1. Locations of the 3 proposed artificial reef areas in the Gulf of Mexico off the south coast of Okaloosa County, Florida (Image provided by Taylor Engineering, Inc. to USACE, 2021). .....	14
Figure 2. Threatened (light) and endangered (dark) green turtle DPSs: 1. North Atlantic, 2. Mediterranean, 3. South Atlantic, 4. Southwest Indian, 5. North Indian, 6. East Indian-West Pacific, 7. Central West Pacific, 8. Southwest Pacific, 9. Central South Pacific, 10. Central North Pacific, and 11. East Pacific.....	22
Figure 3. Green sea turtle nesting at Florida index beaches since 1989.....	27
Figure 4. Kemp’s ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2019 and CONAMP data 2020, 2021).....	32
Figure 5. Leatherback sea turtle nesting at Florida index beaches since 1989.....	40
Figure 6. . Loggerhead sea turtle nesting at Florida index beaches since 1989.....	47
Figure 7. South Carolina index nesting beach counts for loggerhead sea turtles (from the SCDNR website: <a href="https://www.dnr.sc.gov/seaturtle/ibs.htm">https://www.dnr.sc.gov/seaturtle/ibs.htm</a> ).....	48
Figure 8. Locations of artificial reef and shipwreck sites in Okaloosa County waters within the Gulf of Mexico ( <a href="https://portal.myokaloosa.com/arcgis/apps/webappviewer/index.html?id=f5377a1d1931450282ac20dae3448cb5">https://portal.myokaloosa.com/arcgis/apps/webappviewer/index.html?id=f5377a1d1931450282ac20dae3448cb5</a> ). .....	56

## LIST OF TABLES

---

Table 1. Boundary Coordinates for Proposed Reef Areas.....	13
Table 2. ESA-listed Species in the Action Area and Effect Determinations.....	15
Table 3. Number of Leatherback Sea Turtle Nests in Florida .....	40
Table 4. Total Number of NRU Loggerhead Nests (GADNR, SCDNR, and NCWRC nesting datasets compiled at Seaturtle.org). .....	48
Table 5. Estimated total sea turtle mortalities from entanglement over 150 years.....	62

Table 6. 2007-2016 STSSN Data for Florida Gulf Zone 10..... 63  
Table 7. Breakdown of Lethal Sea Turtle Species Entanglements Based on STSSN Data (2007-2016). ..... 64  
Table 8. Anticipated Amount of Sea Turtle Mortalities, by Species, Over 150 Years due to Entanglements Associated with High Relief Artificial Reef Material in 3 Deployment Areas. .. 64  
Table 9. Anticipated Future Take by Species and DPS over 150 years. .... 81

**ACRONYMS, ABBREVIATIONS, AND UNITS OF MEASURE**

---

ac	acre(s)
BMP	Best Management Practice
BOEM	Bureau of Ocean Energy Management
°C	degrees Celsius
CCL	Curved Carapace Length
CFR	Code of Federal Regulations
cm	centimeter(s)
DDT	Dichlorodiphenyltrichloroethane
DEIS	Draft Environmental Impact Statement
DPS	Distinct Population Segment
DTRU	Dry Tortugas Recovery Unit
DWH	Deepwater Horizon
ECO	Environmental Consultation Organizer
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 et seq.)
°F	degrees Fahrenheit
FAD	Fish Aggregating Device
FERC	Federal Energy Regulatory Commission
FMP	Fishery Management Plan
ft	foot/feet
FR	Federal Register
ft <sup>2</sup>	square foot/feet
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
GADNR	Georgia Department of Natural Resources
GCRU	Greater Caribbean Recovery Unit
GPS	Global Positioning System
in	inch(es)
km	kilometer(s)
m	meter(s)
mi	mile(s)
mi <sup>2</sup>	square mile(s)
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
NAD 83	North American Datum of 1983
NEFSC	NMFS Northeast Fisheries Science Center
NGMRU	Northern Gulf of Mexico Recovery Unit

nm	nautical mile(s)
nm <sup>2</sup>	square nautical mile(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
Opinion	Biological Opinion
PCB	Polychlorinated Biphenyls
PDC	Project Design Criteria
PFC	Perfluorinated Chemicals
PFRU	Peninsular Florida Recovery Unit
PRD	NMFS Protected Resources Division
SAV	Submerged Aquatic Vegetation
SCDNR	South Carolina Department of Natural Resources
SCL	Straight Carapace length
SERO	NMFS Southeast Regional Office
SEFSC	NMFS Southeast Fisheries Science Center
STSSN	Sea Turtle Stranding and Salvage Network
TED	Turtle Exclusion Device
TEWG	Turtle Expert Working Group
U.S.	United States
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service

# 1 INTRODUCTION

---

## 1.1 Overview

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

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

This document represents NMFS’s Opinion based on our review of potential effects of the USACE authorizing the deployment of high-relief artificial reef materials by the Okaloosa County Board of County Commissioners (the applicant) into the Gulf of Mexico off Okaloosa County, Florida on the following listed species: green sea turtle (North Atlantic and SA DPSs), Kemp’s ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), leatherback sea turtle, hawksbill sea turtle, Gulf sturgeon, and giant manta ray. Our Opinion is based on information provided by the USACE, the applicant, and the published literature cited within. We conclude that the proposed action is not likely to adversely affect hawksbill sea turtle, Gulf sturgeon, and giant manta ray. We also conclude that the proposed action is not likely to jeopardize the continued existence of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp’s ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), and leatherback sea turtle.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 (“2019 Regulations,” see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court’s July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government’s request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations are once again in effect, and we are

applying the 2019 regulations here. For purposes of this consultation, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

## **1.2 Consultation History**

The following is the consultation history for the NMFS ECO tracking number SERO-2022-01316, Okaloosa County Board of County Commissioners (BOCC) Fish Haven 20 21 22.

On December 3, 2021, we issued a letter of concurrence to NOAA Restoration Center on the Artificial Reef Creation and Restoration Project proposed for funding under the DWH Oil Spill Natural Resource Damage Assessment in the Florida Trustee Implementation Group (SERO-2021-02759, DWH NRDA FL TIG RP#2-Artificial Reefs). The Okaloosa County Fish Havens 20, 21, and 22 were included in this consultation. The use of high-relief artificial reef materials was not proposed for any of the sites funded by NOAA Restoration Center. In our Letter of Concurrence, we determined that the proposed project would not adversely affect any ESA-listed species or designated critical habitat.

On May 27, 2022, we received a request for expedited informal consultation under Section 7 of the ESA from the USACE to permit the deployment of artificial reef materials by Okaloosa County (the applicant) into the Gulf of Mexico off Okaloosa County, Florida, in a letter dated May 27, 2022.

On August 19, 2022, we informed the USACE of the need for formal consultation because of the applicant's proposed use of high-relief artificial reef materials (i.e., materials greater than 7 ft in height from the seafloor) for artificial reef creation. The previous consultation with NOAA Restoration Center (SERO-2021-02759, DWH NRDA FL TIG RP#2-Artificial Reefs, issued December 3, 2021) did not consider the deployment of high-relief artificial reef materials.

On August 30, 2022, we requested additional information related to the project description. We responded to questions from the applicant on September 22, 2022, and requested additional information from the USACE that same day.

We received final response on October 4, 2022, and initiated formal consultation that day.

## **2 PROPOSED ACTION**

---

### **2.1 Project Details**

#### **2.1.1 Project Description**

The USACE proposes to permit the creation of 3 new artificial reef areas for the deployment of artificial reef materials by the Okaloosa County BOCC into the Gulf of Mexico off Okaloosa County, Florida. The purpose of the proposed project is to enhance habitat and opportunities for recreational fishing and diving. Materials will be deployed within 3 different reef areas located

between 1.7 nm and 8.14 nm offshore: Fish Haven 20, Fish Haven 21, and Fish Haven 22. Each reef area will measure approximately 1 nm<sup>2</sup>. Materials will be deployed opportunistically within each reef area as funding and materials become available. The applicant estimates a maximum of approximately 4 total deployments per year across all 3 reef areas, for a total of 60 deployments during the ten year duration of the permit.

Materials proposed for deployment within the reef areas include clean concrete or rock, clean steel vessels and barges (cleaned in accordance with EPA and USCG regulations), heavy gauge steel products (¼-in thickness or greater), and prefabricated structures that are a mixture of clean concrete and heavy gauge steel. NMFS considers high-relief, complex artificial reef material to include any vessel, aircraft, decommissioned oil rig, bridge span, metal tower, or similar material that extends 7 ft or more from the seafloor and that has a footprint greater than 200 ft<sup>2</sup> (individually or collectively), excluding prefabricated artificial reef modules.

The material to be deployed would have a maximum profile height of no more than half the distance from the seafloor to the water surface at MLLW (i.e., anywhere between 30 and 48 ft tall, depending on the reef area). Water depths within the reef areas range between a minimum of 60 ft and maximum of 96 ft at MLLW. Further, the top elevation of the reef may not be less than 6 ft below the water surface.

Artificial reef construction utilizes a number of vessels for material deployment. Reef deployments typically use a combination of the following vessels:

1. 26-ft Safeboat with a 2-ft draft and 9-ft beam. Used as a tow boat for smaller vessel deployments.
2. 29-ft powered barge with a 6-ft draft and 10-ft beam. Used as a tow vessel for larger vessels.
3. 120-ft crane barge with a 6.8-ft draft and 45-ft beam. Used to transport secondary use concrete.
4. 110-ft spud barge with a 7.5-ft draft and 40-ft beam. Used to transport secondary use concrete.
5. 110-ft spud barge with a 7-ft draft and 52-ft beam. Used to transport secondary use concrete.
6. 170-ft offshore supply vessel with a 9-ft draft and 39-ft beam. Used to transport modules, secondary use concrete and to tow large vessels.

Vessel speeds will vary and are dependent on contractor selection and type of vessel being used. Vessel speeds will be reduced while maintaining sufficient maneuverability and navigation.

Materials will be transported to the reef deployment area by barge. Barge-mounted cranes or backhoes or similar heavy machinery will be used to drop reef materials directly into the water. Prior to each deployment, the applicant will complete and submit the “*Florida Artificial Reef Materials Cargo Manifest and Pre-Deployment Notification*” form to the USACE and the FWC, and a support vessel will place marker buoys at the reef site to facilitate accurate positioning of the deployment barge. Upon arrival at the deployment site, the deployment barge will locate itself with respect to the buoys and set 2-3 anchors to minimize movement during material deployment.

The exact travel routes to and from the proposed reef area will be restricted to the existing navigation channels of Choctawhatchee Bay, Destin Pass, Perdido Pass, St. Andrews Bay, St. Andrews Pass, and the Gulf of Mexico. During 2021, twelve trips associated with reef deployments were made. The time window of operations will be during daylight hours anytime throughout the year, but will depend on favorable weather, sea conditions, and material funding and availability. Time underway for each vessel will depend on the port of call. If coming from Orange Beach, Alabama, or Panama City, Florida, it will be a full day of operation. If leaving from Destin, Florida, it will likely be a half day of operation.

Deployment of the materials will occur sequentially. Base materials will be placed first, followed by the placement of secondary materials to add bulk and height to the base. After completion of each deployment, a diver will measure the lateral extent and vertical relief of the structure(s). Based on the diver observations and measurements, subsequent deployments will place additional base or secondary layer material as needed. GPS location data and buoys will identify any additional deployment location(s). Okaloosa County will have its contractor inspect each constructed reef to ensure that each reef remains at or below the maximum allowable height. In addition, Okaloosa County will periodically inspect each reef for subsidence and stability. Subsidence of material is expected to be minimal. The time to complete a deployment is typically between 1 and 5 days, with work being completed during daylight hours only.

### 2.1.2 Construction Conditions

The following construction conditions and project design criteria (PDCs) will be implemented during deployments to avoid and minimize potential effects to ESA-listed species and their habitats.

- **Planning and Deployment Guidelines.** The applicant will incorporate the following guidelines when planning for and deploying artificial reefs:
  - *ASMFC/GSMFC Guidelines for Marine Artificial Reef Materials,*
  - *EPA's National Guidance: Best Management Practices (BMPs) for Preparing Vessels Intended to Create Artificial Reefs,* and
  - *NOAA/NMFS National Artificial Reef Plan.*
- **Protected Species Construction Conditions.** The applicant will comply with NMFS SERO's "*Protected Species Construction Conditions,*" dated May 2021.
- **Vessel Strike Avoidance Measures.** The applicant will comply with NMFS SERO's "*Vessel Strike Avoidance Measures,*" dated May 2021, for species protected under the ESA and the MMPA. In particular, the applicant will ensure the following measures will be implemented:
  - All vessels associated with the project shall operate at "idle/ no wake" speeds at all times while in the construction area, and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom, and in all depths after a protected species has been observed in and has recently departed the area.
  - All vessels will follow deep-water routes (e.g., marked channels) whenever possible.



- The applicant shall instruct all personnel associated with the project of the potential presence of protected species and any critical habitat in a vessel transit area, and the need to avoid collisions with them. All vessels should have personnel onboard responsible for observing water-related activities for the presence of these species.
- If a protected species is sighted, attempt to maintain a distance of 150 ft or greater between the animal and the vessel, and reduce speed and avoid abrupt changes in direction until the animal(s) have left the area.
- If a protected species is sighted within 300 ft of the vessel, all appropriate precautions shall be implemented to avoid a collision. These precautions shall include cessation of any vessel movement when a protected species is observed within 150 ft of operations (excluding at times when movement is required for safe navigation [e.g., transiting inlets]). Operation may not resume until the protected species has departed the immediate area of its own volition.
- **Daylight Hours.** All artificial reef work will only take place during reasonably calm, clear weather and during daylight hours.
- **Benthic Survey.** 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.
- **Buffers.** Siting of artificial reef materials may not occur within the following buffers.
  - Siting of any vessel, aircraft, or large and high-relief material (e.g., bridge spans) may not occur within 1,500 ft of any documented coral colonies. Any vessel used in the deployment of an artificial reef may not anchor or moor within 1,500 ft of any documented coral colonies.
  - The applicant shall maintain a deployment buffer of at least 200 ft from any other submerged aquatic resources, including seagrasses, macroalgae, sponges, and oysters, 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.
  - No artificial reef material will be deployed in any area within 1,100 ft off any identified sea turtle nesting beach that predominantly consists of sandy benthic habitat.
- **Removal of Non-essential Structures.** All railings and other non-essential structures that could otherwise easily accumulate monofilament line should be removed from all high-relief materials.
- **Preparation of Vessels for Deployment.** Pursuant to the EPA BMPs, thorough preparation and cleaning is required before vessels may be used for reefs. Military surplus and vessel structures such as ladders, rails, booms, antennas, etc. will be removed to reduce the potential accumulation of abandoned fishing tackle and lines.
- **Decontamination.** All reef materials must be clean and free from asphalt, petroleum, other hydrocarbons and toxic residues, plastics, Styrofoam, and other loose free-floating material, or other deleterious substances.
- **Weight requirements.** No individual artificial reef component (i.e., prefabricated module, concrete piece, etc.) will weigh less than 500 lbs, with the exception of materials deployed directly by authorized county or state programs in low-energy environments

(e.g., Reef Ball “Bay Ball” or “Mini-Bay Ball” in shallow estuaries or bays). All materials shall be of sufficient weight in-water to not move from the site post-deployment.

- **Entanglement Prevention.** Reef structures, materials, and installation methods shall be designed and deployed to prevent entanglement and entrapment of listed species. Open-bottom prefabricated artificial reef modules may not be deployed unless the module also has an opening at the top that is sufficient to allow the escapement of an adult loggerhead sea turtle. For an open-bottom artificial reef module that is triangular (e.g., pyramid) or square, the top must be open and each of the side’s exposed opening edges (i.e., top edge) must be at least 4 ft long. Optionally, a triangular (e.g., pyramid) open-bottom artificial reef module may reduce the length of two of the side’s exposed opening edges (i.e., top edge) to a minimum of 3 ft long if the third side is lowered to allow a 4 ft length opening edge on that third side. For instance, this would require a pyramid module with a 10 ft base that is 8 ft high to be cut down and remove 2.4 ft of material on two sides and 3.2 ft of material on the third side to produce the required opening. Open-bottom prefabricated modules with a round or oval opening at the top must have a diameter of at least 4 ft as measured from any two points along the exposed opening edge.
- **Egress.** Open-bottom fabricated artificial reef modules may not include any additional sub-components or other material within the interior or obstructing the top opening that could impair the egress of a sea turtle.
- **Protrusions.** For all secondary-use, recycled concrete and similar materials, all steel reinforcement rods, rebar, and other protrusions must be cut at the base of the concrete and level with the surface concrete so that no metal protrudes from the concrete’s surface.
- **FADs.** Mid-water fish aggregating devices (FADs) will not be used.
- **Explosives.** Explosives will not be used to deploy artificial reefs.
- **Protected Species Sightings.** Deployment activities will not commence until the project supervisor reports that no sea turtles, marine mammals, or other ESA-listed species have been sighted within 150 ft (50 yds) of the active deployment site (i.e., barge carrying material or moored vessel to be scuttled [i.e., deliberately sunk]) for at least 20 minutes. Deployment activities will cease immediately if sea turtles, marine mammals, or other ESA-listed species are sighted within 150 ft (50 yds) of the active deployment site. Deployment activities will not recommence until the project supervisor reports that no sea turtles, marine mammals, or other ESA-listed species have been sighted for at least 20 minutes.
- **Reporting.** Any collision with or injury to an ESA-listed species shall be reported immediately to the NMFS’s PRD (727-824-5312). For additional reporting resources, please go to: <https://www.fisheries.noaa.gov/report>.

### 2.1.3 Best Practices

The following best practices will be implemented following completion of the project to avoid and minimize potential effects to ESA-listed species and their habitats.

- **Post-Deployment Notification:** Following each deployment, the applicant will complete and submit the “*Florida Artificial Reef Materials Placement Report and Post-Deployment Notification*” form to the USACE and FWC.

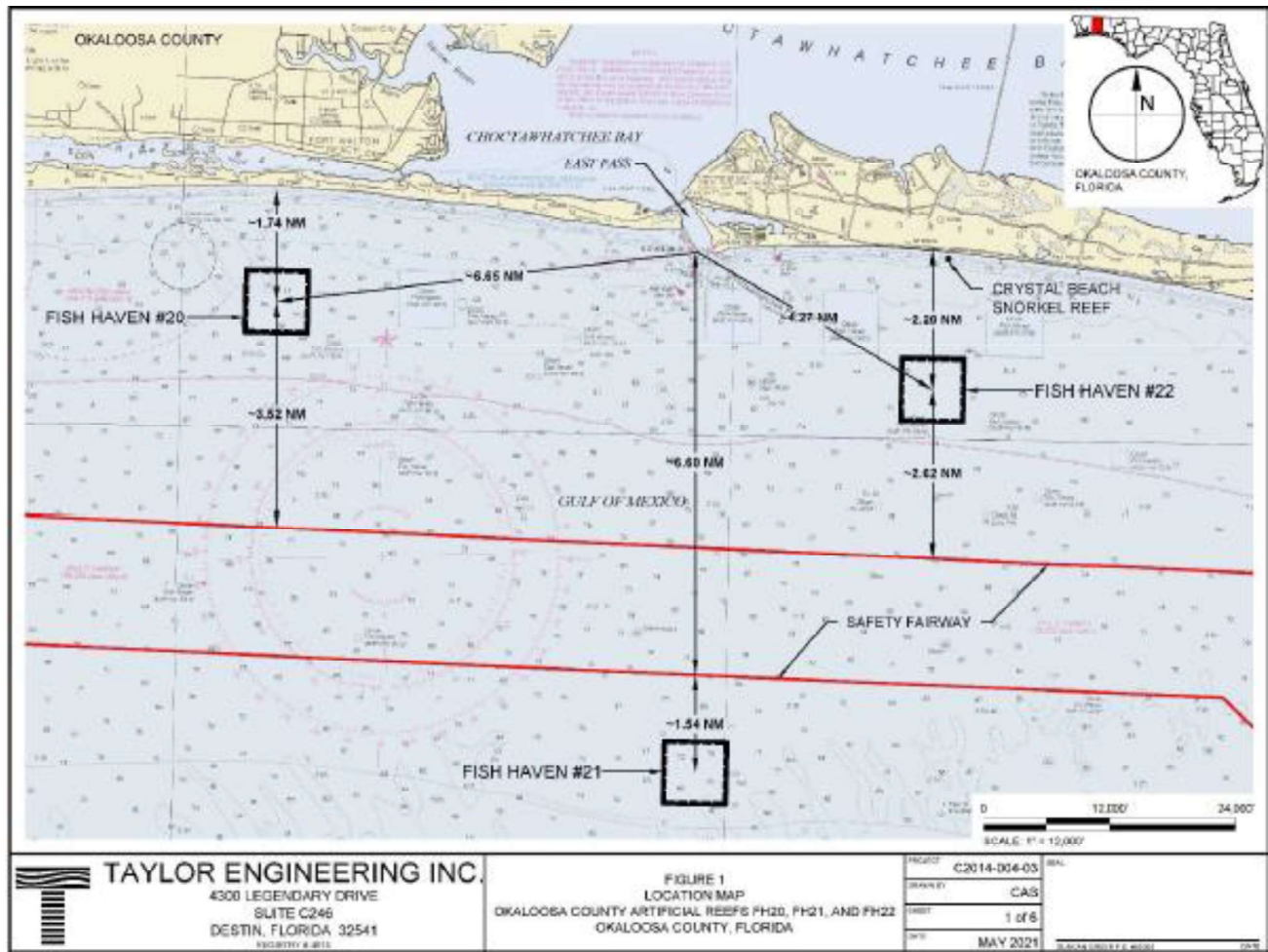
- Annual Monitoring:** The applicant will conduct yearly monitoring within each of the 3 Fish Haven reef areas. Specifically, within 12 months of the effective date of the permit, and every 12 months thereafter for the duration of the permit, the applicant will submit a report summarizing deployments and issues associated with the reef in the preceding 12 months to both the USACE and FWC. The report will document any known changes in material condition (stability, durability, and location) as compared to those same characteristics at the time of deployment. The report may include, but is not limited to, use trends, site management constraints and resolutions, management techniques, modifications of operations, plans, and lessons learned. The report must also include results of any performance monitoring (description of fish and other biota observed).

## 2.2 Action Area

The project sites are located within the Gulf of Mexico between 1.74 nm and 8.14 nm off the coast of Okaloosa County, Florida, at the coordinates listed in Table 1 and shown Figure 1, below.

**Table 1. Boundary Coordinates for Proposed Reef Areas**

	<b>Boundary Waypoint</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Water Depth Ranges</b>
<b>Fish Haven 20</b>	Northwest Corner	30.3748°	-86.6474°	-60 ft to -66 ft at MLLW
	Northeast Corner	30.3748°	-86.6281°	
	Southeast Corner	30.3581°	-86.6281°	
	Southwest Corner	30.3581°	-86.6474°	
	Center Point	30.3664°	-86.6000°	
<b>Fish Haven 21</b>	Northwest Corner	30.2539°	-86.5185°	-72 ft to -96 ft at MLLW
	Northeast Corner	30.2539°	-86.4993°	
	Southeast Corner	30.2372°	-86.4993°	
	Southwest Corner	30.2372°	-86.5185°	
	Center Point	30.2455°	-86.5000°	
<b>Fish Haven 22</b>	Northwest Corner	30.3548°	-86.4488°	-69 ft to -75 ft at MLWW
	Northeast Corner	30.3548°	-86.4295°	
	Southeast Corner	30.3380°	-86.4295°	
	Southwest Corner	30.3380°	-86.4488°	
	Center Point	30.3464°	-86.4000°	



**Figure 1. Locations of the 3 proposed artificial reef areas in the Gulf of Mexico off the south coast of Okaloosa County, Florida (Image provided by Taylor Engineering, Inc. to USACE, 2021).**

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). For the purposes of this federal action, the action area includes the 1 nm<sup>2</sup> area contained within the boundaries of each of the 3 artificial reef areas (also referred to as project sites) and the transit routes for deployment, support, and monitoring vessels.

There are no known existing structures within any of the 3 proposed artificial reef areas. In December 2019, the applicant conducted a direct diver survey of proposed Fish Haven 20 in conjunction with a side scan sonar survey in the same area conducted by FWC. The results of these surveys did not identify any significant biological or cultural resources within the proposed Fish Haven 20 area. According the USACE, the substrate within all 3 proposed project sites consists of unconsolidated and unvegetated bottom, and there are no natural rock outcrops, hard bottom formations, or SAV present within any of the 3 reef deployment areas.

### 3 EFFECTS DETERMINATIONS

Please note the following abbreviations are only used in Table 2 and are not, therefore, included in the list of acronyms: E = endangered; T = threatened; LAA = likely to adversely affect; NLAA = may affect, not likely to adversely affect.

#### 3.1 Effects Determinations for ESA-Listed Species

##### 3.1.1 Agency Effects Determinations

We have assessed the ESA-listed species that may be present in the action area and our determination of the project’s potential effects is shown in **Table 2** below.

**Table 2. ESA-listed Species in the Action Area and Effect Determinations**

Species	ESA Listing Status	Listing Rule/Date	Most Recent Recovery Plan/Outline Date	USACE Effect Determination	NMFS Effect Determination
<b>Sea Turtles</b>					
Green (North Atlantic DPS)	T	81 FR 20057/ April 6, 2016	October 1991	<u>NLAA</u>	<u>LAA</u>
Green (South Atlantic DPS)	T	81 FR 20057/ April 6, 2016	October 1991	<u>NLAA</u>	<u>LAA</u>
Kemp’s ridley	E	35 FR 18319/ December 2, 1970	September 2011	<u>NLAA</u>	<u>LAA</u>
Leatherback	E	35 FR 8491/ June 2, 1970	April 1992	<u>NLAA</u>	<u>LAA</u>
Loggerhead (Northwest Atlantic DPS)	T	76 FR 58868/ September 22, 2011	December 2008	<u>NLAA</u>	<u>LAA</u>
Hawksbill	E	35 FR 8491/ June 2, 1970	December 1993	<u>NLAA</u>	<u>NLAA</u>
<b>Fishes</b>					
Gulf sturgeon (Atlantic sturgeon, Gulf subspecies)	T	56 FR 49653/ September 30, 1991	September 1995	<u>NLAA</u>	<u>NLAA</u>
Giant manta ray	T	83 FR 2916/ January 22, 2018	2019	<u>NLAA</u>	<u>NLAA</u>

Unlike the other ESA-listed sea turtles, hawksbill sea turtles are not likely to be adversely affected by the proposed action. The most recent STSSN data available for Zone 9 (2007-2016), which includes the action area, does not show any reported hawksbill sea turtle strandings. Subsequently, we believe the presence of hawksbill sea turtles within the action area will be rare,

and it is extremely unlikely they would be found interacting with artificial reef material. Therefore, NMFS believes that the proposed action may affect, but is not likely to adversely affect the hawksbill sea turtle as opposed to the other ESA-listed sea turtles that are present within the action area. Hawksbill sea turtles will not be discussed further in this Opinion and further references to ESA-listed sea turtles will be limited to green sea turtles (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtles, loggerhead sea turtles (Northwest Atlantic DPS), and leatherback sea turtles.

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

ESA-listed sea turtles, Gulf sturgeon, and giant manta ray may be adversely affected by their inability to access the project sites for foraging, refuge, and nursery habitat due to their avoidance of construction activities and related noise. We determined these effects are insignificant. Species may forage in the area but the size of the area from which animals will be excluded is relatively small in comparison to the available sandy habitat nearby. In addition, any disturbances to ESA-listed species would be intermittent (1 to 5 days per deployment opportunity), and construction will be limited to daylight hours only. Species will be able to move around the project sites once deployment is complete and at night during deployment.

ESA-listed sea turtles, Gulf sturgeon, and giant manta ray could be physically injured if struck by transport vessels or materials during deployment at reef sites. We believe this is extremely unlikely to occur for the following reasons. All of these animals are highly mobile, and able to avoid slow-moving equipment. Further, the PDCs require that deployment activities will cease immediately if any protected species is sighted within 150 ft (50 yds) of the active deployment site, and such activities will not recommence until the project supervisor reports that no protected species have been sighted for at least 20 minutes. If a protected species is seen within 150 ft (50 yds) of a project vessel, all appropriate precautions shall be implemented to avoid a collision. These precautions shall include ceasing any vessel movement when closer than 150 ft of a protected species (excluding at times when movement is required for safe navigation [e.g., transiting inlets]). Operation will not resume until the protected species has departed the project area of its own volition, or at least 20 minutes have passed since the animal was last seen.

ESA-listed species, namely sea turtles, Gulf sturgeon, and giant manta ray, may also be physically injured or killed if they become entangled in abandoned fishing gear or other debris that may accumulate on low-relief and high-relief artificial reefs, and ESA-listed sea turtles may become entrapped (stuck) in an artificial reef structure. For the reasons discussed below, we believe all ESA-listed species considered in this Opinion are extremely unlikely to become entangled or entrapped in low relief artificial reef material and that ESA-listed fish species are extremely unlikely to become entangled or entrapped in high relief artificial reef materials. As discussed further in Section 5, we believe entanglement in materials associated with high-relief artificial reefs may adversely affect sea turtles.

Low-relief and solid concrete material, rock rubble, and individual artificial reef modules present less complicated vertical relief that is not as likely to accumulate monofilament as larger, higher-relief materials, as documented in Barnette (2017). The implementation of the PDCs listed above

in Section 2.1 would further reduce the likelihood of entanglement and entrapment. The PDCs for Entanglement Prevention require that materials of design, such as "reef balls" used for offshore deployments, are to have an opening at the top that is sufficient to allow the escapement of an adult loggerhead sea turtle. The PDCs for Protrusions require that all reef material have all steel reinforcement rods, rebar, and other protrusions cut off and level with the surface of the concrete to minimize the snagging of fishing gear. Furthermore, as described above, the PDCs for Protected Species Sightings requires that deployment activities will not commence until the project supervisor reports that no protected species have been sighted within 150 ft of the active deployment site for at least 20 minutes and to cease all deployment activities immediately if any protected species are sighted within 150 ft of the active deployment site. Deployment activities will not recommence until the project supervisor reports that no protected species have been sighted for at least 20 minutes. The best available information presented in Barnette (2017) indicates that gear and animal entanglement and sea turtle entrapment on low-relief material is extremely unlikely to occur under these conditions.

With respect to high-relief artificial reef material, we do not anticipate ESA-listed species to experience entrapment. We anticipate that ESA-listed sea turtles are likely to experience entanglement events. We believe entanglement of the ESA-listed fish species that may be in the action area is extremely unlikely to occur because we have no information documenting any artificial reef entanglement event involving these fish species and because it is extremely unlikely that these species will utilize artificial reefs as habitat. Gulf sturgeon, and giant manta ray do not typically feed or rest on or near artificial reef structures due to their life history patterns, thus decreasing any potential for interactions with accumulated monofilament. Life history patterns also make it unlikely for sea turtles to become entrapped in high relief structures. On the other hand, high-relief artificial reef material has been known to have adverse effects on sea turtles due to potential entanglement. Adverse effects from the proposed action on green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), leatherback sea turtle, and hawksbill sea turtle are discussed further in Section 5.

ESA-listed species could also be injured or killed as a result of hooking or other interactions incidental to fishing activities in the vicinity of the proposed action. We believe the proposed action is extremely unlikely to increase the risk of incidental capture because there is no evidence that the establishment of artificial reefs increases the numbers of fishers or boats participating in a given fishery.

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

We have determined that green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), and leatherback sea turtle are likely to be adversely affected by the proposed action and thus require further analysis. We provide greater detail on the potential effects to these species from the proposed action in the Effects of the Action (Section 10.1) and whether those effects, when considered in the context of the Status of the Species (Section 7), the Environmental Baseline (Section **Error! Reference source not found.**), and the Cumulative Effects (Section 8), are likely to likely to jeopardize the continued existence of these ESA-listed species in the wild.

## **3.2 Effects Determinations for Critical Habitat**

### **3.2.1 Agency Effects Determination**

The project is not located in critical habitat, and there are no potential routes of effect to any critical habitat.

## **4 STATUS OF ESA-LISTED SPECIES CONSIDERED FOR FURTHER ANALYSIS**

---

### **4.1 Range wide Status of the ESA-Listed Species Considered for Further Analysis**

#### **4.1.1 Sea Turtles**

There are 4 species of sea turtles considered further for analysis in this Opinion: green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle (Northwest Atlantic DPS). All 4 species travel widely throughout the South Atlantic, Gulf of Mexico, and the Caribbean, and may be adversely affected by the proposed action. Section 4.1.1.1 of this Opinion will address the general threats that confront all sea turtle species. The remainder of Section 4.1.1 (Sections 4.1.1.2 – 4.1.1.5) will address information on the distribution, life history, population structure, abundance, population trends, and unique threats to each species of sea turtle further discussed in this Opinion.

#### **4.1.2 General Threats Faced by All Sea Turtle Species**

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

#### *Fisheries*

Incidental bycatch in commercial fisheries is identified as a major contributor to past declines, and threat to future recovery, for all of the sea turtle species (NMFS and USFWS 1991; NMFS and USFWS 1992; NMFS and USFWS 1993; NMFS and USFWS 2008; NMFS et al. 2011). Domestic fisheries often capture, injure, and kill sea turtles at various life stages. Sea turtles in the pelagic environment are exposed to U.S. Atlantic pelagic longline fisheries. Sea turtles in the benthic environment in waters off the coastal United States are exposed to a suite of other fisheries in federal and state waters. These fishing methods include trawls, gillnets, purse seines, hook-and-line gear (including bottom longlines and vertical lines [e.g., bandit gear, handlines, and rod-reel]), pound nets, and trap fisheries. Refer to the Environmental Baseline section of this opinion (Section 4.1.1) for more specific information regarding federal and state managed fisheries affecting sea turtles within the action area). The Southeast U.S. shrimp fisheries have historically been the largest fishery threat to benthic sea turtles in the southeastern United States, and continue to interact with and kill large numbers of sea turtles each year.



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

#### *Non-Fishery In-Water Activities*

There are also many non-fishery impacts affecting the status of sea turtle species, both in the ocean and on land. In nearshore waters of the United States, the construction and maintenance of federal navigation channels has been identified as a source of sea turtle mortality. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly and can entrain and kill sea turtles (NMFS 1997). Sea turtles entering coastal or inshore areas have also been affected by entrainment in the cooling-water systems of electrical generating plants. Other nearshore threats include harassment or injury resulting from private and commercial vessel operations, military detonations and training exercises, in-water construction activities, and scientific research activities.

#### *Coastal Development and Erosion Control*

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

#### *Environmental Contamination*

Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g., DDT, PCB, and PFC), and others that may cause adverse health effects to sea turtles (Garrett 2004; Grant and Ross 2002; Hartwell 2004; Iwata et al. 1993). Acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges may directly

injure individuals through skin contact with oils (Geraci 1990), inhalation at the water's surface and ingesting compounds while feeding (Matkin and Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area.

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

Marine debris is a continuing problem for sea turtles. Sea turtles living in the pelagic environment commonly eat or become entangled in marine debris (e.g., tar balls, plastic bags/pellets, balloons, and lost, abandoned or discarded fishing gear) as they feed along oceanographic fronts where debris and their natural food items converge. Marine debris can cause significant habitat destruction from derelict vessels, further exacerbated by tropical storms moving debris and scouring and destroying corals and seagrass beds, for instance. Sea turtles that spend significant portions of their lives in the pelagic environment (i.e., juvenile loggerheads, and juvenile green turtles) are especially susceptible to threats from entanglement in marine debris when they return to coastal waters to breed and nest.

### *Climate Change*

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

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

The effects from increased temperatures may be intensified on developed nesting beaches where shoreline armoring and construction have denuded vegetation. Erosion control structures could potentially result in the permanent loss of nesting beach habitat or deter nesting females (NRC 1990). These impacts will be exacerbated by sea level rise. If females nest on the seaward side of the erosion control structures, nests may be exposed to repeated tidal overwash (NMFS and

USFWS 2007b). Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Baker et al. 2006; Daniels et al. 1993; Fish et al. 2005). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006; Baker et al. 2006).

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

#### *Other Threats*

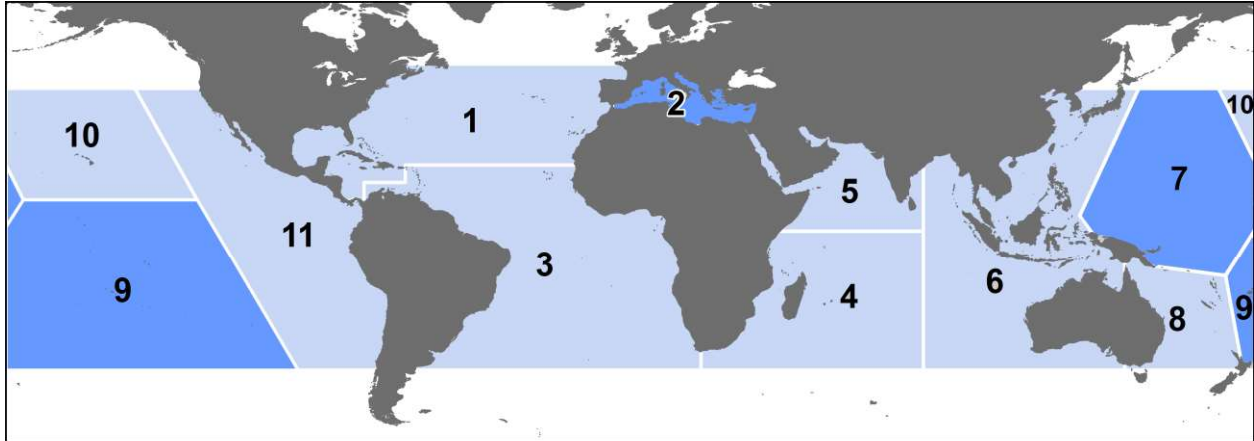
Predation by various land predators is a threat to developing nests and emerging hatchlings. The major natural predators of sea turtle nests are mammals, including raccoons, dogs, pigs, skunks, and badgers. Emergent hatchlings are preyed upon by these mammals as well as ghost crabs, laughing gulls, and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

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

### **4.1.3 Status of Green Sea Turtle – North Atlantic and South Atlantic DPSs**

The green sea turtle was originally listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations, which were listed as endangered. On April 6, 2016, the original listing was replaced with the listing of 11 DPSs (81 FR 20057 2016) (Figure 2). The Mediterranean, Central West Pacific, and Central South Pacific DPSs were listed as endangered. The North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific DPSs were listed as threatened. For the purposes of this consultation, only the South Atlantic DPS and North Atlantic DPS will be considered, as they are the only two DPSs with individuals occurring in the Atlantic Ocean and Gulf of Mexico waters of the United States.





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

#### *Species Description and Distribution*

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

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

Differences in mitochondrial DNA properties of green sea turtles from different nesting regions indicate there are genetic subpopulations (Bowen et al. 1992; FitzSimmons et al. 2006). Despite the genetic differences, sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. Within U.S. waters individuals from both the North Atlantic and South Atlantic DPSs can be found on foraging grounds. While there are currently no in-depth studies available to determine the percent of North Atlantic and South Atlantic DPS individuals in any given location, two small-scale studies provide an insight into the degree of mixing on the foraging grounds. An analysis of cold-stunned green turtles in St. Joseph Bay, Florida (northern Gulf of Mexico) found approximately 4% of individuals came from nesting stocks in the South Atlantic DPS (specifically Suriname, Aves Island, Brazil, Ascension Island, and Guinea Bissau) (Foley et al. 2007). On the Atlantic coast of Florida, a study on the foraging grounds off Hutchinson Island found that approximately 5% of the turtles

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

#### North Atlantic DPS Distribution

The North Atlantic DPS boundary is illustrated in Figure 2. Four regions support nesting concentrations of particular interest in the North Atlantic DPS: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo), U.S. (Florida), and Cuba. By far the most important nesting concentration for green turtles in this DPS is Tortuguero, Costa Rica. Nesting also occurs in the Bahamas, Belize, Cayman Islands, Dominican Republic, Haiti, Honduras, Jamaica, Nicaragua, Panama, Puerto Rico, Turks and Caicos Islands, and North Carolina, South Carolina, Georgia, and Texas, U.S.A. In the eastern North Atlantic, nesting has been reported in Mauritania (Fretey 2001).

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

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

#### South Atlantic DPS Distribution

The South Atlantic DPS boundary is shown in Figure 2, and includes the U.S. Virgin Islands in the Caribbean. The South Atlantic DPS nesting sites can be roughly divided into four regions: western Africa, Ascension Island, Brazil, and the South Atlantic Caribbean (including Colombia, the Guianas, and Aves Island in addition to the numerous small, island nesting sites).

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

#### *Life History Information*

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

After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. This early oceanic phase remains one of the most poorly understood aspects of green sea turtle life history (NMFS and USFWS 2007). Green sea turtles exhibit particularly slow growth rates of about 0.4-2 in (1-5 cm) per year (Green 1993), which may be attributed to their largely herbivorous, low-net energy diet (Bjorndal 1982). At approximately 8-10 in (20-25 cm) carapace length, juveniles leave the pelagic environment and enter nearshore developmental

habitats such as protected lagoons and open coastal areas rich in sea grass and marine algae. Growth studies using skeletochronology indicate that green sea turtles in the western Atlantic shift from the oceanic phase to nearshore developmental habitats after approximately 5-6 years (Bresette et al. 2006; Zug and Glor 1998). Within the developmental habitats, juveniles begin the switch to a more herbivorous diet, and by adulthood feed almost exclusively on seagrasses and algae (Rebel 1974), although some populations are known to also feed heavily on invertebrates (Carballo et al. 2002). Green sea turtles mature slowly, requiring 20-50 years to reach sexual maturity (Chaloupka and Musick 1997; Hirth 1997).

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

#### *Status and Population Dynamics*

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

#### North Atlantic DPS

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

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

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

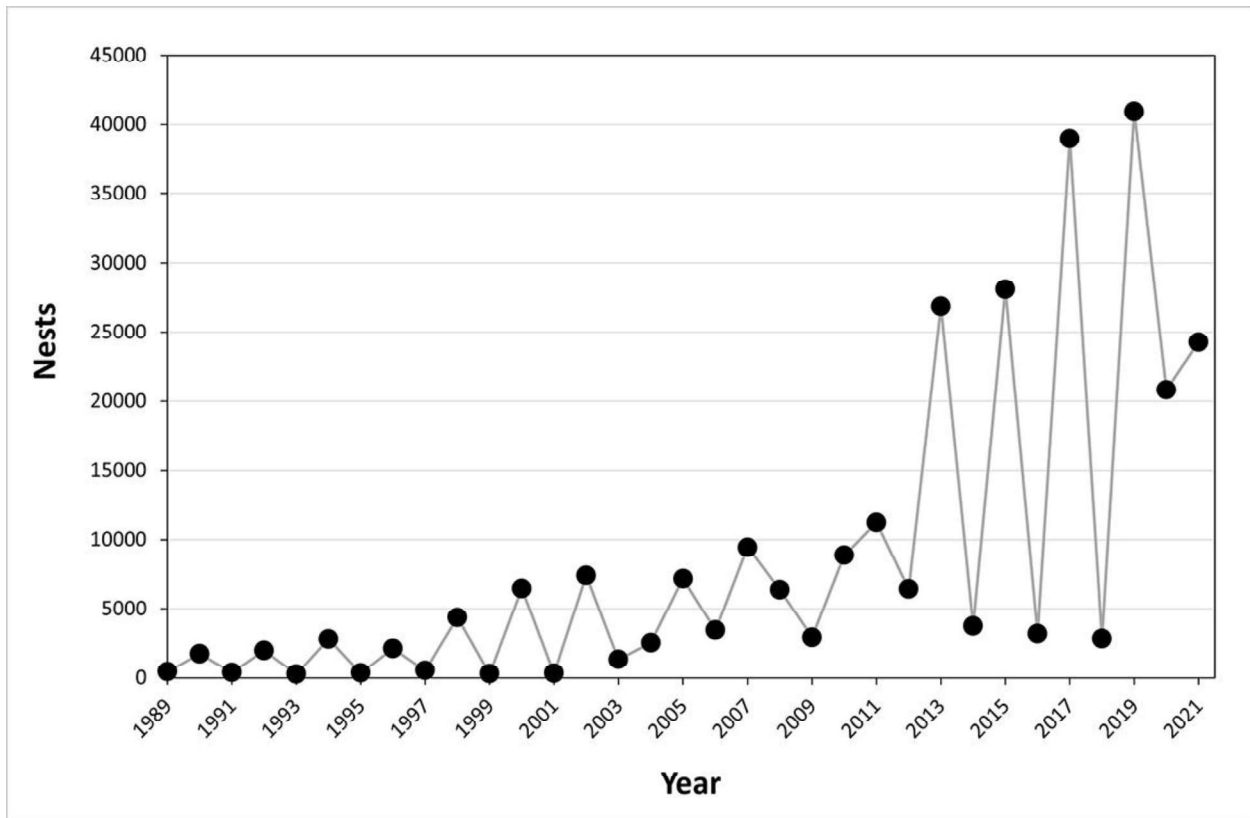


years or more resulted in an estimate of the Tortuguero, Costa Rica population's growing at 4.9% annually.

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

Florida accounts for approximately 5% of nesting for this DPS (Seminoff et al. 2015). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9% at that time. Increases have been even more rapid in recent years. In Florida, index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green sea turtle nesting has generally shown biennial peaks in abundance with a positive trend during the 10 years of regular monitoring (Figure 3). According to data collected from Florida's index nesting beach survey from 1989-2021, green sea turtle nest counts across Florida have increased dramatically, from a low of 267 in the early 1990s to a high of 40,911 in 2019. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in 2010 and 2011. The pattern departed from the low lows and high peaks in 2020 and 2021 as well, when 2020 nesting only dropped by half from the 2019 high, while 2021 nesting only increased by a small amount over the 2020 nesting (Figure 3).





**Figure 3. Green sea turtle nesting at Florida index beaches since 1989.**

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

### South Atlantic DPS

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

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

### *Threats*

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of the species for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. Green sea turtles also face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (e.g., plastics, petroleum products, petrochemicals), ecosystem alterations (e.g., nesting beach development, beach nourishment and shoreline stabilization, vegetation changes), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 4.1.2.

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

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

Whereas oil spill impacts are discussed generally for all species in Section 4.1.2, specific impacts of the DWH spill on green sea turtles are considered here. Impacts to green sea turtles occurred to offshore small juveniles only. A total of 154,000 small juvenile greens (36.6% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. A large number of small juveniles were removed from the population, as 57,300 small juveniles greens are estimated to have died as a result of the exposure. A total of 4 nests (580 eggs) were also translocated during response efforts, with 455 hatchlings released (the fate of which is unknown) (DWH Trustees 2015). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil or dispersants or both, and loss of foraging resources, which could lead to compromised growth or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

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

#### **4.1.4 Status of Kemp's Ridley Sea Turtle**

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

##### *Species Description and Distribution*

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

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

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

#### *Life History Information*

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

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

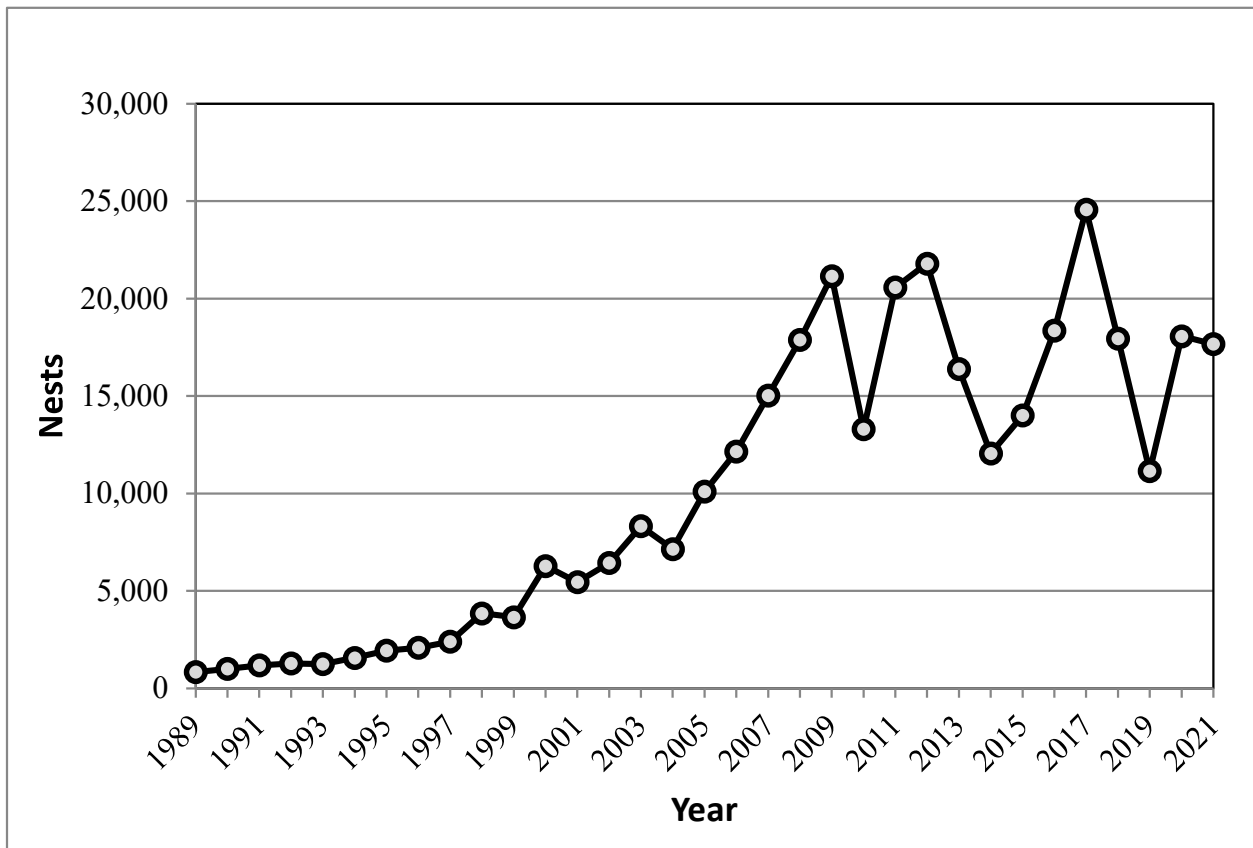
#### *Population Dynamics*

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

through the 1990s, and then accelerated during the first decade of the twenty-first century (Figure 4), which indicates the species is recovering.

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

A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 42 in 2004, to a record high of 353 nests in 2017 (National Park Service data). It is worth noting that nesting in Texas has paralleled the trends observed in Mexico, characterized by a significant decline in 2010, followed by a second decline in 2013-2014, but with a rebound in 2015, the record nesting in 2017, and then a drop back down to 190 nests in 2019, rebounding to 262 nests in 2020, and back to 195 nests in 2021 (National Park Service data). This year, Kemp's ridley nests were recorded in the Chandeleur Islands of coastal Louisiana ([https://www.washingtonpost.com/national/kemps-ridley-sea-turtle-nests-1st-in-75-years-in-louisiana/2022/08/17/0ca8f9b2-1e5a-11ed-9ce6-68253bd31864\\_story.html](https://www.washingtonpost.com/national/kemps-ridley-sea-turtle-nests-1st-in-75-years-in-louisiana/2022/08/17/0ca8f9b2-1e5a-11ed-9ce6-68253bd31864_story.html)).



**Figure 4. Kemp’s ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2019 and CONAMP data 2020, 2021).**

Through modelling, Heppell et al. (2005) predicted the population is expected to increase at least 12-16% per year and could reach at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011) produced an updated model that predicted the population to increase 19% per year and to attain at least 10,000 females nesting on Mexico beaches by 2011.

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

#### *Threats*

Kemp’s ridley sea turtles face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach



development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 4.1.2; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact Kemp's ridley sea turtles.

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

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

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

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

While oil spill impacts are discussed generally for all species in Section 4.1.1, specific impacts of the DWH oil spill event on Kemp's ridley sea turtles are considered here. Kemp's ridley sea turtles experienced the greatest negative impact stemming from the DWH oil spill event of any sea turtle species. Impacts to Kemp's ridley sea turtles occurred to offshore small juveniles, as well as large juveniles and adults. Loss of hatchling production resulting from injury to adult turtles was also estimated for this species. Injuries to adult turtles of other species, such as loggerheads, certainly would have resulted in unrealized nests and hatchlings to those species as well. Yet, the calculation of unrealized nests and hatchlings was limited to Kemp's ridley sea turtles for several reasons. All Kemp's ridley sea turtles in the Gulf of Mexico belong to the same population (NMFS et al. 2011), so total population abundance could be calculated based on numbers of hatchlings because all individuals that enter the population could reasonably be expected to inhabit the northern Gulf of Mexico throughout their lives (DWH Trustees 2016).

A total of 217,000 small juvenile Kemp's ridley sea turtles (51.5% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. That means approximately half of all small juvenile Kemp's ridley sea turtles from the total population estimate of 430,000 oceanic small juveniles were exposed to oil. Furthermore, a large number of small juveniles were removed from the population, as up to 90,300 small juveniles Kemp's ridley sea turtles are estimated to have died as a direct result of the exposure. Therefore, as much as 20% of the small oceanic juveniles of this species were killed during that year. Impacts to large juveniles (>3 years old) and adults were also high. An estimated 21,990 such individuals were exposed to oil (about 22% of the total estimated population for those age classes); of those, 3,110 mortalities were estimated (or 3% of the population for those age classes). The loss of near-reproductive and reproductive-stage females would have contributed to some extent to the decline in total nesting abundance observed between 2011 and 2014. The estimated number of unrealized Kemp's ridley sea turtle nests is between 1,300 and 2,000, which translates to



between approximately 65,000 and 95,000 unrealized hatchlings (DWH Trustees 2016). This is a minimum estimate, however, because the sublethal effects of the DWH oil spill event on turtles, their prey, and their habitats might have delayed or reduced reproduction in subsequent years, which may have contributed substantially to additional nesting deficits observed following the DWH oil spill event. These sublethal effects could have slowed growth and maturation rates, increased remigration intervals, and decreased clutch frequency (number of nests per female per nesting season). The nature of the DWH oil spill event effect on reduced Kemp's ridley sea turtle nesting abundance and associated hatchling production after 2010 requires further evaluation. It is clear that the DWH oil spill event resulted in large losses to the Kemp's ridley sea turtle population across various age classes, and likely had an important population-level effect on the species. Still, we do not have a clear understanding of those impacts on the population trajectory for the species into the future.

#### **4.1.5 Status of Leatherback Sea Turtle**

The leatherback sea turtle was listed as endangered throughout its entire range on June 2, 1970, (35 FR 8491) under the Endangered Species Conservation Act of 1969.

##### *Species Description and Distribution*

The leatherback is the largest sea turtle in the world, with a CCL that often exceeds 5 ft (150 cm) and front flippers that can span almost 9 ft (270 cm) (NMFS and USFWS 1998). Mature males and females can reach lengths of over 6 ft (2 m) and weigh close to 2,000 lb (900 kg). The leatherback does not have a bony shell. Instead, its shell is approximately 1.5 in (4 cm) thick and consists of a leathery, oil-saturated connective tissue overlaying loosely interlocking dermal bones. The ridged shell and large flippers help the leatherback during its long-distance trips in search of food.

Unlike other sea turtles, leatherbacks have several unique traits that enable them to live in cold water. For example, leatherbacks have a countercurrent circulatory system (Greer et al. 1973), a thick layer of insulating fat (Davenport et al. 1990; Goff and Lien 1988), gigantothermy (Paladino et al. 1990), and they can increase their body temperature through increased metabolic activity (Bostrom and Jones 2007; Southwood et al. 2005). Countercurrent circulation is a highly efficient means of minimizing heat loss through the skin's surface because heat is recycled. For example, a countercurrent circulation system often has an artery containing warm blood from the heart surrounded by a bundle of veins containing cool blood from the body's surface. As the warm blood flows away from the heart, it passes much of its heat to the colder blood returning to the heart via the veins. This conserves heat by recirculating it back to the body's core.

“Gigantothermy” refers to a condition when an animal has relatively high volume compared to its surface area, and as a result, it loses less heat. These adaptations allow leatherbacks to be comfortable in a wide range of temperatures, which helps them to travel further than any other sea turtle species (NMFS and USFWS 1995). For example, a leatherback may swim more than 6,000 mi (10,000 km) in a single year (Benson et al. 2007a; Benson et al. 2011; Eckert 2006; Eckert et al. 2006). They search for food between latitudes 71°N and 47°S in all oceans, and travel extensively to and from their tropical nesting beaches. In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS 2001).

While leatherbacks will look for food in coastal waters, they appear to prefer the open ocean at all life stages (Heppell et al. 2003). Leatherbacks have pointed tooth-like cusps and sharp-edged jaws that are adapted for a diet of soft-bodied prey such as jellyfish and salps. A leatherback's mouth and throat also have backward-pointing spines that help retain jelly-like prey. Leatherbacks' favorite prey are jellies (e.g., medusae, siphonophores, and salps), which commonly occur in temperate and northern or sub-arctic latitudes and likely has a strong influence on leatherback distribution in these areas (Plotkin 2003). Leatherbacks are known to be deep divers, with recorded depths in excess of a half-mile (Eckert et al. 1989), but they may also come into shallow waters to locate prey items.

Genetic analyses using microsatellite markers along with mitochondrial DNA and tagging data indicate there are 7 groups or breeding populations in the Atlantic Ocean: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007). General differences in migration patterns and foraging grounds may occur between the 7 nesting assemblages, although data to support this is limited in most cases.

#### *Life History Information*

The leatherback life cycle is broken into several stages: (1) egg/hatchling, (2) post-hatchling, (3) juvenile, (4) subadult, and (5) adult. Leatherbacks are a long-lived species that delay age of maturity, have low and variable survival in the egg and juvenile stages, and have relatively high and constant annual survival in the subadult and adult life stages (Chaloupka 2002; Crouse 1999; Heppell et al. 1999; Heppell et al. 2003; Spotila et al. 1996; Spotila et al. 2000). While a robust estimate of the leatherback sea turtle's life span does not exist, the current best estimate for the maximum age is 43 (Avens et al. 2009). It is still unclear when leatherbacks first become sexually mature. Using skeletochronological data, Avens et al. (2009) estimated that leatherbacks in the western North Atlantic may not reach maturity until 29 years of age, which is longer than earlier estimates of 2-3 years by Pritchard and Trebbau (1984), of 3-6 years by Rhodin (1985), of 13-14 years for females by Zug and Parham (1996), and 12-14 years for leatherbacks nesting in the U.S. Virgin Islands by Dutton et al. (2005). A more recent study that examined leatherback growth rates estimated an age at maturity of 16.1 years (Jones et al. 2011).

The average size of reproductively active females in the Atlantic is generally 5-5.5 ft (150-162 cm) CCL (Benson et al. 2007a; Hirth et al. 1993; Starbird and Suarez 1994). Still, females as small as 3.5-4 ft (105-125 cm) CCL have been observed nesting at various sites (Stewart et al. 2007).

Female leatherbacks typically nest on sandy, tropical beaches at intervals of 2-4 years (Garcia M. and Sarti 2000; McDonald and Dutton 1996; Spotila et al. 2000). Unlike other sea turtle species, female leatherbacks do not always nest at the same beach year after year; some females may even nest at different beaches during the same year (Dutton et al. 2005; Eckert 1989; Keinath and Musick 1993; Steyermark et al. 1996). Individual female leatherbacks have been observed with fertility spans as long as 25 years (Hughes 1996). Females usually lay up to 10 nests during the 3-6 month nesting season (March through July in the United States), typically 8-12 days apart, with 100 eggs or more per nest (Eckert et al. 2012; Eckert 1989; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). Yet, up to approximately 30% of the eggs may

be infertile (Eckert 1989; Eckert et al. 1984; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergent success) is approximately 50% worldwide (Eckert et al. 2012), which is lower than the greater than 80% reported for other sea turtle species (Miller 1997). In the United States, the emergent success is higher at 54-72% (Eckert and Eckert 1990; Stewart and Johnson 2006; Tucker 1988). Thus the number of hatchlings in a given year may be less than the total number of eggs produced in a season. Eggs hatch after 60-65 days, and the hatchlings have white striping along the ridges of their backs and on the edges of the flippers. Leatherback hatchlings weigh approximately 1.5-2 oz (40-50 g), and have lengths of approximately 2-3 in (51-76 mm), with fore flippers as long as their bodies. Hatchlings grow rapidly, with reported growth rates for leatherbacks from 2.5-27.6 in (6-70 cm) in length, estimated at 12.6 in (32 cm) per year (Jones et al. 2011).

In the Atlantic, the sex ratio appears to be skewed toward females. The TEWG reports that nearshore and onshore strandings data from the U.S. Atlantic and Gulf of Mexico coasts indicate that 60% of strandings were females (TEWG 2007). Those data also show that the proportion of females among adults (57%) and juveniles (61%) was also skewed toward females in these areas (TEWG 2007). James et al. (2007) collected size and sex data from large subadult and adult leatherbacks off Nova Scotia and also concluded a bias toward females at a rate of 1.86:1.

The survival and mortality rates for leatherbacks are difficult to estimate and vary by location. For example, the annual mortality rate for leatherbacks that nested at Playa Grande, Costa Rica, was estimated to be 34.6% in 1993-1994, and 34.0% in 1994-1995 (Spotila et al. 2000). In contrast, leatherbacks nesting in French Guiana and St. Croix had estimated annual survival rates of 91% (Rivalan et al. 2005) and 89% (Dutton et al. 2005), respectively. For the St. Croix population, the average annual juvenile survival rate was estimated to be approximately 63% and the total survival rate from hatchling to first year of reproduction for a female was estimated to be between 0.4% and 2%, assuming age at first reproduction is between 9-13 years (Eguchi et al. 2006). Spotila et al. (1996) estimated first-year survival rates for leatherbacks at 6.25%.

Migratory routes of leatherbacks are not entirely known; however, recent information from satellite tags have documented long travels between nesting beaches and foraging areas in the Atlantic and Pacific Ocean basins (Benson et al. 2007a; Benson et al. 2011; Eckert 2006; Eckert et al. 2006; Ferraroli et al. 2004; Hays et al. 2004; James et al. 2005). Leatherbacks nesting in Central America and Mexico travel thousands of miles through tropical and temperate waters of the South Pacific (Eckert and Sarti 1997; Shillinger et al. 2008). Data from satellite tagged leatherbacks suggest that they may be traveling in search of seasonal aggregations of jellyfish (Benson et al. 2007b; Bowlby et al. 1994; Graham 2009; Shenker 1984; Starbird et al. 1993; Suchman and Brodeur 2005).

#### *Status and Population Dynamics*

The status of the Atlantic leatherback population had been less clear than the Pacific population, which has shown dramatic declines at many nesting sites (Spotila et al. 2000; Santidrián Tomillo et al. 2007; Sarti Martínez et al. 2007). This uncertainty resulted from inconsistent beach and aerial surveys, cycles of erosion, and reformation of nesting beaches in the Guianas (representing the largest nesting area). Leatherbacks also show a lesser degree of nest-site fidelity than occurs

with the hardshell sea turtle species. Coordinated efforts of data collection and analyses by the leatherback Turtle Expert Working Group helped to clarify the understanding of the Atlantic population status up through the early 2000's (TEWG 2007). However, additional information for the Northwest Atlantic population has more recently shown declines in that population as well, contrary to what earlier information indicated (Northwest Atlantic Leatherback Working Group 2018). A full status review covering leatherback status and trends for all populations worldwide is being finalized (2020).

The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with most of the nesting occurring in the Guianas and Trinidad. The Southern Caribbean/Guianas stock of leatherbacks was designated after genetics studies indicated that animals from the Guianas (and possibly Trinidad) should be viewed as a single population. Using nesting females as a proxy for population, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate. TEWG observed positive growth within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana (TEWG 2007). More specifically, Tiwari et al. (2013) report an estimated three-generation abundance change of +3%, +20,800%, +1,778%, and +6% in Trinidad, Guyana, Suriname, and French Guiana, respectively. However, subsequent analysis using data up through 2017 has shown decreases in this stock, with an annual geometric mean decline of 10.43% over what they described as the short term (2008-2017) and a long-term (1990-2017) annual geometric mean decline of 5% (Northwest Atlantic Leatherback Working Group 2018).

Researchers believe the cyclical pattern of beach erosion and then reformation has affected leatherback nesting patterns in the Guianas. For example, between 1979 and 1986, the number of leatherback nests in French Guiana had increased by about 15% annually (NMFS 2001). This increase was then followed by a nesting decline of about 15% annually. This decline corresponded with the erosion of beaches in French Guiana and increased nesting in Suriname. This pattern suggests that the declines observed since 1987 might actually be a part of a nesting cycle that coincides with cyclic beach erosion in Guiana (Schulz 1975). Researchers think that the cycle of erosion and reformation of beaches may have changed where leatherbacks nest throughout this region. The idea of shifting nesting beach locations was supported by increased nesting in Suriname,<sup>1</sup> while the number of nests was declining at beaches in Guiana (Hilterman et al. 2003). This information suggested the long-term trend for the overall Suriname and French Guiana population was increasing. A more recent cycle of nesting declines from 2008-2017, as high as 31% annual decline in the Awala-Yalimapo area of French Guiana and almost 20% annual declines in Guyana, has changed the long-term nesting trends in the region negative as described above (Northwest Atlantic Leatherback Working Group 2018).

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. Across the Western Caribbean, nesting is most prevalent in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coastline of Costa Rica and extending through Chiriquí Beach, Panama, represents the fourth largest known leatherback rookery in the world

---

<sup>1</sup> Leatherback nesting in Suriname increased by more than 10,000 nests per year since 1999 with a peak of 30,000 nests in 2001.

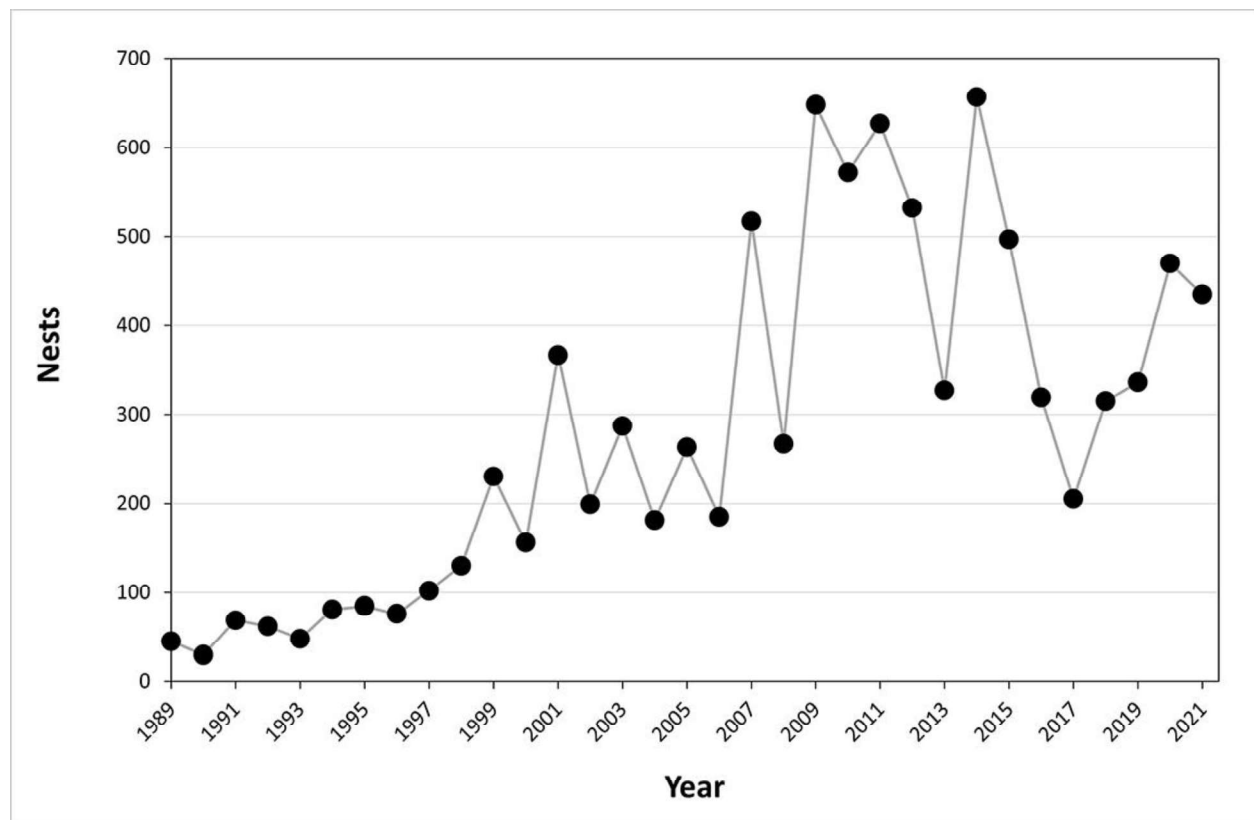
(Troëng et al. 2004). Examination of data from index nesting beaches in Tortuguero, Gandoca, and Pacuaré in Costa Rica indicate that the nesting population likely was not growing over the 1995-2005 time series (TEWG 2007). Other modeling of the nesting data for Tortuguero indicates a possible 67.8% decline between 1995 and 2006 (Troëng et al. 2007). Tiwari et al. (2013) report an estimated three-generation abundance change of -72%, -24%, and +6% for Tortuguero, Gandoca, and Pacuare, respectively. Further decline of almost 6% annual geometric mean from 2008-2017 reflects declines in nesting beaches throughout this stock (Northwest Atlantic Leatherback Working Group 2018).

Nesting data for the Northern Caribbean stock is available from Puerto Rico, St. Croix (U.S. Virgin Islands), and the British Virgin Islands (Tortola). In Puerto Rico, the primary nesting beaches are at Fajardo and on the island of Culebra. Nesting between 1978 and 2005 has ranged between 469-882 nests, and the population has been growing since 1978, with an overall annual growth rate of 1.1% (TEWG 2007). Tiwari et al. (2013) report an estimated three-generation abundance change of -4% and +5,583% at Culebra and Fajardo, respectively. At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has varied from a few hundred nests to a high of 1,008 in 2001, and the average annual growth rate has been approximately 1.1% from 1986-2004 (TEWG 2007). From 2006-2010, Tiwari et al. (2013) report an annual growth rate of +7.5% in St. Croix and a three-generation abundance change of +1,058%. Nesting in Tortola is limited, but has been increasing from 0-6 nests per year in the late 1980s to 35-65 per year in the 2000s, with an annual growth rate of approximately 1.2% between 1994 and 2004 (TEWG 2007). The nesting trend reversed course later, with an annual geometric mean decline of 10% from 2008-2017 driving the long-term trend (1990-2017) down to a 2% annual decline (Northwest Atlantic Leatherback Working Group 2018).

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17% between 1989 and 2005. FWC Index Nesting Beach Survey Data generally indicates biennial peaks in nesting abundance beginning in 2007 (Figure 5 and Table 3). A similar pattern was also observed statewide (Table 3). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting. Overall, the trend showed growth on Florida's east coast beaches. Tiwari et al. (2013) report an annual growth rate of 9.7% and a three-generation abundance change of +1,863%. However, in recent years nesting has declined on Florida beaches, with 2017 hitting a decade-low number, with a partial rebound in 2018. The annual geometric mean trend for Florida has been a decline of almost 7% from 2008-2017, but the long-term trend (1990-2017) remains positive with an annual geometric mean increase of over 9% (Northwest Atlantic Leatherback Working Group 2018).

**Table 3. Number of Leatherback Sea Turtle Nests in Florida**

Year	Index Nesting Beach Survey	Statewide Survey
2011	625	1,653
2012	515	1,712
2013	322	896
2014	641	1,604
2015	489	1,493
2016	319	1,054
2017	205	663
2018	316	949
2019	337	1,105
2020	467	1,652
2021	435	N/A



**Figure 5. Leatherback sea turtle nesting at Florida index beaches since 1989.**

The West African nesting stock of leatherbacks is large and important, but it is a mostly unstudied aggregation. Nesting occurs in various countries along Africa’s Atlantic coast, but much of the nesting is undocumented and the data are inconsistent. Gabon has a very large amount of leatherback nesting, with at least 30,000 nests laid along its coast in a single season (Fretey et al. 2007). Fretey et al. (2007) provide detailed information about other known nesting beaches and survey efforts along the Atlantic African coast. Because of the lack of consistent effort and minimal available data, trend analyses were not possible for this stock (TEWG 2007).

Two other small but growing stocks nest on the beaches of Brazil and South Africa. Based on the data available, TEWG (2007) determined that between 1988 and 2003, there was a positive annual average growth rate between 1.07% and 1.08% for the Brazilian stock. TEWG (2007) estimated an annual average growth rate between 1.04% and 1.06% for the South African stock.

Because the available nesting information is inconsistent, it is difficult to estimate the total population size for Atlantic leatherbacks. Spotila et al. (1996) characterized the entire Western Atlantic population as stable at best and estimated a population of 18,800 nesting females. Spotila et al. (1996) further estimated that the adult female leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, was about 27,600 (considering both nesting and interesting females), with an estimated range of 20,082-35,133. This is consistent with the estimate of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007). TEWG (2007) also determined that at the time of their publication, leatherback sea turtle populations in the Atlantic were all stable or increasing with the exception of the Western Caribbean and West Africa populations. A later review by NMFS and USFWS (2013) suggested the leatherback nesting population was stable in most nesting regions of the Atlantic Ocean. However, as described earlier, the Northwest Atlantic population has experienced declines over the near term (2008-2017), often severe enough to reverse the longer term trends to negative where increases had previously been seen (Northwest Atlantic Leatherback Working Group 2018). Given the relatively large size of the Northwest Atlantic population, it is likely that the overall Atlantic leatherback trend is no longer increasing.

### *Threats*

Leatherbacks face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 4.1.2; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact leatherback sea turtles.

Of all sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, especially gillnet and pot/trap lines. This vulnerability may be because of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, their method of locomotion, and their attraction to the lightsticks used to attract target species in longline fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine and many other stranded individuals exhibited evidence of prior entanglement (Dwyer et al. 2003). Zug and Parham (1996) point out that a combination of the loss of long-lived adults in fishery-related mortalities and a lack of recruitment from intense egg harvesting in some areas has caused a sharp decline in leatherback sea turtle populations. This represents a significant threat to survival and recovery of the species worldwide.

Leatherback sea turtles may also be more susceptible to marine debris ingestion than other sea turtle species due to their predominantly pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding and migratory purposes (Lutcavage et al. 1997; Shoop and Kenney 1992). The stomach contents of leatherback sea turtles revealed that a substantial percentage (33.8% or 138 of 408 cases examined) contained some form of plastic debris (Mrosovsky et al. 2009). Blocking of the gut by plastic to an extent that could have caused death was evident in 8.7% of all leatherbacks that ingested plastic (Mrosovsky et al. 2009). Mrosovsky et al. (2009) also note that in a number of cases, the ingestion of plastic may not cause death outright, but could cause the animal to absorb fewer nutrients from food, eat less in general, etc.—factors that could cause other adverse effects. The presence of plastic in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and forms of debris such as plastic bags (Mrosovsky et al. 2009). Balazs (1985) speculated that the plastic object might resemble a food item by its shape, color, size, or even movement as it drifts about, and therefore induce a feeding response in leatherbacks.

As discussed in Section 4.1.2, global climate change can be expected to have various impacts on all sea turtles, including leatherbacks. Global climate change is likely to also influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007). Several studies have shown leatherback distribution is influenced by jellyfish abundance (Houghton et al. 2006; Witt et al. 2007; Witt et al. 2006); however, more studies need to be done to monitor how changes to prey items affect distribution and foraging success of leatherbacks so population-level effects can be determined.

While oil spill impacts are discussed generally for all species in Section 4.1.2, specific impacts of the DWH oil spill on leatherback sea turtles are considered here. Available information indicates leatherback sea turtles were likely directly affected by the oil spill. Leatherbacks were documented in the spill area, but the number of affected leatherbacks was not estimated due to a lack of information compared to other species. Given that the northern Gulf of Mexico is important habitat for leatherback migration and foraging (TEWG 2007), and documentation of leatherbacks in the DWH oil spill zone during the spill period, it was concluded that leatherbacks were exposed to DWH oil, and some portion of those exposed leatherbacks likely died. Potential DWH-related impacts to leatherback sea turtles include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and dispersants or both, and loss of foraging resources which could lead to compromised growth and reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred. Although adverse impacts likely occurred to leatherbacks, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event may be relatively low. Thus, a population-level impact may not have occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

#### **4.1.6 Status of Loggerhead Sea Turtle – Northwest Atlantic DPS**



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

#### *Species Description and Distribution*

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

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

The majority of loggerhead nesting occurs at the western rims of the Atlantic and Indian Oceans concentrated in the north and south temperate zones and subtropics (NRC 1990). For the Northwest Atlantic DPS, most nesting occurs along the coast of the United States, from southern Virginia to Alabama. Additional nesting beaches for this DPS are found along the northern and western Gulf of Mexico, eastern Yucatán Peninsula, at Cay Sal Bank in the eastern Bahamas (Addison 1997; Addison and Morford 1996), off the southwestern coast of Cuba (Gavilan 2001), and along the coasts of Central America, Colombia, Venezuela, and the eastern Caribbean Islands.

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

Within the Northwest Atlantic DPS, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf Coast of Florida. Previous Section 7 analyses have recognized at least 5 western Atlantic subpopulations, divided geographically as follows: (1) a Northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29°N; (2) a South Florida nesting subpopulation, occurring from 29°N on the east coast of the state to Sarasota on

the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez M. 1990; TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001).

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

#### *Life History Information*

The Northwest Atlantic Loggerhead Recovery Team defined the following 8 life stages for the loggerhead life cycle, which include the ecosystems those stages generally use: (1) egg (terrestrial zone), (2) hatchling stage (terrestrial zone), (3) hatchling swim frenzy and transitional stage (neritic zone), (4) juvenile stage (oceanic zone), (5) juvenile stage (neritic zone), (6) adult stage (oceanic zone), (7) adult stage (neritic zone), and (8) nesting female (terrestrial zone) (NMFS and USFWS 2008). Loggerheads are long-lived animals. They reach sexual maturity between 20-38 years of age, although age of maturity varies widely among populations (Frazer and Ehrhart 1985; NMFS 2001). The annual mating season occurs from late March to early June, and female turtles lay eggs throughout the summer months. Females deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984), but an individual female only nests every 3.7 years on average (Tucker 2010). Each nest contains an average of 100-126 eggs (Dodd Jr. 1988) which incubate for 42-75 days before hatching (NMFS and USFWS 2008). Loggerhead hatchlings are 1.5-2 in long and weigh about 0.7 oz (20 g).

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

between oceanic and coastal habitats interchangeably (Witzell 2002). Stranding records indicate that when immature loggerheads reach 15-24 in (40-60 cm) SCL, they begin to reside in coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002).

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

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

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

#### *Status and Population Dynamics*

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

Numbers of nests and nesting females can vary widely from year to year. Nesting beach surveys, though, can provide a reliable assessment of trends in the adult female population, due to the

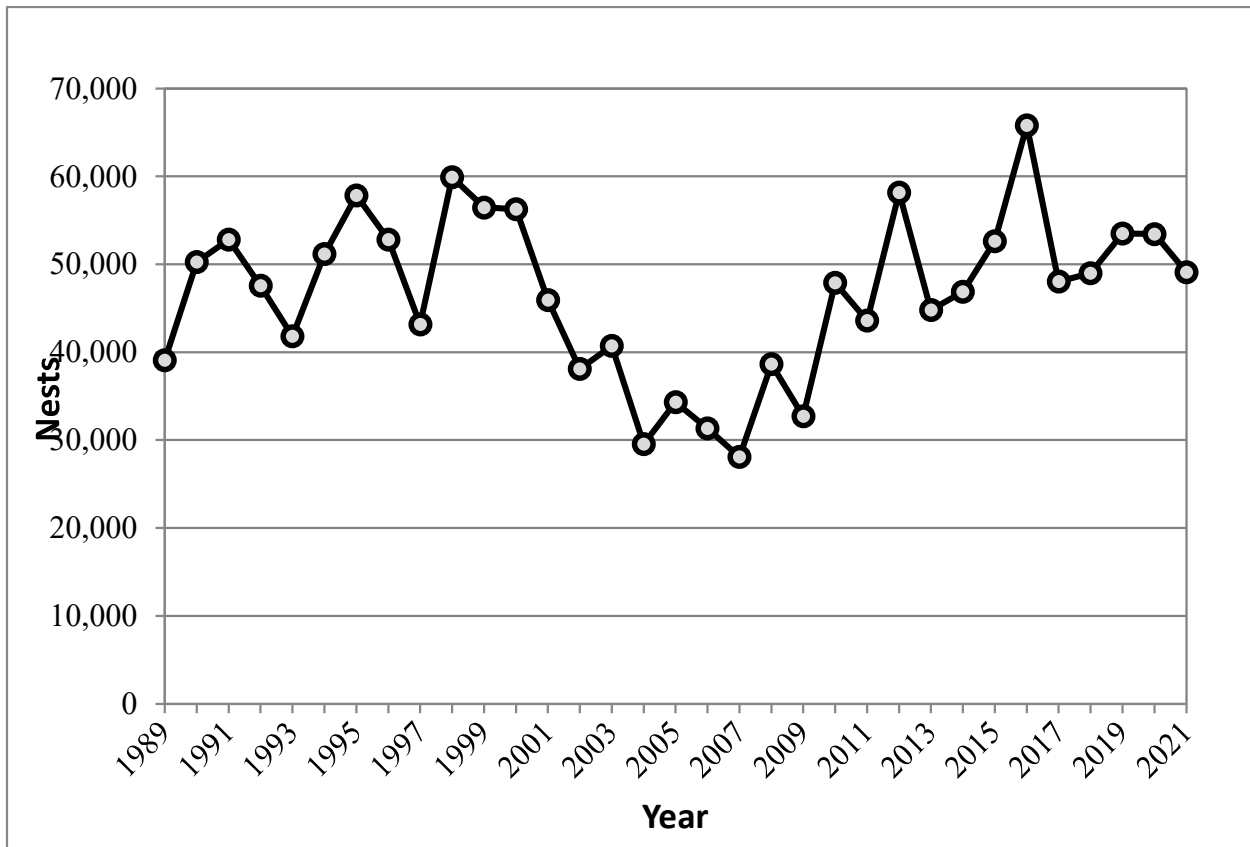
strong nest site fidelity of female loggerhead sea turtles, as long as such studies are sufficiently long and survey effort and methods are standardized (e.g., NMFS and USFWS 2008). NMFS and USFWS (2008) concluded that the lack of change in 2 important demographic parameters of loggerheads, remigration interval and clutch frequency, indicate that time series on numbers of nests can provide reliable information on trends in the female population.

#### Peninsular Florida Recovery Unit

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

In addition to the total nest count estimates, FWRI uses an index nesting beach survey method. The index survey uses standardized data-collection criteria to measure seasonal nesting and allow accurate comparisons between beaches and between years. FWRI uses the standardized index survey data to analyze the nesting trends (Figure 6; <https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>). Since the beginning of the index program in 1989, 3 distinct trends were identified. From 1989-1998, there was a 24% increase that was followed by a sharp decline over the subsequent 9 years. A large increase in loggerhead nesting has occurred since, as indicated by the 71% increase in nesting over the 10-year period from 2007 and 2016. Nesting in 2016 also represented a new record for loggerheads on the core index beaches. While nest numbers subsequently declined from the 2016 high FWRI noted that the 2007-2021 period represents a period of increase. FWRI examined the trend from the 1998 nesting high through 2016 and found that the decade-long post-1998 decline was replaced with a slight but non-significant increasing trend. Looking at the data from 1989 through 2016, FWRI concluded that there was an overall positive change in the nest counts although it was not statistically significant due to the wide variability between 2012-2016 resulting in widening confidence intervals. Nesting at the core index beaches declined in 2017 to 48,033, and rose again each year through 2020, reaching 53,443 nests before dipping back to 49,100 in 2021. It is important to note that with the wide confidence intervals and uncertainty around the variability in nesting parameters (changes and variability in nests/female, nesting intervals, etc.) it is unclear whether the nesting trend equates to an increase in the population or nesting females over that time frame (Ceriani, et al. 2019).





**Figure 6. . Loggerhead sea turtle nesting at Florida index beaches since 1989.**

Northern Recovery Unit

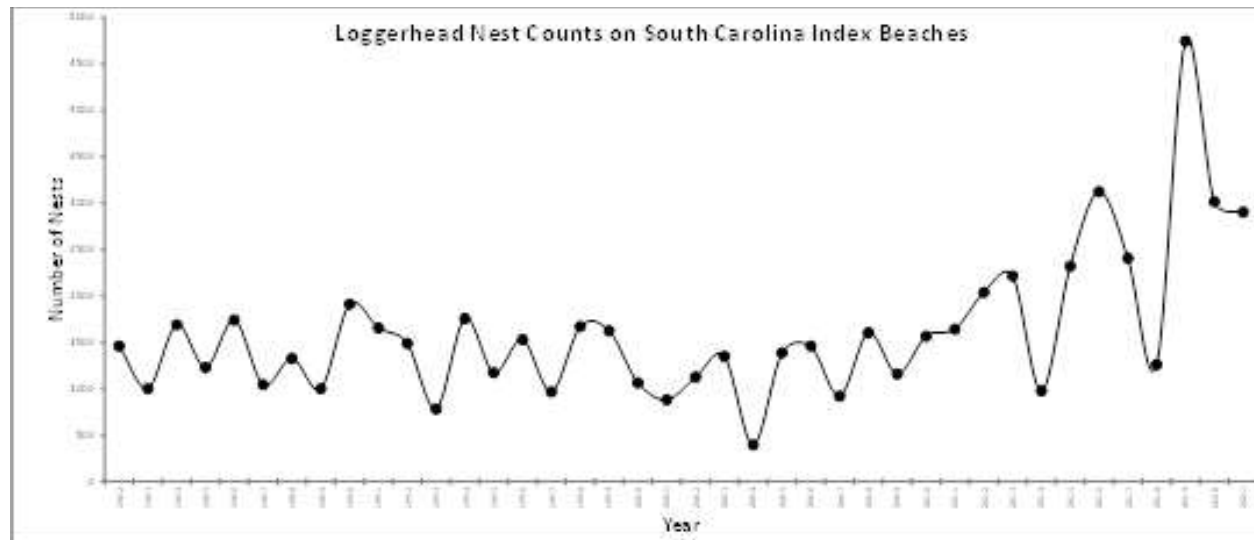
Annual nest totals from beaches within the NRU averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches (GADNR unpublished data; NCWRC unpublished data; SCDNR unpublished data), and represent approximately 1,272 nesting females per year, assuming 4.1 nests per female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

Data since that analysis (Table 4) are showing improved nesting numbers and a departure from the declining trend. Georgia nesting has rebounded to show the first statistically significant increasing trend since comprehensive nesting surveys began in 1989 (Mark Dodd, GADNR press release, <https://georgiawildlife.com/loggerhead-nest-season-begins-where-monitoring-began>). South Carolina and North Carolina nesting have also begun to shift away from the past declining trend. Loggerhead nesting in Georgia, South Carolina, and North Carolina all broke records in 2015 and then topped those records again in 2016. Nesting in 2017 and 2018 declined relative to 2016, back to levels seen in 2013 to 2015, but then bounced back in 2019, breaking records for each of the three states and the overall recovery unit. Nesting in 2020 and 2021 declined from the 2019 records, but still remained high, representing the third and fourth highest total numbers for the NRU since 2008.

**Table 4. Total Number of NRU Loggerhead Nests (GADNR, SCDNR, and NCWRC nesting datasets compiled at Seaturtle.org).**

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

South Carolina also conducts an index beach nesting survey similar to the one described for Florida. Although the survey only includes a subset of nesting, the standardized effort and locations allow for a better representation of the nesting trend over time. Increases in nesting were seen for the period from 2009-2013, with a subsequent steep drop in 2014. Nesting then rebounded in 2015 and 2016, setting new highs each of those years. Nesting in 2017 dropped back down from the 2016 high, but was still the second highest on record. After another drop in 2018, a new record was set for the 2019 season, with a return to 2016 levels in 2020 and 2021 (Figure 7).



**Figure 7. South Carolina index nesting beach counts for loggerhead sea turtles (from the SCDNR website: <https://www.dnr.sc.gov/seaturtle/ibs.htm>).**

### Other Northwest Atlantic DPS Recovery Units

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

### *In-water Trends*

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

### *Population Estimate*

The NMFS SEFSC developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS-SEFSC 2009). The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Resulting trajectories of model runs for each individual recovery unit, and the western

North Atlantic population as a whole, were found to be very similar. The model run estimates from the adult female population size for the western North Atlantic (from the 2004-2008 time frame), suggest the adult female population size is approximately 20,000-40,000 individuals, with a low likelihood of females' numbering up to 70,000 (NMFS-SEFSC 2009). A less robust estimate for total benthic females in the western North Atlantic was also obtained, yielding approximately 30,000-300,000 individuals, up to less than 1 million (NMFS-SEFSC 2009). A preliminary regional abundance survey of loggerheads within the northwestern Atlantic continental shelf for positively identified loggerhead in all strata estimated about 588,000 loggerheads (interquartile range of 382,000-817,000). When correcting for unidentified turtles in proportion to the ratio of identified turtles, the estimate increased to about 801,000 loggerheads (interquartile range of 521,000-1,111,000) (NMFS-NEFSC 2011).

#### *Threats (Specific to Loggerhead Sea Turtles)*

The threats faced by loggerhead sea turtles are well summarized in the general discussion of threats in Section 4.1.2. Yet the impact of fishery interactions is a point of further emphasis for this species. The joint NMFS and USFWS Loggerhead Biological Review Team determined that the greatest threats to the Northwest Atlantic DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009).

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

While oil spill impacts are discussed generally for all species in Section 4.1.2, specific impacts of the DWH oil spill event on loggerhead sea turtles are considered here. Impacts to loggerhead sea turtles occurred to offshore small juveniles as well as large juveniles and adults. A total of 30,800 small juvenile loggerheads (7.3% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. Of those exposed, 10,700 small juveniles are estimated to have died as a result of the exposure. In contrast to small juveniles, loggerheads represented a large proportion of the adults and large juveniles exposed to and killed by the oil. There were 30,000 exposures (almost 52% of all exposures for those age/size classes) and 3,600 estimated mortalities. A total of 265 nests (27,618 eggs) were also translocated during response efforts, with 14,216 hatchlings released, the fate of which is unknown (DWH Trustees 2015). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil or dispersants or both, and loss of foraging resources which could lead to compromised growth and reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

Unlike Kemp's ridleys, the majority of nesting for the Northwest Atlantic DPS occurs on the Atlantic coast and, thus, loggerheads were impacted to a relatively lesser degree. However, it is likely that impacts to the NGMRU of the Northwest Atlantic DPS would be proportionally much



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

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

## **5 ENVIRONMENTAL BASELINE**

---

### **5.1 Overview**

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

By regulation, the environmental baseline for an Opinion refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or

existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

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

## **5.2 Status of ESA-Listed Species Considered for Further Analysis**

As stated in Section 2.2., the action area is located within the Gulf of Mexico between 1.74 nm and 8.14 nm off the coast of Okaloosa County, Florida. As discussed in Section 3.1, five species of ESA-listed sea turtles may be adversely affected by the proposed action. These species are all highly migratory. The status of these species in the action area, as well as the threats to these species, are the same as those discussed in Section 4 (Status of the Species).

## **5.3 Factors Affecting ESA-Listed Species Considered for Further Analysis**

### **5.3.1 Federal Actions**

We have undertaken a number of Section 7 consultations to address the effects of federally-permitted dredging and other federal actions on threatened and endangered sea turtle species, and when appropriate, have authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse effects of the action on sea turtles. The summary below of federal actions and the effects these actions have had on sea turtles includes only those federal actions in the action area which have already concluded or are currently undergoing formal Section 7 consultation.

#### **5.3.1.1 Federal Vessel Activity**

Watercraft are the greatest contributors to overall noise in the sea and have the potential to interact with sea turtles through direct impacts or propellers. Sound levels and tones produced are generally related to vessel size and speed. Larger vessels generally emit more sound than smaller vessels, and vessels underway with a full load, or those pushing or towing a load, are noisier than unladen vessels. Vessels operating at high speeds have the potential to strike sea turtles. Potential sources of adverse effects from federal vessel operations in the action area include operations of the BOEM, FERC, USCG, NOAA, and USACE.

We have conducted Section 7 consultations related to energy projects in the Gulf of Mexico (BOEM, FERC, and USCG) to implement conservation measures for vessel operations. Through the Section 7 process, where applicable, we have and will continue to establish conservation

measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. At the present time, they present the potential for some level of interaction.

Operations of vessels by other federal agencies within the action area (NOAA, BOEM) may adversely affect sea turtles. Yet, the in-water activities of those agencies are limited in scope, as they operate a limited number of vessels or are engaged in research or operational activities that are unlikely to contribute a large amount of risk.

### 5.3.1.2 Oil and Gas Exploration and Extraction

Oil and gas exploration, production, and development in the Gulf of Mexico federally regulated by the BOEM and the USEPA are the subject of a NMFS's programmatic Biological Opinion under the NMFS consultation number FPR-2017-9234. These activities are expected to result in some sublethal effects to ESA-listed sea turtles, including impacts associated with pile driving for, or the explosive removal of, offshore structures, seismic exploration, marine debris, and oil spills. The primary causes of mortality are related to vessel strikes, oil spills and marine debris.

#### *Impact of DWH Oil Spill on Status of Sea Turtles*

On April 20, 2010, while working on an exploratory well approximately 50 mi offshore Louisiana, the semi-submersible drilling rig DWH experienced an explosion and fire. The rig subsequently sank and oil and natural gas began leaking into the Gulf of Mexico. Oil flowed for 86 days, until the well was finally capped on July 15, 2010. Millions of barrels of oil were released into the Gulf. Additionally, approximately 1.84 million gallons of chemical dispersant was applied both subsurface and on the surface to attempt to break down the oil.

The DWH event and associated response activities (e.g., skimming, burning, and application of dispersants) have resulted in adverse effects on ESA-listed sea turtles. The maps below show the spread of the DWH spill and the areas affected, which includes the action area. The effects of the DWH spill on the ESA-listed sea turtles and Gulf sturgeon critical habitat was discussed in Section 3, above.

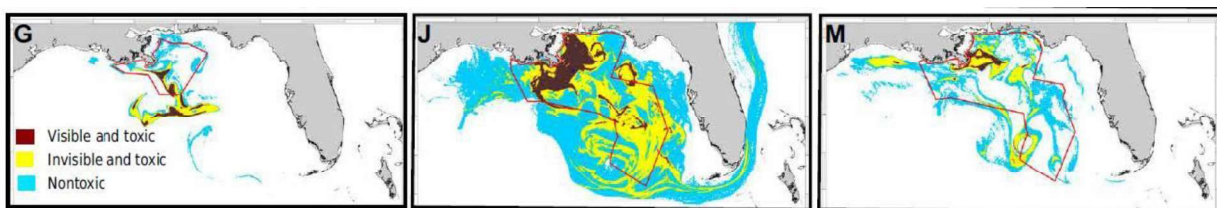


Figure 10. The spread of the impacts from the DWH spill; G from 15 May 2010, J from 18 June 2010, M from 2 July 2010 (Berenshtein et al. 2020).

### 5.3.1.3 ESA Permits

Sea turtles are the focus of research activities authorized by Section 10 permits under the ESA. Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for the purposes of scientific research under Section 10(a)(1)(a) of the ESA. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, to blood sampling, tissue sampling (biopsy), and performing laparoscopy on

intentionally captured sea turtles. The number of authorized takes varies widely depending on the research and species involved, but may involve the taking of hundreds of sea turtles annually. Most takes authorized under these permits are expected to be (and are) nonlethal. Before any research permit is issued, the proposal must be reviewed under the permit regulations. In addition, since issuance of the permit is a federal activity, our issuance of the permit must also be reviewed for compliance with Section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species or the destruction or adverse modification of its critical habitat.

#### **5.3.1.4 Fisheries**

Threatened and endangered sea turtles are adversely affected by fishing gears used throughout the continental shelf of the action area. Gillnet, pelagic and bottom longline, other types of hook-and-line gear, trawl, and pot fisheries have all been documented as interacting with sea turtles. The Gulf of Mexico Fishery Management Council develops and amends Fishery Management Plans (FMPs) for various fishery resources within the Gulf of Mexico and NMFS consults on these FMPs through the Section 7 consultation process. The FMPs and their amendments applicable to the range of the action area include Coastal Migratory Pelagic FMP, Reef Fish FMP, and Shrimp FMP. Some of these consultations resulted in subsequent rulemaking to reduce the impacts of the specific fisheries on sea turtle populations. Examples include additional monitoring of and TED requirements in the southeast U.S. shrimp fisheries, as well as gear limitations and mandatory possession and use of sea turtle release equipment to reduce bycatch mortality in Atlantic highly migratory species fisheries and reef fish fisheries. All Opinions had an ITS and determined that fishing activities, as considered (i.e., with conservation requirements) would not jeopardize any species of sea turtles or other listed species, or destroy or adversely modify critical habitat of any listed species.

#### **5.3.1.5 Department of Defense Training Activities**

The Eglin Gulf Test and Training Range comprises 102,000 nm<sup>2</sup> of Gulf of Mexico surface waters, beginning 3 nm from shore. NMFS previously consulted on maritime strike missions in the Gulf of Mexico involving the use of multiple types of live munitions against small boat targets in the Eglin Gulf Test and Training Range (SER-2012-9587). The Opinion included an ITS and determined that strike operations would not jeopardize any species of green sea turtle (North Atlantic and South Atlantic DPS), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), or leatherback sea turtle or other ESA-listed species, and would not destroy or adversely modify critical habitat of any listed species.

## 5.3.2 State and Private Actions

### 5.3.2.1 State Fisheries

Various fishing methods used in state commercial and recreational fisheries, including gillnets, fly nets, trawling, pot fisheries, pound nets, and vertical line are all known to incidentally take sea turtles, but information on these fisheries is sparse (NMFS 2001). Most of the state data are based on extremely low observer coverage, or sea turtles were not part of data collection; thus, these data provide insight into gear interactions that could occur but are not indicative of the magnitude of the overall problem.

#### *Trawl Fisheries*

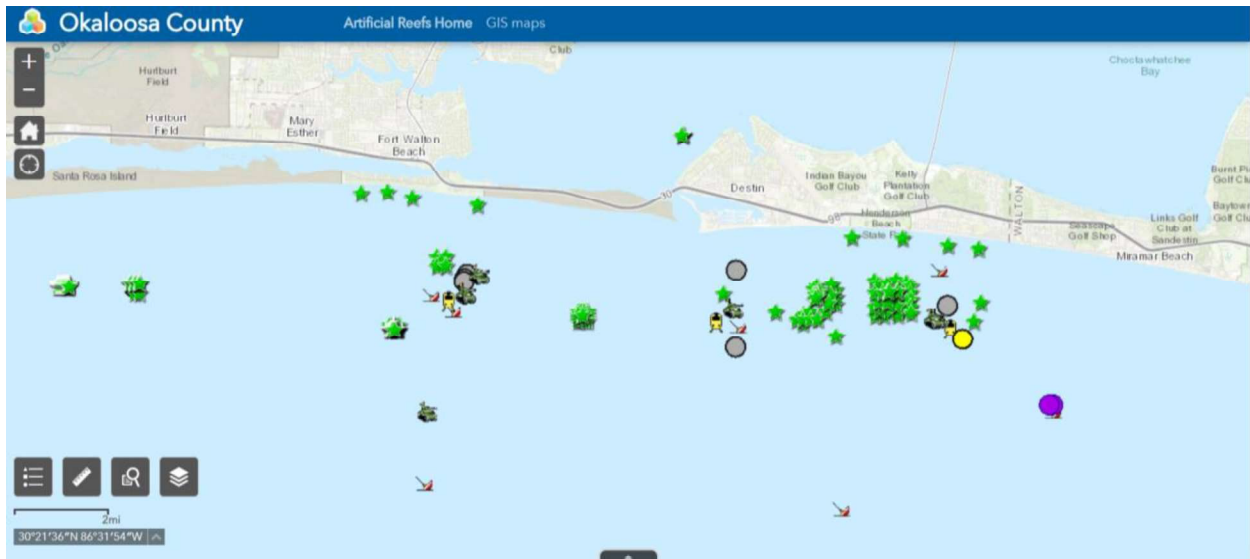
Trawls that operate in the action area may adversely affect sea turtles. On December 16, 2016, we published a notice of availability of our DEIS (EIS No. 20160294; 81 FR 91169) as well as a proposed rule (81 FR 91097) in the *Federal Register* to address incidental bycatch and mortality of sea turtles in the Southeastern U.S. shrimp fisheries. The proposed rule would have revoked the alternative tow time restrictions for skimmer trawls, pusher-head trawls, and wing nets (butterfly trawls) at 50 CFR 223.206(d)(2)(ii)(A)(3), and require those vessels to use TEDs designed to exclude small turtles while fishing. On December 20, 2019 (84 FR 70048), we published a final rule that requires all skimmer trawls 40 feet and greater in length to use TEDs designed to exclude small sea turtles in their nets effective August 1, 2021.

### 5.3.2.2 Recreational Fishing

Recreational fishing as regulated by Mississippi and Louisiana can affect protected species or their habitats within the action area. Recreational fishing from private vessels may occur in the action area. Observations of state recreational fisheries have shown that loggerhead sea turtles are known to bite baited hooks and frequently ingest the hooks. Hooked turtles have been reported by the public fishing from boats, piers, and beach, banks, and jetties and from commercial anglers fishing for reef fish and for sharks with both single rigs and bottom longlines. Additionally, lost fishing gear such as line cut after snagging on rocks, or discarded hooks and line, can also pose an entanglement threat to sea turtles in the area. A detailed summary of the known impacts of hook-and-line incidental captures to loggerhead sea turtles can be found in the SEFSC TEWG (TEWG) reports (Turtle Expert Working Group 1998a; Turtle Expert Working Group 2000).

#### 5.3.2.1 Artificial Reefs

Okaloosa County has a very active artificial reef program. There are numerous artificial reef and shipwreck sites located in close proximity to the proposed action area (**Error! Reference source not found.**). Reef structures range from reef modules (green stars) to concrete rubble (yellow circles), and from decommissioned rail cars (rail car icon) to military tank vehicles (tank icon). Impacts of artificial reefs on sea turtles are described in both the Effects of Action (Section 5) below and in Barnette (2017).



**Figure 8. Locations of artificial reef and shipwreck sites in Okaloosa County waters within the Gulf of Mexico**  
<https://portal.myokaloosa.com/arcgis/apps/webappviewer/index.html?id=f5377a1d1931450282ac20dae3448cb5> ).

### 5.3.2.1 Vessel Traffic

Commercial traffic and recreational boating pursuits can have adverse effects on sea turtles via propeller and boat strike damage. Data show that vessel traffic is one cause of sea turtle mortality (Environment Australia 2003; Hazel and Gyuris 2006; Lutcavage et al. 1997). The STSSN data from 2007-2016 for Zone 9 (which includes the action area) includes 37 records of vessel interactions with sea turtles, which were all fatal. Data indicate that stranded sea turtles showing signs of vessel-related injuries continue in a high percentage of stranded sea turtles in coastal regions of the southeastern United States.

Data show that vessel traffic is one cause of sea turtle mortality (Environment Australia 2003; Hazel and Gyuris 2006; Lutcavage et al. 1997). Stranding data for the Gulf of Mexico coast show that vessel-related injuries are noted in stranded sea turtles. Data indicate that live- and dead-stranded sea turtles showing signs of vessel-related injuries continue in a high percentage of stranded sea turtles in coastal regions of the southeastern United States.

### 5.3.2.1 Coastal Development

Beachfront development, lighting, and beach erosion control all are ongoing activities along the Florida coastline, including the barrier islands near the action area. ESA consultations within or near the action area include dredging and beach nourishment along the shoreline of Okaloosa County (SERO-2021-00113, Okaloosa County CSRSM; issued June 24, 2021). These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. Coastal counties are adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

### **5.3.3 Marine Debris, Pollution, and Environmental Contamination**

Coastal runoff, marina and dock construction, dredging, aquaculture, increased under water noise and boat traffic can degrade marine habitats used by sea turtles (Colburn et al. 1996) and negatively impact nearshore habitats, including the action area. Fueling facilities at marinas can sometimes discharge oil, gas, and sewage into sensitive estuarine and coastal habitats. Although these contaminant concentrations are unknown in the action area, the sea turtles analyzed in this Opinion travel within near shore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycles.

The Gulf of Mexico is an area of high-density offshore oil extraction with chronic, low-level spills and occasional massive spills (e.g., the DWH oil spill event). As discussed above, when large quantities of oil enter a body of water, chronic effects such as cancer, and direct mortality of wildlife becomes more likely (Lutcavage et al. 1997). Oil spills in the vicinity of nesting beaches just prior to or during the nesting season could place nesting females, incubating egg clutches, and hatchlings at significant risk (Fritts and McGehee 1982; Lutcavage et al. 1997; Witherington 1999).

The accumulation of organic contaminants and trace metals has been studied in loggerhead, green, and leatherback sea turtles (Aguirre et al. 1994; Caurant et al. 1999; Corsolini et al. 2000) (Mckenzie et al. 1999). Omnivorous loggerhead sea turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles (Storelli et al. 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. (Sakai et al. 1995) found the presence of metal residues occurring in loggerhead sea turtle organs and eggs. (Storelli et al. 1998) analyzed tissues from 12 loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991). No information on detrimental threshold concentrations is available, and little is known about the consequences of exposure of organochlorine compounds to sea turtles. Research is needed on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

### **5.3.4 Stochastic Events**

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

### **5.3.5 Climate Change**

As discussed in Section 4.1.2 of this Opinion, there is a large and growing body of literature on past, present, and future impacts of global climate change. Potential effects commonly

mentioned include changes in sea temperatures and salinity (due to melting ice and increased rainfall), ocean currents, storm frequency and weather patterns, and ocean acidification. These changes have the potential to affect species behavior and ecology including migration, foraging, reproduction (e.g., success), and distribution. For example, sea turtles currently range from temperate to tropical waters. A change in water temperature could result in a shift or modification of range. Climate change may also affect marine forage species, either negatively or positively (the exact effects for the marine food web upon which sea turtles rely is unclear, and may vary between species). It may also affect migratory behavior (e.g., timing, length of stay at certain locations). These types of changes could have implications for sea turtle recovery within the action area.

With regard to the action area, global climate change may affect the timing and extent of population movements and their range, distribution, species composition of prey, and the range and abundance of competitors and predators. Changes in distribution including displacement from ideal habitats, decline in fitness of individuals, population size due to the potential loss of foraging opportunities, abundance, migration, community structure, susceptibility to disease and contaminants, and reproductive success are all possible impacts that may occur as the result of climate change. Still, more information is needed to better determine the full and entire suite of impacts of climate change on sea turtles and specific predictions regarding impacts in the action area are not currently possible.

## **6 ADVERSE EFFECTS OF THE ACTION**

---

Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if the effect would not occur but for the proposed action and the effect is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

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



NMFS believes that the presence of high-relief artificial reef material is likely to adversely affect green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle (Northwest Atlantic DPS). High-relief artificial reef material specifically refers to vessels, aircrafts, decommissioned oil rigs, bridge spans, metal towers, or similar material that extends 7 ft or more from the seafloor and that has a footprint greater than 200 ft<sup>2</sup> (individually or collectively), excluding prefabricated artificial reef modules.

Because artificial reefs are generally designed and advertised to promote fishing opportunities, sea turtles may be adversely affected by becoming entangled in lost fishing gear and marine debris that accumulates on these structures (e.g., discarded fishing line, anchor line, or discarded netting). The risk of entanglement increases over the lifespan of the artificial reef structure as more gear and debris accumulates (Barnette 2017). Our assessment of this risk and its effects on sea turtles are discussed in more detail below.

#### *Approach to Assessment*

Our analysis first reviews what activities associated with the proposed action are likely to adversely affect sea turtles in the action area (i.e., what the stressors of the proposed action are). We then review an individual's range of responses to a specific stressor, and the factors affecting the likelihood, frequency, and severity of an individual's exposure to that stressor. Subsequently, our focus shifts to evaluating and quantifying exposure. We estimate the number of individuals of each species likely to be exposed and the likely fate of those animals.

Since the proposed action will deploy high-relief material (vessels, aircrafts, decommissioned oil rigs, bridge spans, metal towers and similar material), we anticipate adverse effects on green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle (Northwest Atlantic DPS) from entanglement and drowning in monofilament and other entangling gear that accumulates on that type of reef material. Given the complex habitat and vertical relief afforded by these materials, it is not uncommon for these sites to accumulate significant amount of lost fishing gear over time (Barnette 2017).

In general, due to the absence of monofilament immediately following deployment of an artificial reef, we expect the risk of entanglement to be extremely low for some period of years. However, as time passes and monofilament line accumulates, the probability of an entanglement event increases. Also, the longer the accumulated line is present, the greater the chance that a sea turtle will encounter it. The rate of monofilament accumulation and the time it takes to reach the level where we might anticipate an entanglement-related mortality likely varies significantly due to the factors previously mentioned. As time passes, the integrity of the high-relief material will become compromised and the structure may undergo significant and dramatic collapse. In some areas of the southeastern U.S., this process is facilitated by hurricane events. Regardless, over time, this will reduce the amount of vertical relief, but not eliminate the likelihood of monofilament accumulation. Therefore, the risk of an entanglement event persists, but perhaps at a somewhat lower level.

In some instances though, this collapse may increase the risk of entanglement. For example, as discussed in Barnette (2017), intact vessels sunk as artificial reefs off South Florida may not

present a high risk of entanglement initially, even with significant monofilament entanglement, as sea turtles are frequently observed at the sand/hull interface where there is little entangled line. This potential preference may “shield” them from greater entanglement risk present on the deck and upper structures. Once the vessel collapses, however, the reduced relief of the vessel places entangled monofilament in closer proximity to the seabed and to sea turtles utilizing the material. The probability of entanglement could also remain fairly high or increase in areas that are not typically exposed to current that could otherwise abrade or help accumulate and incorporate entangled monofilament.

Based on best available information presented in Barnette (2017) and STSSN data, we anticipate adult loggerhead and Kemp’s ridley sea turtles will be the sea turtle species primarily associated with entanglement events on high relief artificial reef material as a result of the proposed action. This is likely due to the species habitat preferences and other life history characteristics. Studies evaluating sea turtle dive profiles and depth distribution are limited and generally have focused on female sea turtles, likely due to the ease of tagging during nesting activities. While this is still useful, as it provides information on depth ranges where inter-nesting female sea turtles may spend a significant amount of their time, it does not provide the full depth range in which all sea turtles may be exposed to entanglement risk on artificial reefs. For example, Houghton et al. (2002), while examining the diving depth profiles of two female loggerhead sea turtles during nesting, documented a maximum diving depth of 230 ft; though they noted the vast majority of the inter-nesting interval was spent at depths less than 66 ft. While loggerheads have been documented diving to depths exceeding 760 ft (Sakamoto et al. 1990), other studies have demonstrated the majority of dives are occurring at much shallower depths. For instance, Arendt et al. (2012) documented most dives were conducted shallower than 160 ft, and were typically between 65-130 ft, when looking at male loggerhead sea turtles off the southeastern U.S. However, one of the authors of this study noted that one of the limitations about diving behavior is that a lot of the depths reflect where animals were captured and individual animal preferences, and do not reflect comprehensive diving behavior across the species as a whole (M. Arendt, SCDNR, pers. comm. with NMFS Biologist M. Barnette). In this case, all 3 of the proposed reef deployment areas in this proposed action are in water depths shallower than 100 ft.

Similarly, while it might make sense to scale the threat based on areas where we believe current or other oceanographic parameters, sea turtle densities, fishing patterns, artificial reef size, or other factors may decrease or increase the risk of entanglement from monofilament and other lines fouled on artificial reef material, the limited available information is insufficient to do so. Therefore, to be conservative, we consider all complex, high-relief materials deployed as artificial reefs present similar entanglement risks to sea turtles over time, regardless of their location.

Barnette (2017) documents that a site submerged for more than 120 years appears to be still accumulating monofilament and result in sea turtle mortalities due to entanglement events. Given the remaining structure on that site, it is likely to persist for another 30 years (Barnette 2017). Therefore, for purposes of this analysis, we will use an effective lifespan of 150 years for vessels, decommissioned oil rigs, bridge spans, and other large metal structures.

Frequency of entanglement likely varies greatly by site due to numerous factors. As a result of limited information on the subject, however, it is not practical or feasible to examine these issues further. Barnette (2017) documents that several sites using vessels have had repeated instances of sea turtle entanglement over time, and there was documentation of one site with multiple entanglements. Although specific reasons for the number of entanglements at this reef site have not been identified, some artificial reefs appear to present a more significant threat of entanglement than others due to sea turtle habitat preference, migration corridors, reef structure or composition, or other environmental parameter (Barnette 2017). Barnette (2017) also noted that evidence of sea turtle entanglement events is ephemeral, and the absence of evidence of entanglement should not be viewed as evidence that entanglements have not occurred. Perhaps some complex, high-relief artificial reefs will never result in a sea turtle mortality due to entanglement, but given the available information, we take a risk-averse approach and consider all vessels, decommissioned oil rigs, bridge spans, and other large metal structures deployed as artificial reefs similarly.

The lack of ongoing monitoring and the ephemeral nature of turtle entanglement evidence documented in Barnette (2017) (i.e., decomposition, current, predation, etc.) presents difficulties in estimating an annual take rate due to entanglement. For purposes of this analysis, based on the findings in Barnette (2017), our informed judgement, and taking a risk-averse approach, we will assume a 25-year delay of significant entanglement risk. After that point, we conservatively assume any high-relief artificial structure may result in 1 sea turtle mortality due to entanglement per year on a “mature” artificial reef site (i.e., a site that has accumulated sufficient line to present a lethal threat). Serious entanglement will effectively anchor a sea turtle to the artificial reef and prevent it from reaching the surface to breath, resulting in sea turtle mortality due to drowning (i.e., forced submergence). Numerous entanglement examples are documented in Barnette (2017). We consider this effect (i.e., 1 sea turtle mortality per year) to be ongoing for the next 75 years for vessels, decommissioned oil rigs, bridge spans, and other large metal structures. After that point, we anticipate entanglement risk will be reduced on average due to material deterioration and subsidence. The entanglement risk over the next 50 years of the material’s effective lifespan will result in 1 sea turtle mortality every 3 years. This translates to an estimated take of 92 sea turtles over 150 years resulting from the deployment of a single vessel, decommissioned oil rig, bridge span, or other large metal structure.

### **Estimating Total Sea Turtle Mortalities**

To calculate the overall sea turtle mortalities for the proposed action, we begin with the assumption that the typical lifespan of 1 structure of high relief artificial reef material (i.e., a vessel, decommissioned oil rig, bridge span, or other large metal structure) is 150 years. Next, we assume deployment of 1 structure of high relief artificial reef material will result in the following rates of mortality due to entanglement over 150 years: (1) during the first 25 years, we assume there will be 0 sea turtle mortalities; (2) for the next 75 years, there will be 1 sea turtle mortality each year; and (3) for the last 50 years, we assume there will be 1 sea turtle mortality every 3 years.

The proposed project will result in the annual deployment of a maximum of approximately 4 structures across all 3 reef areas. From this estimate, we calculated an average of 1.333 structure

deployments per site per year (4 structure deployments ÷ 3 sites = 1.333), and rounded that average up to the nearest whole number (i.e., 2 structure deployments per site per year). The life of the proposed USACE permit is 10 years, therefore we estimate that there will be up to 20 deployed structures per site over the life of the proposed action (2 deployments per year x 10 years = 20 deployments per reef site). Below, we calculate the total number of sea turtle mortalities anticipated at each of the proposed 3 reef deployment sites. This is likely an overestimate as not every deployment will be high relief materials, and the estimated number of deployments per year represents a maximum of expected deployments (i.e., 4 structures for all 3 reef areas).

*Years 0-25 = 0 sea turtle mortalities*  
*Years 26-100 = 1 sea turtle mortality per year per structure × 75 years = 75 sea turtle mortalities per structure × 20 structures = 1,500 total sea turtle mortalities*  
*Years 101-150 = 50 years × (1 sea turtle mortality ÷ 3 years) = 16.667 sea turtle mortalities per structure × 20 structures = 333.33 rounded up for whole organism estimate = 334 sea turtle mortalities*  
***Total for 150 years = 1,500 + 334 = 1,834 total sea turtle mortalities per deployment site***

**Table 5. Estimated total sea turtle mortalities from entanglement over 150 years**

<b>High Relief Artificial Reef Site</b>	<b>Sea Turtle Mortality YR 0 to YR 25</b>	<b>Sea Turtle Mortality YR 26 to YR 100</b>	<b>Sea Turtle Mortality YR 101 to YR 150</b>	<b>TOTAL Sea Turtle Mortality YR 0 to YR 150</b>
FH 20 (with 20 structures)	0	1,500	334	1,834
FH 21 (with 20 structures)	0	1,500	334	1,834
FH 22 (with 20 structures)	0	1,500	334	1,834
<b>Total Sea Turtle Mortalities by Time Period</b>	0	4,500	1,002	5,502

In total, the number of sea turtle mortalities over 150 years resulting from the deployment of high relief artificial reef materials is estimated to be 5,502 sea turtles. For each reef deployment area, the annual average number of sea turtle mortalities is 14.67 sea turtles per year per reef site once mature (i.e., 25 years after the last deployment).

## 5.2.2 Estimating Species Take Percentages

We used the 2007-2016 STSSN data for the Zone 9, a statistical sub-area used when reporting commercial fishing data and that includes the action area, to determine the expected number of mortalities for each species within the action area. The 10-year dataset for Zone 9 shows a total of 452 sea turtle strandings (excluding unidentified turtles). Based on the artificial reef location and substrate type, we believe this is the best available data to estimate the relative abundance of sea turtle species in the action area and therefore, the percentages of sea turtle mortalities by species resulting from the proposed action (Table 6).

**Table 6. 2007-2016 STSSN Data for Florida Gulf Zone 10.**

Species	Total Strandings 2007-2016	Species Percent Composition
Green	101	22.4
Kemp's ridley	171	37.8
Leatherback	6	1.33
Loggerhead	174	38.5
<b>Grand Total</b>	<b>452</b>	<b>100</b>

To calculate the number of expected sea turtle mortalities broken down by species, we use the following equation, results of which are summarized in Table 7, below.

$$\begin{aligned}
 & \text{Expected mortalities by species for 1 high-relief artificial reef over a 150-year time frame out of} \\
 & \text{2,751 anticipated total sea turtle mortalities} \\
 & = \text{total expected sea turtle mortalities over 150 years from artificial reefs (2,751)} \\
 & \quad \times \text{percent composition from stranding data for each species (Table 6)}
 \end{aligned}$$

*Expected number of green sea turtle mortalities over 150 years*

$$= 5,502 \times 0.224 = 1,232.45$$

*Expected number of Kemp's ridley sea turtle mortalities over 150 years*

$$= 5,502 \times 0.378 = 2,079.76$$

*Expected number of leatherback sea turtle mortalities over 150 years*

$$= 5,502 \times 0.0133 = 73.18$$

*Expected number of loggerhead sea turtle mortalities over 150 years*

$$= 5,502 \times 0.385 = 2,118.27$$

### *North Atlantic and South Atlantic Green Sea Turtle DPSs*

As described in Section 4.1.3, information suggests that the vast majority of the anticipated green sea turtles caught in the Gulf of Mexico and South Atlantic regions are likely to come from the North Atlantic DPS. However, it is possible that animals from the South Atlantic DPS could be captured during the proposed action. We assume based on Foley et al. (2007) that 96% of animals affected by the proposed action are from the North Atlantic DPS and that 4% of the green sea turtles affected by the proposed action are from the South Atlantic DPS. Applying these percentages to our rounded-to-the-nearest-whole estimated take of 1,232.45 green sea turtles over 150 years and rounding in such a way as to conservatively assume the most lethal captures, results in an estimated catch of up to 1,184 green sea turtles from the North Atlantic

DPS ( $1,232.45 \times 0.96 = 1,183.15$ , rounded up to 1,184), and an estimated catch of up to 50 green sea turtles from the South Atlantic DPS ( $1,232.45 \times 0.04 = 49.30$ , rounded up to 50).

**Table 7. Breakdown of Lethal Sea Turtle Entanglements Based on STSSN Data (2007-2016) by Species.**

Species	Percent from Stranding Data	Species Breakdown Out of 5,502 Anticipated Sea Turtle Takes	Take Estimate Rounded Up
Green (both DPSs)	22.4%	1,232.45	1,234
North Atlantic DPS	Assuming 96%	1,183.15	1,184
South Atlantic DPS	Assuming 4%	49.30	50
Kemp's ridley	37.8%	2,079.76	2,080
Leatherback	1.32%	73.18	74
Loggerhead (Northwest Atlantic DPS)	38.5%	2,118.27	2,119
<b>Total</b>	<b>100</b>	<b>5,502</b>	<b>5,507</b>

Table 8 summarizes the total number of anticipated lethal entanglements over a period of 150 years for each sea turtle species. We took the total number of sea turtle mortalities expected for each time period of reef aging (see Table 5) and multiplied it by the species percentages in Table 6 (e.g., 4,500 mortalities in YR 26-100  $\times$  0.378 Kemp's ridley sea turtles = 1,701 Kemp's ridley sea turtle mortalities during YR 26-100 of the life of the reef). All calculated values are rounded to the nearest whole number. We note rounding estimates results in a slightly higher total number of sea turtle takes than those calculated in Table 5 (i.e., 5,507 instead of 5,502).

**Table 8. Anticipated Amount of Sea Turtle Mortalities, by Species, Over 150 Years due to Entanglements Associated with High Relief Artificial Reef Material in 3 Deployment Areas.**

Species	Sea Turtle Mortality YR 0 to YR 25	Sea Turtle Mortality YR 26 to YR 100	Sea Turtle Mortality YR 101 to YR 150	TOTAL Sea Turtle Mortality YR 0 to YR 150
Green sea turtle (North Atlantic DPS)	0	968	216	1,184
Green sea turtle (South Atlantic DPS)	0	41	9	50
Kemp's ridley sea turtle	0	1,701	379	2,080
Leatherback sea turtle	0	60	14	74
Loggerhead sea turtle (Northwest Atlantic DPS)	0	1,733	386	2,119
<b>Total sea turtle mortality by time period</b>	<b>0</b>	<b>4,503</b>	<b>1,004</b>	<b>5,507</b>

## 7 CUMULATIVE EFFECTS

---

ESA Section 7 regulations require NMFS to consider cumulative effects in formulating its Opinions (50 CFR 402.14). Cumulative effects include the effects of future state or private activities that are reasonably certain to occur in the action area considered in this Opinion (50 CFR 402.02). Human-induced mortality and injury of sea turtles occurring in the action area are reasonably certain to occur in the future. Primary sources of those effects include vessel interactions and pollution. While the combination of these activities may prevent or slow the recovery of populations of sea turtles, the magnitude of these effects is currently unknown.

### *Vessel Interactions*

NMFS's STSSN data indicate that vessel interactions are responsible for a large number of sea turtles stranding within the action area each year. Such collisions are reasonably certain to continue into the future. Collisions with boats can stun or easily kill sea turtles, and many stranded sea turtles have obvious propeller or collision marks (Dwyer et al. 2003). Still, it is not always clear whether the collision occurred pre- or post-mortem. We believe that sea turtle injuries and mortalities by vessel interactions will continue in the future.

### *Pollution*

Human activities in the action area causing pollution are reasonably certain to continue in the future, as are impacts from the pollution on sea turtles. However, the level of impacts cannot be projected. Marine debris (e.g., discarded fishing line or lines from boats) can entangle sea turtles in the water and drown them. Sea turtles commonly ingest plastic or mistake debris for food. Noise pollution has been raised primarily as a concern for marine mammals (including ESA-listed large whales) but may be a concern for other marine organisms, including sea turtles. The potential effects of noise pollution on sea turtles range from minor behavioral disturbance to injury and death. The noise level in the ocean is thought to be increasing at a substantial rate due to increases in shipping and other activities, including seismic exploration, offshore drilling, and sonar used by military and research vessels. Concerns about noise in the action area of this consultation include increasing noise due to increasing recreational vessels.

Beyond the threats noted above, NMFS is not aware of any proposed or anticipated changes in other human-related actions (e.g., poaching, habitat degradation) or natural conditions (e.g., overabundance of land or sea predators, changes in oceanic conditions, etc.) that would substantially change the impacts that each threat has on the sea turtles covered by this Opinion.

## 8 JEOPARDY ANALYSIS

---

To “jeopardize the continued existence of...” means to “engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR 402.02). Thus, in making this determination for each species, we must look at whether the proposed 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.

The NMFS and USFWS's ESA Section 7 Handbook (USFWS and NMFS 1998) defines survival and recovery, as they apply to the ESA's jeopardy standard. Survival means "the species' persistence...beyond the conditions leading to its endangerment, with sufficient resilience to allow recovery from endangerment." The Handbook further explains that survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a sufficiently large population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter. Per the Handbook and the ESA regulations at 50 CFR 402.02, recovery means "improvement in the status of a listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." Recovery is the process by which species' ecosystems are restored or threats to the species are removed so self-sustaining and self-regulating populations of listed species can be supported as persistent members of native biotic communities.

The analyses conducted in the previous sections of this Opinion serve to provide a basis to determine whether the proposed action would be likely to jeopardize the continued existence of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), and leatherback sea turtle. In Section 6.0, we outlined how the proposed action can adversely affect these species. Now we turn to an assessment of the species response to these impacts, in terms of overall population effects, and whether those effects of the proposed actions, when considered in the context of the Environmental Baseline (Section 5.0), the Status of the Species (Section 4.1), and the Cumulative Effects (Section 7.0), will jeopardize the continued existence of the affected species. For any species listed globally, our jeopardy determination must find the proposed action will appreciably reduce the likelihood of survival and recovery at the global species range. For any species listed as DPSs, a jeopardy determination must find the proposed action will appreciably reduce the likelihood of survival and recovery of that DPS.

## **8.1 Green Sea Turtles**

The proposed action may result in the lethal take of 1,234 green sea turtles (1,184 from the North Atlantic DPS and 50 from the South Atlantic DPS) over the next 150 years. The take is expected to be no green sea turtles during the first 25 years, 1,009 during the next 75 years, and 225 during the last 50 years.

As discussed in the Effects of the Action section, green sea turtles from both the North Atlantic and South Atlantic DPSs can be found on foraging grounds within U.S. waters. While there are currently no in-depth studies available to determine the percent of North Atlantic and South Atlantic DPS individuals in any given location, an analysis of cold-stunned green turtles off the St. Joseph Bay, Florida, foraging grounds, which is located on the northern coast of the Gulf of Mexico, found approximately 4% of juvenile individuals came from nesting stocks in the South Atlantic DPS (specifically Suriname/Aves Island, Brazil, Ascension Island, and Guinea Bissau) (Foley et al. 2007). While it is highly likely green sea turtles found in or near the action area will be from the North Atlantic DPS, we cannot rule out that they may also be from the South



Atlantic DPS. Therefore, to analyze effects in a precautionary manner, we will conduct 2 jeopardy analyses, one for each DPS (i.e., assuming up to 96% could come from the North Atlantic DPS and 4% could come from the South Atlantic DPS).

### **8.1.1 North Atlantic DPS**

The deployment of up to 60 high relief artificial reef structures across 3 separate reef areas over a period of 10 years may result in the lethal take of 1,184 green sea turtles from the North Atlantic DPS over the next 150 years.

#### *8.1.1.1 Survival*

The potential lethal take of up to 1,184 green sea turtles from the North Atlantic DPS over the next 150 years from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas would reduce the species' population compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. A lethal take could also result in a potential reduction in future reproduction, assuming that at least some of the individuals take are female and would have survived to reproduce in the future. For example, as discussed above, an adult green sea turtle can lay 3-4 clutches of eggs every 2-4 years, with approximately 110-115 eggs/nest, of which a small percentage is expected to survive to sexual maturity. The anticipated lethal takes are expected to occur over a long time period (150 years) with more than 968 of those takes occurring after the artificial reef sites become mature (25 years) and before the artificial reef sites reach the age of 100. In addition, the deployment of the high-relief artificial reef material will occur opportunistically as materials and funding become available and deployments will occur only within 3 discrete 1 nm<sup>2</sup> areas (i.e., Fish Havens 20, 21, and 22). Because green sea turtles from the North Atlantic DPS generally have large ranges, no reduction in the distribution is expected from the take of these individuals.

Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends. Seminoff et al. (2015) estimated that there are greater than 167,000 nesting green sea turtle females in the North Atlantic DPS. The nesting at Tortuguero, Costa Rica, accounts for approximately 79% of that estimate (approximately 131,000 nesters), with Quintana Roo, Mexico, (approximately 18,250 nesters; 11%), and Florida, USA (approximately 8,400 nesters; 5%), also accounting for a large portion of the overall nesting (Seminoff et al. 2015). At Tortuguero, Costa Rica, the number of nests laid per year from 1999 to 2010 increased, despite substantial human impacts to the population at the nesting beach and at foraging areas (Campell and Lagueux 2005; Troëng 1998; Troëng and Rankin 2005). Nesting locations in Mexico along the Yucatan Peninsula also indicate the number of nests laid each year increased to over 1,500 nests/year by 2000 (NMFS and USFWS 2007a). By 2012, more than 26,000 nests were counted in Quintana Roo (J. Zurita, CIQROO, unpubl. data, 2013, in Seminoff et al. 2015). In Florida, most nesting occurs along the Atlantic coast of eastern central Florida, where a mean of 5,055 nests were deposited each year from 2001 to 2005 (Meylan et al. 2006) and 10,377 each year from 2008 to 2012 (B. Witherington, FFWCC, pers. comm., 2013). As described in the Section 4.1.3, the overall trend in nesting has increased

substantially over the last 20 years on the Index Nesting Beaches (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>).

In summary, green sea turtle nesting at the primary nesting beaches within the range of the North Atlantic DPS has been increasing over the past 2 decades, against the background of the past and ongoing human and natural factors (i.e., the environmental baseline) that have contributed to the current status of the species. We believe these nesting trends are indicative of a species with a high number of sexually mature individuals. Therefore, we believe the potential lethal take of 591 green sea turtles from the North Atlantic DPS over the next 150 years will not have any measurable effect on that trend because this loss is anticipated to occur over a long timeframe and would result in a low amount of take on an average annual basis compared to the increasing trend. After analyzing the magnitude of the effects of the proposed action, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the green sea turtle North Atlantic DPS in the wild.

#### *8.1.1.2 Recovery*

The North Atlantic DPS of green sea turtles does not have a recovery plan separate from the existing Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991). Because animals within the North Atlantic DPS all occur in the Atlantic Ocean and would be subject to the recovery actions described in that plan, we believe it is appropriate to continue using that Recovery Plan as a guide until a new plan, specific to the North Atlantic DPS, is developed. The Atlantic Recovery Plan lists the following relevant recovery objectives over a period of 25 continuous years:

*Objective: The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years.*

*Objective: A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.*

According to data collected from Florida's index nesting beach survey from 1989-2019, green sea turtle nest counts across Florida index beaches have increased substantially from a low of approximately 267 in the early 1990s to a high of almost 41,000 in 2019 (See Figure 3), and the overall increasing trend in nesting over time indicates that the first listed recovery objective is being met. There are no estimates specifically addressing changes in abundance of individuals on foraging grounds currently available. Given the clear increases in nesting, however, it is likely that numbers on foraging grounds have also increased, consistent with the criteria of the second listed recovery objective.

The potential lethal take of up to 1,184 green sea turtles from the North Atlantic DPS over the next 150 years resulting from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas will cause a reduction in numbers when it occurs. This take is unlikely to have any detectable influence on the recovery objectives and trends noted above, and will not result in an appreciable reduction in the likelihood of North Atlantic DPS green sea

turtles' recovery in the wild even when considered in the context of the Status of the Species, the Environmental Baseline, and Cumulative Effects discussed in this Opinion.

#### *8.1.1.3 Conclusion*

The lethal take of 1,184 green sea turtles from the North Atlantic DPS over the next 150 years resulting from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the North Atlantic DPS of green sea turtle in the wild.

### **8.1.2 South Atlantic DPS**

The deployment of up to 60 high relief artificial reef structures across 3 separate reef areas over a period of 10 years may result in the lethal take of up to 50 green sea turtles from the South Atlantic DPS over the next 150 years.

#### *8.1.2.1 Survival*

The potential lethal take of up to 50 green sea turtle from the South Atlantic DPS over the next 150 years resulting from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas would reduce the species' population compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. As discussed above, lethal interactions would also result in a potential reduction in future reproduction, assuming the individual taken is female and would have survived otherwise to reproduce. The anticipated lethal take is expected to occur over a long time period (150 years) with more than 41 of those takes occurring after the artificial reef sites become mature (25 years) and before the artificial reef sites reach the age of 100. In addition, the deployment of the high-relief artificial reef material will occur opportunistically as materials and funding become available and deployments will occur only within 3 discrete 1 nm<sup>2</sup> areas (i.e., Fish Havens 20, 21, and 22). Because green sea turtles in the South Atlantic DPS generally have large ranges, no reduction in their distribution is expected from the take of these individuals.

Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends. In Section 4.1.3, we summarized available information on number of nesters and nesting trends at South Atlantic DPS beaches. Seminoff et al. (2015) estimated that there are greater than 63,000 nesting females in the South Atlantic DPS, though they noted the adult female nesting abundance from 37 beaches could not be quantified. The nesting at Poilão, Guinea-Bissau, accounted for approximately 46% of that estimate (approximately 30,000 nesters), with Ascension Island, United Kingdom, (approximately 13,400 nesters; 21%), and the Galibi Reserve, Suriname (approximately 9,400 nesters; 15%) also accounting for a large portion of the overall nesting (Seminoff et al. 2015).

Seminoff et al. (2015) reported that while trends cannot be estimated for many nesting populations due to the lack of data, they could discuss possible trends at some of the primary nesting sites. Seminoff et al. (2015) indicated that the nesting concentration at Ascension Island

(United Kingdom) is one of the largest in the South Atlantic DPS and the population has increased substantially over the last 3 decades (Broderick et al. 2006; Glen et al. 2006). Mortimer and Carr (1987) counted 5,257 nests in 1977 (about 1,500 females), and 10,764 nests in 1978 (about 3,000 females) whereas from 1999–2004, a total of about 3,500 females nested each year (Broderick et al. 2006). Since 1977, numbers of nests on 1 of the 2 major nesting beaches, Long Beach, have increased exponentially from around 1,000 to almost 10,000 (Seminoff et al. 2015). From 2010 to 2012, an average of 23,000 nests per year was laid on Ascension (Seminoff et al. 2015). Seminoff et al. (2015), caution that while these data are suggestive of an increase, historic data from additional years are needed to fully substantiate this possibility.

Seminoff et al. (2015) reported that the nesting concentration at Galibi Reserve and Matapica in Suriname was stable from the 1970s through the 1980s. From 1975–1979, 1,657 females were counted (Schulz 1982), a number that increased to a mean of 1,740 females from 1983–1987 (Ogren 1989b), and to 1,803 females in 1995 (Weijerman et al. 1996). Since 2000, there appears to be a rapid increase in nest numbers (Seminoff et al. 2015).

In the Bijagos Archipelago (Poilão, Guinea-Bissau), Parris and Agardy (1993 as cited in Fretey 2001) reported approximately 2,000 nesting females per season from 1990 to 1992, and Catry et al. (2002) reported approximately 2,500 females nesting during the 2000 season. Given the typical large annual variability in green sea turtle nesting, Catry et al. (2009) suggested it was premature to consider there to be a positive trend in Poilão nesting, though others have made such a conclusion (Broderick et al. 2006). Despite the seeming increase in nesting, interviews along the coastal areas of Guinea-Bissau generally resulted in the view that sea turtles overall have decreased noticeably in numbers over the past two decades (Catry et al. 2009). In 2011, a record estimated 50,000 green sea turtle clutches were laid throughout the Bijagos Archipelago (Seminoff et al. 2015).

In summary, nesting at some of the primary nesting beaches for the South Atlantic DPS has been increasing over the past 3 decades, against the background of past and ongoing human and natural factors (as contemplated in the Status of the Species and Environmental Baseline sections) that have contributed to the current status of the species. We believe these nesting trends are indicative of a species with a high number of sexually mature individuals. Since the abundance trend information for green sea turtles is increasing, we believe the potential lethal take of up to 50 green sea turtles from the South Atlantic DPS over the next 150 years resulting from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas will not have any measurable effect on that trend. After analyzing the magnitude of the effects of the proposed action, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the green sea turtle South Atlantic DPS in the wild.

#### *8.1.2.2 Recovery*

Like the North Atlantic DPS, the South Atlantic DPS of green sea turtles does not have a recovery plan separate from the existing Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991). Because the animals within the South Atlantic DPS

all occur in the Atlantic Ocean and are subject to the recovery actions described in that plan, we believe it is appropriate to continue using that Recovery Plan as a guide until a new plan, specific to the South Atlantic DPS, is developed. In our analysis for the North Atlantic DPS, we stated that the Atlantic Recovery Plan lists the following relevant recovery objectives over a period of 25 continuous years:

*Objective: The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years.*

*Objective: A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.*

The nesting recovery objective is specific to the North Atlantic DPS, but demonstrates the importance of increases in nesting to recovery. As previously stated, nesting at some of the primary South Atlantic DPS nesting beaches has been increasing over the past 3 decades. There are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds. Given the increases in nesting and in-water abundance, however, it is likely that numbers on foraging grounds have increased.

The potential lethal take of up to 50 green sea turtle from the South Atlantic DPS over the next 150 years resulting from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas will result in a reduction in numbers when it occurs, but it is unlikely to have any detectable influence on the trends noted above, even when considered in context with the Status of the Species, the Environmental Baseline, and Cumulative Effects discussed in this Opinion. Thus, the proposed action will not impede achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of the South Atlantic DPS of green sea turtles' recovery in the wild

### *8.1.2.3 Conclusion*

The potential lethal take of up to 50 green sea turtle from the South Atlantic DPS over the next 150 years resulting from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the South Atlantic DPS of green sea turtle in the wild.

## **8.2 Kemp's Ridley Sea Turtles**

The deployment of up to 60 high relief artificial reef structures across 3 separate reef areas over a period of 10 years may result in the lethal take of 2,080 Kemp's ridley sea turtles over the next 150 years. The take is expected to be no Kemp's ridley sea turtles during the first 25 years, approximately 1,701 during the next 75 years (one turtle per year per structure deployed), and approximately 379 during the last 50 years (one turtle every 3 years per structure deployed).

### 8.2.1 Survival

The potential lethal take of up to 2,080 Kemp's ridley sea turtles over the next 150 years from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas would reduce the species' population compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. The TEWG (Turtle Expert Working Group 1998b) estimates age at maturity from 7-15 years, females return to their nesting beach about every 2 years (Turtle Expert Working Group 1998b). The mean clutch size for Kemp's ridley sea turtle is 100 eggs/nest, with an average of 2.5 nests/female/season. As a result, lethal take could also result in a potential reduction in future reproduction, assuming at least some of the individuals lethally taken are female and would have otherwise survived to reproduce in the future. The loss of 2,080 Kemp's ridley sea turtles could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage would be expected to survive to sexual maturity. Thus, the death of any females would eliminate their contribution to future generations, and result in a reduction in sea turtle reproduction. The anticipated lethal takes are expected to occur over a long time period (150 years), with more than 80% of those takes occurring after the artificial reef sites become mature (25 years) and before the artificial reef sites reach the age of 100. In addition, the deployment of the high-relief artificial reef material will occur opportunistically as materials and funding become available and deployments will occur only within 3 discrete 1 nm<sup>2</sup> areas (i.e., Fish Havens 20, 21, and 22). Because Kemp's ridley sea turtles generally have large ranges, no reduction in the distribution is expected from the take of these individuals over the life of the proposed action.

In the absence of any total population estimates for Kemp's ridley sea turtle, nesting trends are the best proxy for estimating population changes. Following a significant, unexplained 1-year decline in 2010, Kemp's ridley sea turtle nests in Mexico reached a record high of 21,797 in 2012 (Gladys Porter Zoo nesting database 2013). There was a second significant decline in Mexico nests 2013 through 2014; however, nesting in Mexico has increased 2015 through 2017 (Gladys Porter Zoo 2016). There was a record high nesting season in 2017, with 24,570 nests recorded (J. Pena, pers. comm., August 31, 2017), but nesting for 2018 declined to 17,945, followed by another decline to 11,090 in 2019 (Gladys Porter Zoo 2019). Nesting numbers rebounded in 2020 (18,068 nests) and 2021 (17,671 nests) (CONAMP data, 2021).

A small nesting population is also emerging in the United States, primarily in Texas, rising from 4 nests in 1995 to 197 in 2009, to a record high of 353 nests in 2017 [(NMFS and USFWS 2015); (NPS 2017)]. Nesting in Texas has paralleled the trends observed in Mexico, characterized by a significant decline in 2010, followed by a second decline in 2013-2014, but with a rebound in 2015-2017, and then a drop back down to 190 nests in 2019. Numbers rebounded again in 2020 with 262 nests, and dropped in 2021 to 195 nests (National Park Service data).

Given the significant inter-annual variation in nesting data, sea turtle population trends necessarily are measured over decades and the long-term trend line better reflects the population increase in Kemp's ridley sea turtles. With the recent increase in nesting data (2015-17) and recent declining numbers of nesting females (2013-14 and 2018-19), it is too early to tell whether

the long-term trend line is affected. Nonetheless, long-term data from 1990 to present continue to support that Kemp's ridley sea turtle is increasing in population size.

We believe this long-term increasing trend in nesting is evidence of an increasing population, as well as a population that is maintaining (and potentially increasing) its genetic diversity. We believe these nesting trends are indicative of a species with a high number of sexually mature individuals. Since the abundance trend information is clearly increasing, we believe the potential lethal take of 2,080 Kemp's ridley sea turtles over the next 150 years from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas will not have any measurable effect on that trend. After analyzing the magnitude of the effects of the proposed action, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of Kemp's ridley sea turtles in the wild.

### **8.2.2 Recovery**

As to whether the proposed action will appreciably reduce the species' likelihood of recovery, the recovery plan for the Kemp's ridley sea turtle (NMFS et al. 2011) lists the following relevant recovery objective:

*Objective: A population of at least 10,000 nesting females in a season (as measured by clutch frequency/female/season) distributed at the primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained. Methodology and capacity to implement and ensure accurate nesting female counts have been developed.*

With respect to this recovery objective, the most recent nesting numbers in 2019 indicate there were a total of 11,090 nests on the main nesting beaches in Mexico. This number represents approximately 4,436 nesting females for the season based on 2.5 clutches/female/season. The number of nests reported annually from 2010 to 2014 overall declined, rebounded in 2015 through 2017, but have declined again in 2018 and 2019. Numbers rebounded again in 2020 with 262 nests, and dropped in 2021 to 195 nests (National Park Service data). Although there has been a substantial increase in the Kemp's ridley population within the last few decades, the number of nesting females is still below the number of 10,000 nesting females per season required for downlisting (NMFS and USFWS 2015). Since we concluded that the potential loss of up to 2,080 Kemp's ridley sea turtles over the next 150 years (with no takes anticipated during the first 25 years) is not likely to have any detectable effect on nesting trends, we do not believe the proposed action will impede the progress toward achieving this recovery objective. Thus, we believe the proposed action will not result in an appreciable reduction in the likelihood of Kemp's ridley sea turtles' recovery in the wild.

### **8.2.3 Conclusion**

The lethal take of 2,080 Kemp's ridley sea turtles over the next 150 years resulting from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the Kemp's ridley sea turtle in the wild.

### 8.3 Leatherback Sea Turtles

The deployment of up to 60 high relief artificial reef structures across 3 separate reef areas over a period of 10 years may result in the lethal take of 74 leatherback sea turtles over the next 150 years. The take is expected to be no leatherback sea turtles during the first 25 years, approximately 60 during the next 75 years (one turtle per year per structure deployed), and approximately 14 during the last 50 years (one turtle every 3 years per structure deployed).

#### 8.3.1 Survival

The potential lethal take of up to 74 leatherback sea turtles over the next 150 years from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas would reduce the species' population compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. Lethal captures could also result in a potential reduction in future reproduction, assuming one or more of these individuals would be female and would have survived otherwise to reproduce in the future. For example, an adult female leatherback sea turtle can produce up to 700 eggs or more per nesting season (Schulz 1975). Although a significant portion (up to approximately 30%) of the eggs can be infertile, the annual loss of adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings of which a small percentage would be expected to survive to sexual maturity. While we have no reason to believe the proposed action will disproportionately affect females, the death of any female leatherbacks that would have survived otherwise to reproduce would eliminate its and its future offspring's contribution to future generations. The anticipated lethal take is expected to occur over a long time period (150 years). In addition, the deployment of the high-relief artificial reef material will occur opportunistically as materials and funding become available and deployments will occur only within 3 discrete 1 nm<sup>2</sup> areas (i.e., Fish Havens 20, 21, and 22). Because leatherback sea turtles generally have large ranges, no reduction in the distribution is expected from the take of these individuals.

The Leatherback TEWG estimated there are between 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) in the North Atlantic based on 2004 and 2005 nesting count data (Turtle Expert Working Group 2007). The potential loss of up to 30 leatherback sea turtle over the next 150 years accounts for only 0.003158-0.088235% of those population estimates, which are only a subset of the entire population. We do not believe this potential loss will have any detectable impact on these population numbers.

Of the 15 leatherback nesting populations in the North Atlantic, 7 show an increase in nesting (Florida, Puerto Rico [not Culebra], St. Croix-U.S. Virgin Islands, British Virgin Islands, Trinidad, Guyana, and Brazil) and 3 have shown a decline in nesting (Puerto Rico [Culebra], Costa Rica [Tortuguero], and Costa Rica [Gandoca]). However, subsequent analysis using data up through 2017 has shown decreases in this stock, with an annual geometric mean decline of 10.43% over what they described as the short term (2008-2017) and a long-term (1990-2017) annual geometric mean decline of 5% (NWALWG 2018).



The main nesting areas in Puerto Rico are at Fajardo on the main island of Puerto Rico and on the island of Culebra. Between 1978 and 2005, nesting increased in Puerto Rico from a minimum of 9 nests recorded in 1978 and to a minimum of 469-882 nests recorded each year between 2000 and 2005 (NMFS and USFWS 2013b). However since 2004, nesting has steadily declined in Culebra, which appears to reflect a shift in nest site fidelity rather than a decline in the female population (NMFS and USFWS 2013b).

In the U.S. Virgin Islands, St. Croix (Sandy Point NWR), leatherback nesting was estimated to increase at 13% per year from 1994 through 2001. However, nesting data from 2001 through 2010 indicate nesting has slowed, possibly due to fewer new recruits and lowered reproductive output (NMFS and USFWS 2013b). The average annual growth rate was calculated as approximately 1.1 (with an estimated confidence interval between 1.07 and 1.13) using the number of observed females at Sandy Point, St. Croix, from 1986 to 2004 (Turtle Expert Working Group 2007).

In Costa Rica, Tortuguero, leatherback nesting has decreased 88.5% overall from 1995 through 2011 (NMFS and USFWS 2013b). Troëng et al. (2007) estimated a 67.8% overall decline from 1995 through 2006. However, these estimates are based on an extrapolation of track survey data, which has consistently underestimated the number of nests reported during the surveys (NMFS and USFWS 2013b). Regardless of the method used to derive the estimate, the number of nests observed over the last 17 years has declined. Troëng et al. (2005) found a slight decline in the number of nests at Gandoca, Costa Rica, between 1995 and 2003, but the confidence intervals were large. Data between 1990 and 2004 at Gandoca averaged 582.9 (+ 303.3) nests each year, indicating nest numbers have been lower since 2000 (Chacón-Chaverri and Eckert 2007), and the numbers are not increasing (Turtle Expert Working Group 2007).

Aside from the long-term nesting trend in Florida (an annual geometric mean increase of over 9%), most all of the other nesting populations appear to be decreasing, reversing the stable and increasing trend that was observed as of 2017. However, since we anticipate 74 mortalities over the next 150 years, which is only a small fraction of the reduced but still large overall nesting population, and we have no reason to believe nesting females will be disproportionately affected, we believe the potential mortality associated with the proposed action will have no detectable effect on current nesting trends.

Since we do not anticipate the proposed action will have any detectable impact on the population overall, or current nesting trends, we do not believe the proposed action will cause an appreciable reduction in the likelihood of survival of this species in the wild.

### **8.3.2 Recovery**

The Atlantic recovery plan for the U.S. population of the leatherback sea turtles (NMFS and USFWS 1992) lists the following relevant recovery objective:

*Objective: The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico; St. Croix, U.S. Virgin Islands; and along the east coast of Florida.*

We believe the proposed action is not likely to impede the recovery objective above and will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild. As discussed in 3.2.1.5, data from 2018 have shown a reverse in trends, as the Culebra, St. Croix, and Florida nesting populations have decreased in recent years; however, it is unclear whether declines may at least in part reflect a shift in nest site fidelity or if it is indicative of a decline in the female population. Broader nesting declines elsewhere on the NW Atlantic nesting beaches suggest that the declines in nests may indicate a true decline in either nesters or reproductive output. However, since we concluded that the potential loss of up to 74 leatherback sea turtle over the next 150 years (with no takes anticipated during the first 25 years) is not likely to have any detectable effect on these nesting trends, we do not believe the proposed action would impede the progress toward achieving this recovery objective. Thus, we believe the proposed action will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild.

### **8.3.3 Conclusion**

The lethal take of 74 leatherback sea turtles over the next 150 years resulting from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the leatherback sea turtle in the wild.

## **8.4 Loggerhead Sea Turtles**

The deployment of up to 60 high relief artificial reef structures across 3 separate reef areas over a period of 10 years may result in the lethal take of 2,119 loggerhead sea turtles in the Northwest Atlantic DPS over the next 150 years. The take is expected to be no loggerhead sea turtles during the first 25 years, approximately 1,733 during the next 75 years (one turtle per year per structure deployed), and approximately 386 during the last 50 years (one turtle every 3 years per structure deployed).

### **8.4.1 Survival**

The potential lethal take of up to 2,119 loggerhead sea turtles in the Northwest Atlantic DPS over the next 150 years from the deployment of up to 60 high relief artificial reef structures across 3 separate reef areas would reduce the species' population compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. A lethal take could also result in a potential reduction in future reproduction, assuming at least some of the individuals taken are female and would have survived to reproduce in the future. For example, an adult female loggerhead sea turtle can lay approximately 4 clutches of eggs every 3 years, with 100-126 eggs per clutch. While we have no reason to believe the proposed action will disproportionately affect females, the loss of even 1 adult female could preclude the production of thousands of eggs and hatchlings of which a small percentage would be expected to survive to sexual maturity. The anticipated lethal takes are expected to occur over a long time period (150 years), 1,799 those takes occurring after the artificial reef sites become mature (25 years) and before the artificial reef sites reach the age of 100. Therefore, a reduction

in the distribution of loggerhead sea turtles is not expected from lethal takes attributed to the proposed action. In addition, the deployment of the high-relief artificial reef material will occur opportunistically as materials and funding become available and deployments will occur only within 3 discrete 1 nm<sup>2</sup> areas (i.e., Fish Havens 20, 21, and 22). Loggerhead sea turtles in the Northwest Atlantic DPS generally have large ranges; thus, no reduction in the distribution is expected from the take of these individuals.

Whether or not the reductions in loggerhead sea turtle numbers and reproduction attributed to the proposed action would appreciably reduce the likelihood of survival depends on what effect these reductions in numbers and reproduction would have on overall population sizes and trends (i.e., whether the estimated reductions, when viewed within the context of the environmental baseline, the status of the species and cumulative effects, are of such an extent that adverse effects on population dynamics are appreciable). In Section 4.1.6, we reviewed the status of this species in terms of nesting and female population trends and several assessments based on population modeling (i.e., (Conant et al. 2009; NMFS 2009). Below we synthesize what that information means both in general terms and the more specific context of the proposed action.

Loggerhead sea turtles are a slow growing, late-maturing species. Because of their longevity, loggerhead sea turtles require high survival rates throughout their life to maintain a population. In other words, late-maturing species cannot tolerate much anthropogenic mortality without going into decline. Conant et al. (2009) concluded loggerhead natural growth rates are small, natural survival needs to be high, and even low- to moderate mortality can drive the population into decline. Because recruitment to the adult population is slow, population modeling studies suggest even small increased mortality rates in adults and subadults could substantially impact population numbers and viability (Chaloupka and Musick 1997; Crouse et al. 1987; Crowder et al. 1994; Heppell et al. 1995).

NMFS (2009) estimated the minimum adult female population size for the Northwest Atlantic DPS in the 2004-2008 timeframe to likely be between approximately 20,000-40,000 individuals (median 30,050), with a low likelihood of being as many as 70,000 individuals. Another estimate for the entire western North Atlantic population was a mean of 38,334 adult females using data from 2001-2010 (Richards et al. 2011). A much less robust estimate for total benthic females in the western North Atlantic was also obtained, with a likely range of approximately 30,000-300,000 individuals, up to less than 1 million.

NMFS (2011) preliminarily estimated the loggerhead population in the Northwestern Atlantic Ocean along the continental shelf of the Eastern Seaboard during the summer of 2010 at 588,439 individuals (estimate ranged from 381,941 to 817,023) based on positively identified individuals. The NMFS-NEFSC's point estimate increased to approximately 801,000 individuals when including data on unidentified sea turtles that were likely loggerheads. The NMFS-NEFSC (2011) underestimates the total population of loggerheads since it did not include Florida's east coast south of Cape Canaveral or the Gulf of Mexico, which are areas where large numbers of loggerheads are also expected. In other words, it provides an estimate of a subset of the entire population.

Florida accounts for more than 90% of U.S. loggerhead nesting. The FWC conducted a detailed analysis of Florida's long-term loggerhead nesting data (1989-2019). They indicated that following a 24% increase in nesting between 1989 and 1998, nest counts declined sharply from 1999 to 2007. However, annual nest counts showed a strong increase (71%) from 2008 to 2016. Examining only the period between the high-count nesting season in 1998 and the 2016 nesting season, researchers found a slight but insignificant increase, indicating a reversal of the post-1998 decline. Nesting at the core index beaches declined in 2017 to 48,033, and rose again each year through 2020, reaching 53,443 nests before dipping back to 49,100 in 2021. The overall change in counts from 1989 to 2021 was significantly positive; however, it should be noted that wide confidence intervals are associated with this complex data set, which, along with uncertainty around the variability in nesting parameters (nests/female, nesting intervals, etc.) it is unclear whether the positive nesting trend equates to an increase in the population of nesting females over that time frame (Ceriani et al. 2019).

Abundance estimates accounting for only a subset of the entire loggerhead sea turtle population in the western North Atlantic indicate the population is large (i.e., several hundred thousand individuals). Nesting trends have been significantly increasing over several years against the background of the past and ongoing human and natural factors (as contemplated in the Status of the Species and Environmental Baseline) that have contributed to the current status of the species.

The proposed action could lethally take 2,119 loggerhead sea turtles in the Northwest Atlantic DPS over the next 150 years. We do not expect this loss to result in a detectable change to the population numbers or increasing trends because this loss is anticipated to occur over a long timeframe and would result in a low amount of take on an average annual basis compared to the total population estimate and anticipated growth rate. Further, the lethal take calculated represents an overestimate of potential take over 150 years. Actual take will depend on the number of high relief artificial reef materials actually deployed, and lethal take will likely be minimized by the implementation of the Construction Conditions and Best Practices outlined in Sections 2.1.2 and 2.1.3.

After analyzing the magnitude of the effects of the proposed action, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the loggerhead sea turtle Northwest Atlantic DPS in the wild.

#### **8.4.2 Recovery**

The loggerhead recovery plan for the Northwest Atlantic population of loggerhead sea turtles defines the recovery goal as "...ensur[ing] that each recovery unit meets its Recovery Criteria alleviating threats to the species so that protection under the ESA is no longer necessary" (NMFS and USFWS 2008). The plan then identifies 13 recovery objectives needed to achieve that goal. The recovery plan for the Northwest Atlantic population of loggerhead sea turtles (NMFS and USFWS 2008) lists the following recovery objectives that are relevant to the effects of the proposed action:

*Objective: Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females.*

*Objective: Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.*

The recovery plan anticipates that, with implementation of the plan, the western North Atlantic population will recover within 50-150 years, but notes that reaching recovery in only 50 years would require a rapid reversal of the then-declining trends of the NRU, PFRU, and NGMRU. The minimum end of the range assumes a rapid reversal of the current declining trends; the higher end assumes that additional time will be needed for recovery actions to bring about population growth (NMFS and USFWS 2008).

Nesting trends in most recovery units have been significantly increasing over several years. We do not believe the proposed action impedes the progress of the recovery program or achieving the overall recovery strategy because the amount of take expected to occur over a 150-year time period, as a result of the proposed action is not expected to be detectable on a population level or on nesting trends, and therefore it is not expected to affect population growth over the timeframe analyzed. We also indicated that the lethal take of 2,119 loggerhead sea turtles in the Northwest Atlantic DPS over the next 150 years is minimal in relation to the overall population, and it would not impede achieving the Recovery Objectives, even when considered in the context of the Status of the Species, the Environmental Baseline, and Cumulative Effects discussed in this Opinion. We believe this is true for both nesting and juvenile in-water populations. For these reasons, we do not believe the proposed action will impede achieving the recovery objectives or overall recovery strategy.

### **8.4.3 Conclusion**

The lethal take of 2,119 loggerhead sea turtles associated with the proposed action over the next 150 years (with no takes anticipated during the first 25 years) is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the Northwest Atlantic DPS of the loggerhead sea turtle in the wild.

## **9 CONCLUSION**

---

We reviewed the Status of the Species, the Environmental Baseline, the Effects of the Action, and the Cumulative Effects using the best available data. The proposed action will result in the take of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle (Northwest Atlantic DPS). Given the nature of the proposed action and the information provided above, we conclude that the action, as proposed, is not likely to jeopardize the continued existence of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle (Northwest Atlantic DPS).

## 10 INCIDENTAL TAKE STATEMENT

---

### 10.1 Overview

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

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

Section 7(b)(4)(c) of the ESA specifies that to provide an Incidental Take Statement for an endangered or threatened species of marine mammal, the taking must be authorized under Section 101(a)(5) of the MMPA. Since no incidental take of listed marine mammals is anticipated as a result of the proposed action, no statement on incidental take of protected marine mammals is provided and no take is authorized. Nevertheless, the applicant must immediately notify (within 24 hours, if communication is possible) our Office of Protected Resources if a take of a listed marine mammal occurs.

As soon as the applicant becomes aware of any take of an ESA-listed species under NMFS's purview that occurs during the proposed action, the applicant shall report it to NMFS SERO PRD via the [NMFS SERO Endangered Species Take Report Form](https://forms.gle/85fP2da4Ds9jEL829) (<https://forms.gle/85fP2da4Ds9jEL829>). This form shall be completed for each individual known reported capture, entanglement, stranding, or other take incident. Information provided via this form shall include the title, Okaloosa Co BOCC Fish Haven 20 21 22, the issuance date, and ECO tracking number, SERO-2022-01316, for this Opinion; the species name; the date and time of the incident; the general location and activity resulting in capture; condition of the species (i.e., alive, dead, sent to rehabilitation); size of the individual, behavior, identifying features (i.e., presence of tags, scars, or distinguishing marks), and any photos that may have been taken. At that time, consultation may need to be reinitiated.

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

## 10.2 Amount of Extent of Anticipated Incidental Take

NMFS anticipates the total lethal take over the next 150 years as a result of the project will consist of up to 1,184 green sea turtles (North Atlantic DPS), 50 green sea turtles (South Atlantic DPS), up to 2,080 Kemp’s ridley sea turtles, 74 leatherback sea turtles, and 2,119 loggerhead sea turtles (Table 9. Anticipated Future Take by Species and DPS over 150 years. Table 9).

**Table 9. Anticipated Future Take by Species and DPS over 150 years.**

Species	Estimated lethal take during first 25 years	Estimated lethal take during first 50 years	Estimated lethal take during first 75 years	Estimated lethal take during first 100 years	Estimated lethal take over entire 150 years
Green sea turtle (North Atlantic DPS)	0	322	645	968	1,184
Green sea turtle (South Atlantic DPS)	0	13	27	41	50
Kemp’s ridley sea turtle	0	567	1,134	1,701	2,080
Leatherback sea turtle	0	20	40	60	74
Loggerhead sea turtle (Northwest Atlantic DPS)	0	577	1,155	1,733	2,119

Based on the best available data, we do not anticipate any non-lethal take of the species listed above. The level of takes occurring annually is highly variable and influenced by sea temperatures, species abundances, monofilament accumulation, and other factors that cannot be predicted. Because one of the purpose of an ITS is to serve as a reinitiation trigger that provides clear signals that the level of anticipated take has been exceeded and, therefore, would require reexamination of the proposed action through a reinitiated consultation, we express the anticipated future take by species over the course of life of the project. The take numbers during the first 25 years, first 100 years, and 150 years are from Table 5. The take for the first 50 years and 75 years are calculated by dividing the take for the first 100 years by 75 (the years of reef maturity at year 100), and then multiplying the result by the number of years the reef has been mature (i.e., a 50 year reef has been mature for 25 years, and 75 year reef has been mature for 50 years). The resulting numbers were rounded down in order to be conservative for each species for the purpose of triggering reinitiation. The exceedance of any take estimate provided in Table 9 for any defined time period will require reinitiation (i.e., take higher than 0 for any species during the first 25 years of life for any high-relief artificial reef structure placed will require reinitiation).

## 10.3 Effect of Take

NMFS has determined that the anticipated take specified in Section 9.1 is not likely to jeopardize the continued existence of green sea turtle (North Atlantic and South Atlantic DPSs), Kemp’s ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle (Northwest Atlantic DPS) if the project is developed as proposed.

## **10.4 Reasonable and Prudent Measures**

Section 7(b)(4) of the ESA requires NMFS to issue to any federal agency whose proposed action is found to comply with Section 7(a)(2) of the ESA, but may incidentally take individuals of listed species, a statement specifying the impact of that taking. It also states the Reasonable and Prudent Measures necessary to minimize the impacts from the proposed action, and Terms and Conditions to implement those measures, must be provided and followed to minimize those impacts. Only incidental taking that complies with the specified terms and conditions is authorized.

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

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

1. The USACE must ensure that the applicant provides take reports regarding all interactions with ESA-listed species at Okaloosa County BOCC Fish Havens 20, 21, and 22.
2. The USACE must ensure that the applicant minimizes the likelihood of injury or mortality to ESA-listed species resulting from entanglement in lost fishing gear or marine debris that accumulates at Okaloosa County BOCC Fish Havens 20, 21, and 22.
3. The USACE must ensure that the applicant coordinates periodic marine debris removal (i.e., cleanup) events concurrent with required annual monitoring at Okaloosa County BOCC Fish Havens 20, 21, and 22.

## **10.5 Terms and Conditions**

In order to be exempt from take prohibitions established by Section 9 of the ESA, USACE must comply (or ensure that the applicant or its agent(s) comply) with the following Terms and Conditions, which implement the above Reasonable and Prudent Measures:



1. To implement RPM 1, if the applicant discovers or observes any live, damaged, injured or dead individual of an endangered or threatened species during construction or monitoring, the Permittee shall immediately notify the USACE, Jacksonville District Engineer so that any necessary stranding response coordination can be initiated with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service.
2. To implement RPM 1, the federal action agency must ensure that the applicant reports all known captures of ESA-listed species and any other takes of ESA-listed species to the NMFS SERO PRD.
  - a. If and when the applicant becomes aware of any known reported capture, entanglement, stranding, or other take, the applicant must report it to NMFS SERO PRD via the NMFS SERO Endangered Species Take Report Form (<https://forms.gle/85fP2da4Ds9jEL829>).
    - i. This form must reference this Opinion by the NMFS tracking number (SERO-2022-01316 Okaloosa Co BOCC Fish Haven 20 21 22) and date of issuance.
    - ii. This form shall be completed for each individual known reported capture, entanglement, stranding, or other take incident.
    - iii. Information provided via this form shall include the species name; the date and time of the incident; the general location and activity resulting in capture; condition of the species (i.e., alive, dead, sent to rehabilitation); size of the individual, behavior, identifying features (i.e., presence of tags, scars, or distinguishing marks), and any photos that may have been taken.
  - b. Every year, the applicants must submit a summary report of capture, entanglement, stranding, or other take of ESA-listed species at Okaloosa Co BOCC Fish Havens 20 21 22 to NMFS SERO PRD by email: [nmfs.ser.esa.consultations@noaa.gov](mailto:nmfs.ser.esa.consultations@noaa.gov).
    - i. Emails and reports must reference this Opinion by the NMFS tracking number (SERO-2022-01316 Okaloosa Co BOCC Fish Haven 20 21 22) and the date of issuance.
    - ii. The report will contain the following information: the total number of ESA-listed species captures, entanglements, strandings, or other take that was reported at Okaloosa Co BOCC Fish Havens 20, 21, or 22.
    - iii. The report will contain all information for any sea turtles taken to a rehabilitation facility holding an appropriate USFWS Native Endangered and Threatened Species Recovery permit. This information can be obtained from the appropriate State Coordinator for the STSSN (<https://www.fisheries.noaa.gov/state-coordinators-sea-turtle-stranding-and-salvage-network>)
    - iv. The first report will be submitted by January 31 of the year following issuance of the permit and will cover the period from permit issuance through December 31 of that year. The second report will be submitted by January 31 of the following year, and will cover the previous calendar year and the information in the first report. Thereafter, reports will be prepared every year, covering the prior rolling three-year time period, and emailed no later than January 31 of any year.

- v. Reports will include records of the clean-ups required in the terms and conditions in 3, below.
3. To implement RPM 2, the USACE must ensure that the applicant provides to the public educational resources on reducing marine debris along with all physical and online promotional materials for the Okaloosa County artificial reefs. Examples are available at <https://marinedebris.noaa.gov/multimedia/posters>.
4. To implement RPMs 2 and 3, the USACE must ensure that the applicant will:
  - a. Conduct in-water structure cleanups on a regular basis to remove any derelict tackle, fishing line, or marine debris attached to the structure.
  - b. Submit a record of each cleaning event in the report required by T&C 1 above.

## **11 CONSERVATION RECOMMENDATIONS**

---

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

- Conduct or fund research designed to increase the public’s knowledge and awareness of marine debris and its impacts on ESA-listed species.
- Provide funding or resources (e.g., divers, equipment, etc.) to aid annual monitoring and frequent reef clean-ups to prevent the accumulation of lost fishing gear and marine debris.

## **12 REINITIATION OF CONSULTATION**

---

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

### 13 LITERATURE CITED

---

- 81 FR 20057. 2016. Endangered and Threatened Wildlife and Plants; Final Rule To List Eleven Distinct Population Segments of the Green Sea Turtle (*Chelonia mydas*) as Endangered or Threatened and Revision of Current Listings Under the Endangered Species Act. Final Rule. Federal Register 81(66):20057 -20090.
- Ackerman, R. A. 1997. The nest environment and the embryonic development of sea turtles. Pages 83-106 in P. L. Lutz, and J. A. Musick, editors. The Biology of Sea Turtles. CRC Press, Boca Raton, Florida.
- Addison, D. 1997. Sea turtle nesting on Cay Sal, Bahamas, recorded June 2-4, 1996. Bahamas Journal of Science 5(1):34-35.
- Addison, D., and B. Morford. 1996. Sea turtle nesting activity on the Cay Sal Bank, Bahamas. Bahamas Journal of Science 3(3):31-36.
- Aguilar, R., J. Mas, and X. Pastor. 1994. Impact of Spanish swordfish longline fisheries on the loggerhead sea turtle *Caretta caretta* population in the western Mediterranean. Pages 91-96 in J. I. Richardson, and T. H. Richardson, editors. Proceedings of the 12th Annual Workshop on Sea Turtle Biology and Conservation. U.S. Department of Commerce, Jekyll Island, Georgia.
- Aguilar, R., J. Mas, and X. Pastor. 1995. Impact of Spanish swordfish longline fisheries on the loggerhead sea turtle *Caretta caretta* population in the western Mediterranean. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, NOAA Technical Memorandum NMFS-SEFSC-361, Miami, FL.
- Aguirre, A., G. Balazs, T. Spraker, S. K. K. Murakawa, and B. Zimmerman. 2002. Pathology of oropharyngeal fibropapillomatosis in green turtles *Chelonia mydas*. Journal of Aquatic Animal Health 14:298-304.
- Amos, A. F. 1989. The occurrence of Hawksbills (*Eretmochelys imbricata*) along the Texas Coast. Pages 9-11 in S. A. Eckert, K. L. Eckert, and T. H. Richardson, editors. Ninth Annual Workshop on Sea Turtle Conservation and Biology.
- Antonelis, G. A., J. D. Baker, T. C. Johanos, R. C. Braun, and A. L. Harting. 2006. Hawaiian monk seal (*Monachus schauinslandi*): Status and conservation issues. Atoll Research Bulletin 543:75-101.
- Arendt, M., J. Byrd, A. Segars, P. Maier, J. Schwenter, J. B. D. Burgess, J. D. Whitaker, L. Liguori, L. Parker, D. Owens, and G. Blanvillain. 2009. Examination of local movement and migratory behavior of sea turtles during spring and summer along the Atlantic coast off the southeastern United States. South Carolina Department of Natural Resources, Marine Resources Division.
- Avens, L., J. C. Taylor, L. R. Goshe, T. T. Jones, and M. Hastings. 2009. Use of skeletochronological analysis to estimate the age of leatherback sea turtles *Dermochelys coriacea* in the western North Atlantic. Endangered Species Research 8(3):165-177.
- Baker, J., C. Littnan, and D. Johnston. 2006. Potential effects of sea-level rise on terrestrial habitat and biota of the northwestern Hawaiian Islands. Pages 3 in Twentieth Annual Meeting Society for Conservation Biology Conference, San Jose, California.
- Balazs, G. H. 1982. Growth rates of immature green turtles in the Hawaiian Archipelago. Pages 117-125 in K. A. Bjorndal, editor. Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington D.C.

- Balazs, G. H. 1983. Recovery records of adult green turtles observed or originally tagged at French Frigate Shoals, Northwestern Hawaiian Islands. National Oceanographic and Atmospheric Administration, National Marine Fisheries Service, NOAA-TM-NMFS-SWFC-36.
- Balazs, G. H. 1985. Impact of ocean debris on marine turtles: Entanglement and ingestion. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Center, Technical Memorandum NMFS-SWFC-54, Honolulu, HI.
- Balazs, G. H., S. G. Pooley, and S. K. K. Murakawa. 1995. Guidelines for handling marine turtles hooked or entangled in the Hawaii longline fishery: Results of an expert workshop held in Honolulu, Hawaii, March 15-17, 1995. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, NOAA Technical Memorandum NMFS-SWFSC-222, Honolulu, HI.
- Barnette, M.C. 2017. Potential Impacts of Artificial Reef Development on Sea Turtle Conservation in Florida. NOAA Technical Memorandum NMFS-SER-5, 36 pp. doi:10.7289/V5/TM-NMFS-SER-5.
- Bass, A. L., and W. N. Witzell. 2000. Demographic composition of immature green turtles (*Chelonia mydas*) from the east central Florida coast: Evidence from mtDNA markers. *Herpetologica* 56(3):357-367.
- Bass, A. L., D. A. Good, K. A. Bjorndal, J. I. Richardson, Z.-M. Hillis, J. A. Horrocks, and B. W. Bowen. 1996. Testing models of female reproductive migratory behaviour and population structure in the Caribbean hawksbill turtle, *Eretmochelys imbricata*, with mtDNA sequences. *Molecular Ecology* 5:321-328.
- Benson, S. R., T. Eguchi, D. G. Foley, K. A. Forney, H. Bailey, C. Hitipeuw, B. P. Samber, R. F. Tapilatu, V. Rei, P. Ramohia, J. Pita, and P. H. Dutton. 2011. Large-scale movements and high-use areas of western Pacific leatherback turtles, *Dermochelys coriacea*. *Ecosphere* 2(7).
- Benson, S. R., K. A. Forney, J. T. Harvey, J. V. Carretta, and P. H. Dutton. 2007b. Abundance, distribution, and habitat of leatherback turtles (*Dermochelys coriacea*) off California, 1990–2003. *Fishery Bulletin* 105(3):337-347.
- Bjorndal, K. A. 1982. The consequences of herbivory for life history pattern of the Caribbean green turtle, *Chelonia mydas*. Pages 111-116 in *Biology and Conservation of Sea Turtles*. Smithsonian Institution, Washington, D. C.
- Bjorndal, K. A. 1997. Foraging ecology and nutrition of sea turtles. Pages 199–231 in *The Biology of Sea Turtles*. CRC Press, Boca Raton, Florida.
- Bjorndal, K. A., and A. B. Bolten. 2002. Proceedings of a workshop on assessing abundance and trends for in-water sea turtle populations. National Oceanographic and Atmospheric Administration, National Marine Fisheries Service, NMFS-SEFSC-445.
- Bjorndal, K. A., J. A. Wetherall, A. B. Bolten, and J. A. Mortimer. 1999. Twenty-six years of green turtle nesting at Tortuguero, Costa-Rica: An encouraging trend. *Conservation Biology* 13(1):126-134.
- Bjorndal, K. A., A. B. Bolten, and M. Y. Chaloupka. 2005. Evaluating trends in abundance of immature green turtles, *Chelonia mydas*, in the greater Caribbean. *Ecological Applications* 15(1):304-314.

- Bjorndal, K. A., A. B. Bolten, T. Dellinger, C. Delgado, and H. R. Martins. 2003. Compensatory growth in oceanic loggerhead sea turtles: Response to a stochastic environment. *Ecology* 84(5):1237-1249.
- Bolten, A., and B. Witherington. 2003. *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D. C.
- Bolten, A. B., K. A. Bjorndal, and H. R. Martins. 1994. Life history model for the loggerhead sea turtle (*Caretta caretta*) populations in the Atlantic: Potential impacts of a longline fishery. Pages 48-55 in G. J. Balazs, and S. G. Pooley, editors. *Research Plan to Assess Marine Turtle Hooking Mortality*, volume Technical Memorandum NMFS-SEFSC-201. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center.
- Bolten, A. B., K. A. Bjorndal, H. R. Martins, T. Dellinger, M. J. Biscoito, S. E. Encalada, and B. W. Bowen. 1998. Transatlantic developmental migrations of loggerhead sea turtles demonstrated by mtDNA sequence analysis. *Ecological Applications* 8(1):1-7.
- Bostrom, B. L., and D. R. Jones. 2007. Exercise warms adult leatherback turtles. *Comparative Biochemistry and Physiology A: Molecular and Integrated Physiology* 147(2):323-31.
- Bouchard, S., K. Moran, M. Tiwari, D. Wood, A. Bolten, P. Eliazar, and K. Bjorndal. 1998. Effects of exposed pilings on sea turtle nesting activity at Melbourne Beach, Florida. *Journal of Coastal Research* 14(4):1343-1347.
- Boulan, R. H., Jr. 1983. Some notes on the population biology of green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) turtles in the northern U.S. Virgin Islands: 1981-1983. Report to the National Marine Fisheries Service, Grant No. NA82-GA-A-00044.
- Boulon Jr., R. H. 1994. Growth rates of wild juvenile hawksbill turtles, *Eretmochelys imbricata*, in St. Thomas, United States Virgin Islands. *Copeia* 1994(3):811-814.
- Bowen, B. W., A. B. Meylan, J. P. Ross, C. J. Limpus, G. H. Balazs, and J. C. Avise. 1992. Global population structure and natural history of the green turtle (*Chelonia mydas*) in terms of matriarchal phylogeny. *Evolution* 46(4):865-881.
- Bowen, B. W., and W. N. Witzell. 1996. *Proceedings of the International Symposium on Sea Turtle Conservation Genetics*. National Oceanographic and Atmospheric Administration, National Marine Fisheries Service, NMFS-SEFSC-396.
- Bowlby, C. E., G. A. Green, and M. L. Bonnell. 1994. Observations of leatherback turtles offshore of Washington and Oregon. *Northwestern Naturalist* 75(1):33-35.
- Brainard, R. E., and coauthors. 2011. Status review report of 82 candidate coral species petitioned under the U.S. Endangered Species Act. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Fisheries Science Center, NOAA Technical Memorandum NMFS-PIFSC-27, Honolulu, HI.
- Braun, C. D., G. B. Skomal, S. R. Thorrold, and M. L. Berumen. 2015. Movements of the reef manta ray (*Manta alfredi*) in the Red Sea using satellite and acoustic telemetry. *Marine Biology* 162(12):2351-2362
- Brautigam, A., and K. L. Eckert. 2006. *Turning the tide: Exploitation, trade and management of marine turtles in the Lesser Antilles, Central America, Columbia and Venezuela*. TRAFFIC International, Cambridge, United Kingdom.
- Bresette, M., R. A. Scarpino, D. A. Singewald, and E. P. de Maye. 2006. Recruitment of post-pelagic green turtles (*Chelonia mydas*) to nearshore reefs on Florida's southeast coast. Pages 288 in M. Frick, A. Panagopoulou, A. F. Rees, and K. Williams, editors. *Twenty-*

- Sixth Annual Symposium on Sea Turtle Biology and Conservation. International Sea Turtle Society, Athens, Greece.
- Burgess, K. B., and coauthors. 2016. Manta birostris, predator of the deep? Insight into the diet of the giant manta ray through stable isotope analysis. *Royal Society Open Science* 3(11):160717.
- Caldwell, D. K., and A. Carr. 1957. Status of the sea turtle fishery in Florida. Pages 457-463 in J. B. Trefethen, editor Twenty-Second North American Wildlife Conference. Wildlife Management Institute, Statler Hotel, Washington, D. C.
- Campell, C. L., and C. J. Lagueux. 2005. Survival probability estimates for large juvenile and adult green turtles (*Chelonia mydas*) exposed to an artisanal marine turtle fishery in the western Caribbean. *Herpetologica* 61(2):91-103.
- Carballo, J. L., C. Olabarria, and T. G. Osuna. 2002. Analysis of four macroalgal assemblages along the Pacific Mexican coast during and after the 1997-98 El Niño. *Ecosystems* 5(8):749-760.
- Carillo, E., G. J. W. Webb, and S. C. Manolis. 1999. Hawksbill turtles (*Eretmochelys imbricata*) in Cuba: an assessment of the historical harvest and its impacts. *Chelonian Conservation and Biology* 3(2):264-280.
- Carr, A. F. 1986. New perspectives on the pelagic stage of sea turtle development. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Center.
- Carr, T., and N. Carr. 1991. Surveys of the sea turtles of Angola. *Biological Conservation* 58(1):19-29.
- Chaloupka, M. 2002. Stochastic simulation modelling of southern Great Barrier Reef green turtle population dynamics. *Ecological Modelling* 148(1):79-109.
- Chaloupka, M., and C. Limpus. 2005. Estimates of sex- and age-class-specific survival probabilities for a southern Great Barrier Reef green sea turtle population. *Marine Biology* 146(6):1251-1261.
- Chaloupka, M., T. M. Work, G. H. Balazs, S. K. K. Murakawa, and R. Morris. 2008. Cause-specific temporal and spatial trends in green sea turtle strandings in the Hawaiian Archipelago (1982-2003). *Marine Biology* 154(5):887-898.
- Chaloupka, M., C. Limpus, and J. Miller. 2004. Green turtle somatic growth dynamics in a spatially disjunct Great Barrier Reef metapopulation. *Coral Reefs* 23(3):325-335.
- Chaloupka, M. Y., and C. J. Limpus. 1997. Robust statistical modelling of hawksbill sea turtle growth rates (southern Great Barrier Reef). *Marine Ecology Progress Series* 146(1-3):1-8.
- Chaloupka, M. Y., and J. A. Musick. 1997. Age growth and population dynamics. Pages 233-276 in P. L. Lutz, and J. A. Musick, editors. *The Biology of Sea Turtles*. CRC Press, Boca Raton, Florida
- Chaloupka, M. Y., and J. A. Musick. 1997. Age growth and population dynamics. Pages 233-276 in P. L. Lutz, and J. A. Musick, editors. *The Biology of Sea Turtles*. CRC Press, Boca Raton, Florida.
- Chassot, E., M. Amandè, C. Pierre, R. Pianet, and R. Dédo. 2008. Some preliminary results on tuna discards and bycatch in the French purse seine fishery of the eastern Atlantic Ocean. *Collective Volume Of Scientific Papers* 64.
- Chin, A., P. Kyne, T. Walker, and R. McAuley. 2010. An integrated risk assessment for climate change: Analysing the vulnerability of sharks and rays on Australia's Great Barrier Reef. *Global Change Biology* 16:1936-1953.

- CITES. 2013. Consideration of proposals for amendment of Appendices I and II: Manta Rays. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Sixteenth Meeting of the Conference of the Parties, CoP16 Prop. 46 (Rev. 2), Bangkok, Thailand.
- Clark, T. B. 2010. Abundance, home range, and movement patterns of manta rays (*Manta alfredi*, *M. birostris*) in Hawai'i. Dissertation. University of Hawai'i at Mānoa, Honolulu, HI.
- Coles, R. J. 1916. Natural history notes on the devil-fish, *Manta birostris* (Walbaum) and *Mobula olfersi* (Muller). Bulletin of the American Museum of Natural History 35(33):649-657.
- Conant, T. A., P. H. Dutton, T. Eguchi, S. P. Epperly, C. C. Fahy, M. H. Godfrey, S. L. MacPherson, E. E. Possardt, B. A. Schroeder, J. A. Seminoff, M. L. Snover, C. M. Upton, and B. E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. National Oceanic and Atmospheric Administration, National Marine Fisheries Service.
- Convention on Migratory Species. 2014. Proposal for the inclusion of the reef manta ray (*Manta alfredi*) in CMS Appendix I and II. Convention on Migratory Species (CMS), 18th Meeting of the Scientific Council, UNEP/CMS/ScC18/Doc.7.2.9, Bonn, Germany.
- Cook, M., and coauthors. 2016. Hooked on Kemp's - Preliminary results of Mississippi's angler survey. Pages 223-224 in L. Belskis, A. Frey, M. Jenson, R. LeRoux, and K. Stewart (compilers), editors. Proceedings of the Thirty-fourth Annual Symposium on Sea Turtle Biology and Conservation. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, NOAA Technical Memorandum NOAA NMFS-SEFSC-701, Miami, FL.
- Couturier, L. I. E., and coauthors. 2012. Biology, ecology and conservation of the Mobulidae. Journal of Fish Biology 80(5):1075-1119.
- Couturier, L. I. E., and coauthors. 2013. Stable isotope and signature fatty acid analyses suggest reef manta rays feed on demersal zooplankton. PLOS ONE 8(10):e77152.
- Crabbe, M. J. 2008. Climate change, global warming and coral reefs: modelling the effects of temperature. Computational Biology and Chemistry 32(5):311-4.
- Crouse, D. T. 1999. Population modeling and implications for Caribbean hawksbill sea turtle management Chelonian Conservation and Biology 3(2):185-188.
- Daniels, R. C., T. W. White, and K. K. Chapman. 1993. Sea-level rise - destruction of threatened and endangered species habitat in South Carolina. Environmental Management 17(3):373-385.
- Davenport, J., D. L. Holland, and J. East. 1990. Thermal and biochemical characteristics of the lipids of the leatherback turtle (*Dermochelys coriacea*): Evidence of endothermy. Journal of the Marine Biological Association of the United Kingdom 70:33-41.
- Diez, C. E., and R. P. Van Dam. 2002. Habitat effect on hawksbill turtle growth rates on feeding grounds at Mona and Monito Islands, Puerto Rico. Marine Ecology Progress Series 234:301-309.
- Diez, C. E., and R. P. Van Dam. 2007. In-water surveys for marine turtles at foraging grounds of Culebra Archipelago, Puerto Rico
- D'Ilio, S., D. Mattei, M. F. Blasi, A. Alimonti, and S. Bogianni. 2011. The occurrence of chemical elements and POPs in loggerhead turtles (*Caretta caretta*): An overview. Marine Pollution Bulletin 62(8):1606-1615.

- Dodd Jr., C. K. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service, 88(14).
- Doughty, R. W. 1984. Sea turtles in Texas: A forgotten commerce. *Southwestern Historical Quarterly* 88:43-70.
- Dow, W., K. Eckert, M. Palmer, and P. Kramer. 2007. An atlas of sea turtle nesting habitat for the wider Caribbean region. The Wider Caribbean Sea Turtle Conservation Network and The Nature Conservancy, Beaufort, North Carolina.
- Dulvy, N. K., S. A. Pardo, C. A. Simpfendorfer, and J. K. Carlson. 2014. Diagnosing the dangerous demography of manta rays using life history theory. *PeerJ Preprints* 2.
- Duque, V. M., V. M. Paez, and J. A. Patino. 2000. Ecología de anidación y conservación de la tortuga cana, *Dermochelys coriacea*, en la Playona, Golfo de Uraba Chocoano (Colombia), en 1998 *Actualidades Biológicas Medellín* 22(72):37-53.
- Dutton, D. L., P. H. Dutton, M. Chaloupka, and R. H. Boulon. 2005. Increase of a Caribbean leatherback turtle *Dermochelys coriacea* nesting population linked to long-term nest protection. *Biological Conservation* 126(2):186-194.
- DWH Trustees. 2015. Deepwater Horizon Oil Spill: Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement. Retrieved from <http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/>.
- Dwyer, K. L., C. E. Ryder, and R. Prescott. 2003. Anthropogenic mortality of leatherback turtles in Massachusetts waters. Pages 260 in J. A. Seminoff, editor *Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation*, Miami, Florida.
- Eckert, K. L. 1995. Hawksbill sea turtle (*Eretmochelys imbricata*). Pages 76-108 in *National Marine Fisheries Service and U.S. Fish and Wildlife Service Status Reviews for Sea Turtles Listed under the Endangered Species Act of 1973*. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Springs, Maryland.
- Eckert, K. L., J. A. Overing, and B. B. Lettsome. 1992. Sea turtle recovery action plan for the British Virgin Islands. UNEP Caribbean Environment Programme, Wider Caribbean Sea Turtle Recovery Team and Conservation Network, Kingston, Jamaica.
- Eckert, K. L., and S. A. Eckert. 1990. Embryo mortality and hatch success in (*in situ*) and translocated leatherback sea turtle (*Dermochelys coriacea*) eggs. *Biological Conservation* 53:37-46.
- Eckert, K. L., S. A. Eckert, T. W. Adams, and A. D. Tucker. 1989. Inter-nesting migrations by leatherback sea turtles (*Dermochelys coriacea*) in the West Indies. *Herpetologica* 45(2):190-194.
- Eckert, K. L., B. P. Wallace, J. G. Frazier, S. A. Eckert, and P. C. H. Pritchard. 2012. Synopsis of the biological data on the leatherback sea turtle (*Dermochelys coriacea*). U.S. Fish and Wildlife Service.
- Eckert, S. A. 1989. Diving and foraging behavior of the leatherback sea turtle, *Dermochelys coriacea*. University of Georgia, Athens, Georgia.
- Eckert, S. A. 2006. High-use oceanic areas for Atlantic leatherback sea turtles (*Dermochelys coriacea*) as identified using satellite telemetered location and dive information. *Marine Biology* 149(5):1257-1267.
- Eckert, S. A., D. Bagley, S. Kubis, L. Ehrhart, C. Johnson, K. Stewart, and D. DeFreese. 2006. Internesting and postnesting movements and foraging habitats of leatherback sea turtles



- (*Dermochelys coriacea*) nesting in Florida. *Chelonian Conservation and Biology* 5(2):239-248.
- Eckert, S. A., D. W. Nellis, K. L. Eckert, and G. L. Kooyman. 1984. Deep diving record for leatherbacks. *Marine Turtle Newsletter* 31:4.
- Eckert, S. A., and L. Sarti. 1997. Distant fisheries implicated in the loss of the world's largest leatherback nesting population. *Marine Turtle Newsletter* 78:2-7.
- Eguchi, T., P. H. Dutton, S. A. Garner, and J. Alexander-Garner. 2006. Estimating juvenile survival rates and age at first nesting of leatherback turtles at St. Croix, U.S. Virgin Islands. Pages 292-293 in M. Frick, A. Panagopoulou, A. F. Rees, and K. Williams, editors. Twenty-Sixth Annual Symposium on Sea Turtle Biology and Conservation. International Sea Turtle Society, Athens, Greece.
- Ehrhart, L. M. 1983. Marine turtles of the Indian River Lagoon System. *Florida Scientist* 46(3/4):337-346.
- Ehrhart, L. M., and R. G. Yoder. 1978. Marine turtles of Merritt Island National Wildlife Refuge, Kennedy Space Centre, Florida. *Florida Marine Research Publications* 33:25-30.
- Ehrhart, L. M., W. E. Redfoot, and D. A. Bagley. 2007. Marine turtles of the central region of the Indian River Lagoon System, Florida. *Florida Scientist* 70(4):415-434.
- Epperly, S. P., J. Braun-McNeill, and P. M. Richards. 2007. Trends in catch rates of sea turtles in North Carolina, USA. *Endangered Species Research* 3(3):283-293.
- Ferraroli, S., J. Y. Georges, P. Gaspar, and Y. Le Maho. 2004. Where leatherback turtles meet fisheries. *Nature* 429:521-522.
- Fish, M. R., I. M. Cote, J. A. Gill, A. P. Jones, S. Renshoff, and A. R. Watkinson. 2005. Predicting the Impact of Sea-Level Rise on Caribbean Sea Turtle Nesting Habitat. *Conservation Biology* 19(2):482-491.
- FitzSimmons, N. N., L. W. Farrington, M. J. McCann, C. J. Limpus, and C. Moritz. 2006. Green turtle populations in the Indo-Pacific: A (genetic) view from microsatellites. Pages 111 in N. Pilcher, editor Twenty-Third Annual Symposium on Sea Turtle Biology and Conservation.
- Fleming, E. H. 2001. *Swimming Against the Tide: Recent Surveys of Exploitation, Trade, And Management of Marine Turtles In the Northern Caribbean*. TRAFFIC North America, Washington, D.C., USA.
- Foley, A. M., B. A. Schroeder, A. E. Redlow, K. J. Fick-Child, and W. G. Teas. 2005. Fibropapillomatosis in stranded green turtles (*Chelonia mydas*) from the eastern United States (1980-98): Trends and associations with environmental factors. *Journal of Wildlife Diseases* 41(1):29-41.
- Foley, A. M., K. E. Singel, P. H. Dutton, T. M. Summers, A. E. Redlow, and J. Lessman. 2007. Characteristics of a green turtle (*Chelonia mydas*) assemblage in northwestern Florida determined during a hypothermic stunning event. *Gulf of Mexico Science* 25(2):131-143.
- Foley, A. M., B. A. Schroeder, and S. L. MacPherson. 2008. Post-nesting migrations and resident areas of Florida loggerheads (*Caretta caretta*). Pages 75-76 in H. J. Kalb, A. S. Rhode, K. Gayheart, and K. Shanker, editors. Twenty-Fifth Annual Symposium on Sea Turtle Biology and Conservation. U.S. Department of Commerce, Savannah, Georgia.
- Formia, A. 1999. Les tortues marines de la Baie de Corisco. *Canopee* 14: i-ii.
- Frazer, N. B., and L. M. Ehrhart. 1985. Preliminary growth models for green, (*Chelonia mydas*) and loggerhead, (*Caretta caretta*), turtles in the wild. *Copeia* 1985(1):73-79.

- Fretey, J. 2001. Biogeography and conservation of marine turtles of the Atlantic Coast of Africa, UNEbraskaP/CMississippi Secretariat.
- Fretey, J., A. Billes, and M. Tiwari. 2007. Leatherback, *Dermochelys coriacea*, nesting along the Atlantic coast of Africa. *Chelonian Conservation and Biology* 6(1):126-129.
- Garcia M., D., and L. Sarti. 2000. Reproductive cycles of leatherback turtles. Pages 163 in F. A. Abreu-Grobois, R. Briseno-Duenas, R. Marquez, and L. Sarti, editors. Eighteenth International Sea Turtle Symposium.
- Garduño-Andrade, M., V. Guzmán, E. Miranda, R. Briseño-Dueñas, and F. A. Abreu-Grobois. 1999. Increases in hawksbill turtle (*Eretmochelys imbricata*) nestings in the Yucatán Peninsula, Mexico, 1977-1996: Data in support of successful conservation? *Chelonian Conservation and Biology* 3(2):286-295.
- Garrett, C. 2004. Priority Substances of Interest in the Georgia Basin - Profiles and background information on current toxics issues. Canadian Toxics Work Group Puget Sound, Georgia Basin International Task Force, GBAP Publication No. EC/GB/04/79.
- Gavilan, F.M. 2001. Status and distribution of the loggerhead turtle, *Caretta caretta*, in the wider Caribbean region. Pages 36-40 in K. L. Eckert, and F. A. Abreu Grobois, editors. *Marine Turtle Conservation in the Wider Caribbean Region - A Dialogue for Effective Regional Management*, Santo Domingo, Dominican Republic.
- Geraci, J. R. 1990. Physiologic and toxic effects on cetaceans. Pages 167-197 in J. R. Geraci, and D. J. S. Aubin, editors. *Sea Mammals and Oil: Confronting the Risks*. Academic Press, San Diego.
- Germanov, E. S., and A. D. Marshall. 2014. Running the gauntlet: regional movement patterns of *Manta alfredi* through a complex of parks and fisheries. *PLOS ONE* 9(10):e110071.
- Germanov, E. S., and coauthors. 2019. Microplastics on the menu: Plastics pollute Indonesian manta ray and whale shark feeding grounds. *Frontiers in Marine Science* 6(679).
- Girard, C., A. D. Tucker, and B. Calmettes. 2009. Post-nesting migrations of loggerhead sea turtles in the Gulf of Mexico: Dispersal in highly dynamic conditions. *Marine Biology* 156(9):1827-1839.
- Girondot, M., and coauthors. 2015. Spatio-temporal distribution of *Manta birostris* in French Guiana waters. *Journal of the Marine Biological Association of the United Kingdom* 95(1):153-160.
- Gladys Porter Zoo. 2013. Gladys Porter Zoo's Preliminary Annual Report on the Mexico/United States of America Population Restoration Project for the Kemp's Ridley Sea Turtle, *Lepidochelys kempii*, on the Coasts of Tamaulipas, Mexico 2013.
- Goff, G. P., and J. Lien. 1988. Atlantic leatherback turtles, *Dermochelys coriacea*, in cold water off Newfoundland and Labrador. *Canadian Field-Naturalist* 102:1-5.
- Gonzalez Carman, V., K. Alvarez, L. Prosdocimi, M. C. Inchaurreaga, R. Dellacasa, A. Faiella, C. Echenique, R. Gonzalez, J. Andrejuk, H. Mianzan, C. Campagna, and D. Albareda. 2011. Argentinian coastal waters: A temperate habitat for three species of threatened sea turtles. *Marine Biology Research* 7:500-508.
- Groombridge, B. 1982. Kemp's ridley or Atlantic ridley, *Lepidochelys kempii* (Garman 1980). *The IUCN Amphibia, Reptilia Red Data Book*:201-208
- Groombridge, B., and R. Luxmoore. 1989. *The Green Turtle and Hawksbill (Reptilia: Cheloniidae): World Status, Exploitation and Trade*. Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Lausanne, Switzerland.

- Graham, T. R. 2009. Scyphozoan jellies as prey for leatherback sea turtles off central California. Master's Theses. San Jose State University.
- Graham, N. A. J., and coauthors. 2008. Climate Warming, Marine Protected Areas and the Ocean-Scale Integrity of Coral Reef Ecosystems. *PLOS ONE* 3(8):e3039.
- Graham, R. T., and coauthors. 2012. Satellite tracking of manta rays highlights challenges to their conservation. *PLOS ONE* 7(5).
- Grant, S. C. H., and P. S. Ross. 2002. Southern Resident killer whales at risk: Toxic chemicals in the British Columbia and Washington environment. Department of Fisheries and Oceans Canada, Sidney, B.C.
- Green, D. 1993. Growth rates of wild immature green turtles in the Galápagos Islands, Ecuador. *Journal of Herpetology* 27(3):338-341.
- Greer, A. E. J., J. D. J. Lazell, and R. M. Wright. 1973. Anatomical evidence for a counter-current heat exchanger in the leatherback turtle (*Dermochelys coriacea*). *Nature* 244:181.
- Gudger, E. W. 1922. The most northerly record of the capture in Atlantic waters of the United States of the giant ray, *Manta birostris*. *Science* 55(1422):338-340.
- Guinder, V. A., and J. C. Molinero. 2013. Climate change effects on marine phytoplankton. Pages 68-90 in A. H. Arias, and M. C. Menendez, editors. *Marine Ecology in a Changing World*. CRC Press, Boca Raton, FL.
- Guseman, J. L., and L. M. Ehrhart. 1992. Ecological geography of western Atlantic loggerheads and green turtles: Evidence from remote tag recoveries. Pages 50 in M. Salmon, and J. Wyneken, editors. *Eleventh Annual Workshop on Sea Turtle Biology and Conservation*. U.S. Department of Commerce, Jekyll Island, Georgia.
- Hart, K. M., M. M. Lamont, I. Fujisaki, A. D. Tucker, and R. R. Carthy. 2012. Common coastal foraging areas for loggerheads in the Gulf of Mexico: Opportunities for marine conservation. *Biological Conservation* 145:185-194.
- Hartwell, S. I. 2004. Distribution of DDT in sediments off the central California coast. *Marine Pollution Bulletin* 49(4):299-305.
- Hawkes, L. A., A. C. Broderick, M. H. Godfrey, and B. J. Godley. 2007. Investigating the potential impacts of climate change on a marine turtle population. *Global Change Biology* 13:1-10.
- Hays, G. C., J. D. R. Houghton, and A. E. Myers. 2004. Pan-Atlantic leatherback turtle movements. *Nature* 429:522.
- Hays, G. C., S. Åkesson, A. C. Broderick, F. Glen, B. J. Godley, P. Luschi, C. Martin, J. D. Metcalfe, and F. Papi. 2001. The diving behavior of green turtles undertaking oceanic migration to and from Ascension Island: Dive durations, dive profiles, and depth distribution. *Journal of Experimental Biology* 204:4093-4098.
- Hays, G. C., A. C. Broderick, F. Glen, B. J. Godley, J. D. R. Houghton, and J. D. Metcalfe. 2002. Water temperature and interesting intervals for loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles. *Journal of Thermal Biology* 27(5):429-432.
- Hearn, A. R., and coauthors. 2014. Elasmobranchs of the Galapagos Marine Reserve. Pages 23-59 in J. Denking, and L. Vinuesa, editors. *Social and Ecological Interactions in the Galapagos Island, The Galapagos Marine Reserve: A dynamic social-ecological system*. Springer, New York, NY.
- Heinrichs, S., M. O'Malley, H. Medd, and P. Hilton. 2011. Global Threat to Manta and Mobula Rays. *Manta Ray of Hope, 2011 Report*.

- Heppell, S. S., L. B. Crowder, and T. R. Menzel. 1999. Life table analysis of long-lived marine species with implications for conservation and management. Pages 137-148 in American Fisheries Society Symposium.
- Heppell, S. S., M. L. Snover, and L. Crowder. 2003. Sea turtle population ecology. Pages 275-306 in P. Lutz, J. A. Musick, and J. Wyneken, editors. *The Biology of Sea Turtles*. CRC Press, Boca Raton, Florida.
- Heppell, S. S., L. B. Crowder, D. T. Crouse, S. P. Epperly, and N. B. Frazer. 2003. Population models for Atlantic loggerheads: Past, present, and future. Pages 255-273 in A. Bolten, and B. Witherington, editors. *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D. C.
- Heppell, S. S., D. T. Crouse, L. B. Crowder, S. P. Epperly, W. Gabriel, T. Henwood, R. Márquez, and N. B. Thompson. 2005. A population model to estimate recovery time, population size, and management impacts on Kemp's ridley sea turtles. *Chelonian Conservation and Biology* 4(4):767-773.
- Herbst, L. H. 1994. Fibropapillomatosis of marine turtles. *Annual Review of Fish Diseases* 4:389-425.
- Herbst, L. H., E. R. Jacobson, R. Moretti, T. Brown, J. P. Sundberg, and P. A. Klein. 1995. An infectious etiology for green turtle fibropapillomatosis. *Proceedings of the American Association for Cancer Research Annual Meeting* 36:117.
- Heron, S. F., C. M. Eakin, J. A. Maynard, and R. van Hooidek. 2016. Impacts and effects of ocean warming on coral reefs. Pages 177-197 in D. Laffoley, and J. M. Baxter, editors. *Explaining Ocean Warming: Causes, scale, effects and consequences*. IUCN, Gland, Switzerland.
- Hildebrand, H. H. 1963. Hallazgo del area de anidacion de la tortuga marina "lora", *Lepidochelys kempi* (Garman), en la costa occidental del Golfo de Mexico (Rept., Chel.). *Ciencia, Mexico* 22:105-112.
- Hildebrand, H. H. 1982. A historical review of the status of sea turtle populations in the western Gulf of Mexico. Pages 447-453 in K. A. Bjorndal, editor. *Biology and Conservation of Sea Turtles*. Smithsonian Institution Press, Washington, D. C.
- Hill, A. 2013. Fishing piers and protected species: An assessment of the presence and effectiveness of conservation measures in Charlotte and Lee County, Florida. University of Miami, Rosenstiel School of Marine and Atmospheric Science, Master's of Professional Science internship report, Miami, FL.
- Hillis, Z.-M., and A. L. Mackay. 1989. Research report on nesting and tagging of hawksbill sea turtles *Eretmochelys imbricata* at Buck Island Reef National Monument, U.S. Virgin Islands, 1987-88.
- Hilterman, M., E. Goverse, M. Godfrey, M. Girondot, and C. Sakimin. 2003. Seasonal sand temperature profiles of four major leatherback nesting beaches in the Guyana Shield. Pages 189-190 in J. A. Seminoff, editor *Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation*.
- Hirth, H. F. 1971. Synopsis of biological data on the green turtle *Chelonia mydas* (Linnaeus) 1758. Food and Agriculture Organization.
- Hirth, H. F. 1997. Synopsis of the biological data on the green turtle *Chelonia mydas* (Linnaeus 1758). *Biological Report* 91(1):120.

- Hirth, H. F., and E. M. A. Latif. 1980. A nesting colony of the hawksbill turtle (*Eretmochelys imbricata*) on Seil Ada Kebir Island, Suakin Archipelago, Sudan. *Biological Conservation* 17:125-130.
- Hirth, H., J. Kasu, and T. Mala. 1993. Observations on a leatherback turtle *Dermochelys coriacea* nesting population near Piguwa, Papua New Guinea. *Biological Conservation* 65:77-82.
- Houghton, J. D. R., T. K. Doyle, M. W. Wilson, J. Davenport, and G. C. Hays. 2006. Jellyfish aggregations and leatherback turtle foraging patterns in a temperate coastal environment. *Ecology* 87(8):1967-1972.
- Hughes, G. R. 1996. Nesting of the leatherback turtle (*Dermochelys coriacea*) in Tongaland, KwaZulu-Natal, South Africa, 1963-1995. *Chelonian Conservation Biology* 2(2):153-158.
- Iwata, H., S. Tanabe, N. Sakai, and R. Tatsukawa. 1993. Distribution of persistent organochlorines in the oceanic air and surface seawater and the role of ocean on their global transport and fate. *Environmental Science and Technology* 27(6):1080-1098.
- Intergovernmental Panel on Climate Change. 2013. Climate Change 2013: The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change, Cambridge, United Kingdom; New York, NY.
- Jacobson, E. R. 1990. An update on green turtle fibropapilloma. *Marine Turtle Newsletter* 49:7-8.
- Jacobson, E. R., J. L. Mansell, J. P. Sundberg, L. Hajjar, M. E. Reichmann, L. M. Ehrhart, M. Walsh, and F. Murru. 1989. Cutaneous fibropapillomas of green turtles (*Chelonia mydas*). *Journal Comparative Pathology* 101:39-52.
- Jacobson, E. R., S. B. Simpson Jr., and J. P. Sundberg. 1991. Fibropapillomas in green turtles. Pages 99-100 in G. H. Balazs, and S. G. Pooley, editors. *Research Plan for Marine Turtle Fibropapilloma*, volume NOAA-TM-NMFS-SWFSC-156.
- Jambeck, J. R., and coauthors. 2015. Plastic waste inputs from land into the ocean. *Science* 347(6223):768-771.
- James, M. C., S. A. Eckert, and R. A. Myers. 2005. Migratory and reproductive movements of male leatherback turtles (*Dermochelys coriacea*). *Marine Biology* 147(4):845-853.
- James, M. C., S. A. Sherrill-Mix, and R. A. Myers. 2007. Population characteristics and seasonal migrations of leatherback sea turtles at high latitudes. *Marine Ecology Progress Series* 337:245-254.
- Johnson, S. A., and L. M. Ehrhart. 1994. Nest-site fidelity of the Florida green turtle. Pages 83 in B. A. Schroeder, and B. E. Witherington, editors. *Thirteenth Annual Symposium on Sea Turtle Biology and Conservation*.
- Johnson, S. A., and L. M. Ehrhart. 1996. Reproductive ecology of the Florida green turtle: Clutch frequency. *Journal of Herpetology* 30(3):407-410.
- Jones, G. P., M. I. McCormick, M. Srinivasan, and J. V. Eagle. 2004. Coral decline threatens fish biodiversity in marine reserves. *Proc Natl Acad Sci U S A* 101(21):8251-8253.
- Jones, T. T., M. D. Hastings, B. L. Bostrom, D. Pauly, and D. R. Jones. 2011. Growth of captive leatherback turtles, *Dermochelys coriacea*, with inferences on growth in the wild: Implications for population decline and recovery. *Journal of Experimental Marine Biology and Ecology* 399(1):84-92.

- Kashiwagi, T., T. Ito, and F. Sato. 2010. Occurrences of reef manta ray, *Manta alfredi*, and giant manta ray, *M. birostris*, in Japan, examined by photographic records. *Japanese Society for Elasmobranch Studies* 46:20-27.
- Kashiwagi, T., A. D. Marshall, M. B. Bennett, and J. R. Ovenden. 2011. Habitat segregation and mosaic sympatry of the two species of manta ray in the Indian and Pacific Oceans: *Manta alfredi* and *M. birostris*. *Marine Biodiversity Records* 4:1-8.
- Keinath, J. A., and J. A. Musick. 1993. Movements and diving behavior of a leatherback turtle, *Dermochelys coriacea*. *Copeia* 1993(4):1010-1017.
- Lagueux, C. J. 2001. Status and distribution of the green turtle, *Chelonia mydas*, in the wider Caribbean region. Pages 32-35 in K. L. Eckert, and F. A. Abreu Grobois, editors. *Marine Turtle Conservation in the Wider Caribbean Region - A Dialogue for Effective Regional Management*, Santo Domingo, Dominican Republic.
- Laurent, L., P. Casale, M. N. Bradai, B. J. Godley, G. Gerosa, A. C. Broderick, W. Schroth, B. Schierwater, A. M. Levy, D. Freggi, E. M. A. El-Mawla, D. A. Hadoud, H. E. Gomati, M. Domingo, M. Hadjichristophorou, L. Kornaraky, F. Demirayak, and C. H. Gautier. 1998. Molecular resolution of marine turtle stock composition in fishery by-catch: A case study in the Mediterranean. *Molecular Ecology* 7:1529-1542.
- Law, R. J., C. F. Fileman, A. D. Hopkins, J. R. Baker, J. Harwood, D. B. Jackson, S. Kennedy, A. R. Martin, and R. J. Morris. 1991. Concentrations of trace metals in the livers of marine mammals (seals, porpoises and dolphins) from waters around the British Isles. *Marine Pollution Bulletin* 22(4):183-191.
- Lawson, J. M., and coauthors. 2017. Sympathy for the devil: a conservation strategy for devil and manta rays. *PeerJ* 5:e3027.
- Lawson, J. M., and coauthors. 2016. Sympathy for the devil: A conservation strategy for devil and manta rays. *PeerJ* 5:e3027.
- León, Y. M., and C. E. Diez. 1999. Population structure of hawksbill turtles on a foraging ground in the Dominican Republic. *Chelonian Conservation and Biology* 3(2):230-236.
- León, Y. M., and C. E. Diez. 2000. Ecology and population biology of hawksbill turtles at a Caribbean feeding ground. Pages 32-33 in F. A. Abreu-Grobois, R. Briseño-Dueñas, R. Márquez-Millán, and L. Sarti-Martinez, editors. *Eighteenth International Sea Turtle Symposium*. U.S. Department of Commerce, Mazatlán, Sinaloa, México.
- Lezama, C. 2009. impacto de la pesquería artesanal sobre la tortuga verde (*Chelonia mydas*) en las costas del Rio de la Plata exterior. Universidad de la República.
- Lima, E. H. S. M., M. T. D. Melo, and P. C. R. Barata. 2010. Incidental capture of sea turtles by the lobster fishery off the Ceará Coast, Brazil. *Marine Turtle Newsletter* 128:16-19.
- Limpus, C. J. 1992. The hawksbill turtle, *Eretmochelys imbricata*, in Queensland: Population structure within a southern Great Barrier Reef feeding ground. *Australian Wildlife Research* 19:489-506.
- Limpus, C. J., and J. D. Miller. 2000. Final report for Australian hawksbill turtle population dynamics project. Queensland Parks and Wildlife Service.
- López-Barrera, E. A., G. O. Longo, and E. L. A. Monteiro-Filho. 2012. Incidental capture of green turtle (*Chelonia mydas*) in gillnets of small-scale fisheries in the Paranaguá Bay, Southern Brazil. *Ocean and Coastal Management* 60:11-18.
- López-Mendilaharsu, M., A. Estrades, M. A. C. Caraccio, V., M. Hernández, and V. Quirici. 2006. Biología, ecología y etología de las tortugas marinas en la zona costera uruguayana, Montevideo, Uruguay: Vida Silvestre, Uruguay.

- Lund, F. P. 1985. Hawksbill turtle (*Eretmochelys imbricata*) nesting on the East Coast of Florida. *Journal of Herpetology* 19(1):166-168.
- Lutcavage, M., P. Plotkin, B. Witherington, and P. Lutz. 1997. Human impacts on sea turtle survival. Pages 387–409 in P. Lutz, and J. A. Musick, editors. *The Biology of Sea Turtles*, volume 1. CRC Press, Boca Raton, Florida.
- Mackay, A. L. 2006. 2005 sea turtle monitoring program the East End beaches (Jack's, Isaac's, and East End Bay) St. Croix, U.S. Virgin Islands. Nature Conservancy.
- Maharaj, A. M. 2004. A comparative study of the nesting ecology of the leatherback turtle *Dermochelys coriacea* in Florida and Trinidad. University of Central Florida, Orlando, Florida.
- Marcovaldi, N., B. B. Gifforni, H. Becker, F. N. Fiedler, and G. Sales. 2009. Sea Turtle Interactions in Coastal Net Fisheries in Brazil. U.S. National Marine Fisheries Service, Southeast Fisheries Science Center: Honolulu, Gland, Switze, Honolulu, Hawaii, USA.
- Márquez M., R. 1990. Sea turtles of the world. An annotated and illustrated catalogue of sea turtle species known to date, Rome.
- Márquez M., R. 1994. Synopsis of biological data on the Kemp's ridley sea turtle, *Lepidochelys kempii* (Garman, 1880). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Center.
- Marshall, A., and coauthors. 2011. *Manta birostris*. The IUCN Red List of Threatened Species.
- Marshall, A. D., L. J. V. Compagno, and M. B. Bennett. 2009. Redescription of the genus *Manta* with resurrection of *Manta alfredi* (Krefft, 1868) (Chondrichthyes; Myliobatoidei; Mobulidae). *Zootaxa* 2301:1-28.
- Matkin, C. O., and E. Saulitis. 1997. Restoration notebook: Killer whale (*Orcinus orca*). Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.
- Matos, R. 1986. Sea turtle hatchery project with specific reference to the leatherback turtle (*Dermochelys coriacea*), Humacao, Puerto Rico 1986. Puerto Rico Department of Natural Resources, de Tierra, Puerto Rico.
- Mayor, P. A., B. Phillips, and Z.-M. Hillis-Starr. 1998. Results of the stomach content analysis on the juvenile hawksbill turtles of Buck Island Reef National Monument, U.S.V.I. Pages 230-233 in S. P. Epperly, and J. Braun, editors. Seventeenth Annual Sea Turtle Symposium.
- McDonald, D. L., and P. H. Dutton. 1996. Use of PIT tags and photoidentification to revise remigration estimates of leatherback turtles (*Dermochelys coriacea*) nesting in St. Croix, U.S. Virgin Islands, 1979-1995. *Chelonian Conservation and Biology* 2(2):148-152.
- McMichael, E., R. R. Carthy, and J. A. Seminoff. 2003. Evidence of homing behavior in juvenile green turtles in the northeastern Gulf of Mexico. Pages 223-224 in J. A. Seminoff, editor Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation.
- Medeiros, A. M., O. J. Luiz, and C. Domit. 2015. Occurrence and use of an estuarine habitat by giant manta ray *Manta birostris*. *Journal of Fish Biology* 86(6):1830-1838.
- Meylan, A. 1988. Spongivory in hawksbill turtles: A diet of glass. *Science* 239(4838):393-395.
- Meylan, A., and M. Donnelly. 1999. Status justification for listing the hawksbill turtle (*Eretmochelys imbricata*) as critically endangered on the 1996 IUCN Red List of threatened animals. *Chelonian Conservation and Biology* 3(2):200-224.
- Meylan, A. B. 1999a. International movements of immature and adult hawksbill turtles (*Eretmochelys imbricata*) in the Caribbean region. *Chelonian Conservation and Biology* 3(2):189-194.

- Meylan, A. B. 1999b. Status of the hawksbill turtle (*Eretmochelys imbricata*) in the Caribbean region. *Chelonian Conservation and Biology* 3(2):177-184.
- Meylan, A., B. Schroeder, and A. Mosier. 1994. Marine turtle nesting activity in the State of Florida, 1979-1992. Pages 83 in K. A. Bjorndal, A. B. Bolten, D. A. Johnson, and P. J. Eliazar, editors. Fourteenth Annual Symposium on Sea Turtle Biology and Conservation.
- Meylan, A. B., B. A. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the State of Florida 1979-1992. *Florida Department of Environmental Protection* (52):63.
- Milessi, A. C., and M. C. Oddone. 2003. Primer registro de *Manta birostris* (Donndorff 1798) (Batoidea: Mobulidae) en el Rio de La Plata, Uruguay. *Gayana* 67(1):126-129.
- Milliken, T., and H. Tokunaga. 1987. The Japanese sea turtle trade 1970-1986. TRAFFIC (JAPAN), Center for Environmental Education, Washington, D. C.
- Miller, J. D. 1997. Reproduction in sea turtles. Pages 51-58 in P. L. Lutz, and J. A. Musick, editors. *The Biology of Sea Turtles*. CRC Press, Boca Raton, Florida.
- Miller, M. H., and C. Klimovich. 2017. Endangered Species Act status review report: Giant manta ray (*Manta birostris*) and reef manta ray (*Manta alfredi*). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD.
- Milton, S. L., and P. L. Lutz. 2003. Physiological and genetic responses to environmental stress. Pages 163-197 in P. L. Lutz, J. A. Musick, and J. Wyneken, editors. *The Biology of Sea Turtles*, volume II. CRC Press, Boca Raton, Florida.
- Mo, C. L. 1988. Effect of bacterial and fungal infection on hatching success of Olive Ridley sea turtle eggs. *World Wildlife Fund-U.S.*
- Moncada, F., E. Carrillo, A. Saenz, and G. Nodarse. 1999. Reproduction and nesting of the hawksbill turtle, *Eretmochelys imbricata*, in the Cuban Archipelago. *Chelonian Conservation and Biology* 3(2):257-263.
- Moncada, F., A. Abreu-Grobois, D. Bagley, K. A. Bjorndal, A. B. Bolten, J. A. Caminas, L. Ehrhart, A. Muhlia-Melo, G. Nodarse, B. A. Schroeder, J. Zurita, and L. A. Hawkes. 2010. Movement patterns of loggerhead turtles *Caretta caretta* in Cuban waters inferred from flipper tag recaptures. *Endangered Species Research* 11(1):61-68.
- Monzón-Argüello, C., L. F. López-Jurado, C. Rico, A. Marco, P. López, G. C. Hays, and P. L. M. Lee. 2010. Evidence from genetic and Lagrangian drifter data for transatlantic transport of small juvenile green turtles. *Journal of Biogeography* 37(9):1752-1766.
- Moore, A. B. M. 2012. Records of poorly known batoid fishes from the north-western Indian Ocean (Chondrichthyes: Rhynchobatidae, Rhinobatidae, Dasyatidae, Mobulidae). *African Journal of Marine Science* 34(2):297-301.
- Mortimer, J. A., J. Collie, T. Jupiter, R. Chapman, A. Liljevik, and B. Betsy. 2003. Growth rates of immature hawksbills (*Eretmochelys imbricata*) at Aldabra Atoll, Seychelles (Western Indian Ocean). Pages 247-248 in J. A. Seminoff, editor *Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation*.
- Mortimer, J. A., M. Day, and D. Broderick. 2002. Sea turtle populations of the Chagos Archipelago, British Indian Ocean Territory. Pages 47-49 in A. Mosier, A. Foley, and B. Brost, editors. *Twentieth Annual Symposium on Sea Turtle Biology and Conservation*.
- Mortimer, J. A., and M. Donnelly. 2008. Hawksbill turtle (*Eretmochelys imbricata*) International Union for Conservation of Nature and Natural Resources.



- Mourier, J. 2012. Manta rays in the Marquesas Islands: First records of *Manta birostris* in French Polynesia and most easterly location of *Manta alfredi* in the Pacific Ocean, with notes on their distribution. *Journal of Fish Biology* 81(6):2053-2058.
- Mrosovsky, N., G. D. Ryan, and M. C. James. 2009. Leatherback turtles: The menace of plastic. *Marine Pollution Bulletin* 58(2):287-289.
- Murphy, T. M., and S. R. Hopkins. 1984. Aerial and ground surveys of marine turtle nesting beaches in the southeast region. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Center.
- Musick, J. A., and C. J. Limpus. 1997. Habitat utilization and migration in juvenile sea turtles. Pages 137-163 in P. L. Lutz, and J. A. Musick, editors. *The Biology of Sea Turtles*. CRC Press, New York, New York.
- Naro-Maciel, E., J. H. Becker, E. H. S. M. Lima, M. A. Marcovaldi, and R. DeSalle. 2007. Testing dispersal hypotheses in foraging green sea turtles (*Chelonia mydas*) of Brazil. *Journal of Heredity* 98(1):29-39.
- Naro-Maciel, E., A. C. Bondioli, M. Martin, A. de Padua Almeida, C. Baptistotte, C. Bellini, M. A. Marcovaldi, A. J. Santos, and G. Amato. 2012. The interplay of homing and dispersal in green turtles: A focus on the southwestern atlantic. *Journal of Heredity* 103(6):792-805.
- NMFS-NEFSC. 2011. Preliminary summer 2010 regional abundance estimate of loggerhead turtles (*Caretta caretta*) in northwestern Atlantic Ocean continental shelf waters. U.S. Department of Commerce, Northeast Fisheries Science Center, Reference Document 11-03.
- NMFS-SEFSC. 2009. An assessment of loggerhead sea turtles to estimate impacts of mortality on population dynamics. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, PRD-08/09-14.
- NMFS. 1997. Endangered Species Act Section 7 Consultation - Biological Opinion on Navy activities off the southeastern United States along the Atlantic coast, National Marine Fisheries Service, Office of Protected Resources and the Southeast Regional Office.
- NMFS. 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the western North Atlantic. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center.
- NMFS. 2012. Protocols for categorizing sea turtles for post-release mortality estimates. August 2001, revised February 2012. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, PRD Contribution: #PRD-2011-07, Miami, FL.
- NMFS. 2019. Recovery outline - Giant manta ray. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD.
- NMFS. 2021. Protected species construction conditions, NOAA Fisheries Southeast Regional Office. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, revised May 2021, Saint Petersburg, FL.
- NMFS and USFWS. 1991. Recovery plan for U.S. population of Atlantic green turtle (*Chelonia mydas*). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Washington, D.C.

- NMFS, and USFWS. 1992. Recovery plan for leatherback turtles *Dermochelys coriacea* in the U. S. Caribbean, Atlantic and Gulf of Mexico. National Marine Fisheries Service and U.S. Fish and Wildlife Service, Silver Spring, Maryland.
- NMFS, and USFWS. 1993. Recovery plan for the hawksbill turtle *Eretmochelys imbricata* in the U.S. Caribbean, Atlantic and Gulf of Mexico. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, St. Petersburg, Florida.
- NMFS, and USFWS. 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, Maryland.
- NMFS, and USFWS. 1998. Recovery plan for U.S. Pacific populations of the leatherback turtle (*Dermochelys coriacea*). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, Maryland.
- NMFS, and USFWS. 2007. Leatherback sea turtle (*Dermochelys coriacea*) 5-year review: Summary and evaluation. National Marine Fisheries Service and U.S. Fish and Wildlife Service, Silver Spring, Maryland.
- NMFS, and USFWS. 2007. Green Sea Turtle (*Chelonia mydas*) 5-year review: Summary and Evaluation. National Marine Fisheries Service, Silver Spring, Maryland.
- NMFS, and USFWS. 2007a. Kemp's ridley sea turtle (*Lepidochelys kempii*) 5-year review: Summary and evaluation. National Marine Fisheries Service and U.S. Fish and Wildlife Service, Silver Spring, Maryland.
- NMFS, and USFWS. 2007b. Loggerhead sea turtle (*Caretta caretta*) 5-year review: Summary and evaluation. National Marine Fisheries Service and U.S. Fish and Wildlife Service, Silver Spring, Maryland.
- NMFS and USFWS. 2008. Recovery plan for the Northwest Atlantic population of the loggerhead sea turtle (*Caretta caretta*), Second revision. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, MD.
- NMFS USFWS. 2013. Leatherback sea turtle (*Dermochelys coriacea*) 5-year review: Summary and evaluation. NOAA, National Marine Fisheries Service, Office of Protected Resources and U.S. Fish and Wildlife Service, Southeast Region, Jacksonville Ecological Services Office.
- NMFS, USFWS, and SEMARNAT. 2011. Bi-national recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*), Second revision. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, MD.
- Northwest Atlantic Leatherback Working Group. 2018. Northwest Atlantic Leatherback Turtle (*Dermochelys coriacea*) Status Assessment (Bryan Wallace and Karen Eckert, Compilers and Editors). Conservation Science Partners and the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). WIDECAST Technical Report No. 16. Godfrey, Illinois. 36 pp.
- Notarbartolo di Sciara, G., and E. V. Hillyer. 1989. Mobulid rays off eastern Venezuela (Chondrichthyes, Mobulidae). *Copeia* (3):607-614.
- NRC. 1990. Decline of the sea turtles: Causes and prevention. National Research Council, Washington, D. C.
- Ogren, L. H. 1989. Distribution of juvenile and subadult Kemp's ridley sea turtles: Preliminary results from 1984-1987 surveys. Pages 116-123 in C. W. Caillouet Jr., and A. M. Landry

- Jr., editors. First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management. Texas A&M University, Sea Grant College, Galveston, Texas.
- O'Malley, M. P., K. Lee-Brooks, and H. B. Medd. 2013. The global economic impact of manta ray watching tourism. *PLOS ONE* 8(5):e65051.
- Oliver, S., M. Braccini, S. J. Newman, and E. S. Harvey. 2015. Global patterns in the bycatch of sharks and rays. *Marine Policy* 54:86-97.
- Paladino, F. V., M. P. O'Connor, and J. R. Spotila. 1990. Metabolism of leatherback turtles, gigantothermy, and thermoregulation of dinosaurs. *Nature* 344:858-860.
- Parsons, J. J. 1972. The hawksbill turtle and the tortoise shell trade. Pages 45-60 in *Études de Géographie Tropicale Offertes a Pierre Gourou*. Mouton, Paris, France.
- Pike, D. A., R. L. Antworth, and J. C. Stiner. 2006. Earlier nesting contributes to shorter nesting seasons for the loggerhead seaturtle, *Caretta caretta*. *Journal of Herpetology* 40(1):91-94.
- Plotkin, P. T. 2003. Adult migrations and habitat use. Pages 225-241 in P. L. Lutz, J. A. Musick, and J. Wyneken, editors. *The Biology of Sea Turtles*, volume 2. CRC Press.
- Plotkin, P. T., and A. F. Amos. 1988. Entanglement in and ingestion of marine debris by sea turtles stranded along the South Texas coast. Pages 7 in *Supplemental Deliverables under Entanglement-Debris Task No. 3. Debris, Entanglement and Possible Causes of Death in Stranded Sea Turtles (FY88)*.
- Pritchard, P. C. H. 1969. The survival status of ridley sea-turtles in America. *Biological Conservation* 2(1):13-17.
- Pritchard, P. C. H., and P. Trebbau. 1984. *The turtles of Venezuela*. SSAR.
- Pritchard, P. C. H., P. Bacon, F. H. Berry, A. Carr, J. Feltemyer, R. M. Gallagher, S. Hopkins, R. Lankford, M. R. Marquez, L. H. Ogren, W. Pringle Jr., H. Reichart, and R. Witham. 1983. *Manual of sea turtle research and conservation techniques*, Second ed. Center for Environmental Education, Washington, D. C.
- Prosdocimi, L., V. González Carman, D. A. Albareda, and M. I. Remis. 2012. Genetic composition of green turtle feeding grounds in coastal waters of Argentina based on mitochondrial DNA. *Journal of Experimental Marine Biology and Ecology* 412:37-45.
- Rambahinarison, J. M., and coauthors. 2018. Life history, growth, and reproductive biology of four mobulid species in the Bohol Sea, Philippines. *Frontiers in Marine Science* 5:269.
- Rebel, T. P. 1974. *Sea Turtles and the Turtle Industry of the West Indies, Florida and the Gulf of Mexico*. University of Miami Press, Coral Gables, Florida.
- Rhodin, A. G. J. 1985. Comparative chondro-osseous development and growth in marine turtles. *Copeia* 1985:752-771.
- Richardson, J. I., R. Bell, and T. H. Richardson. 1999. Population ecology and demographic implications drawn from an 11-year study of nesting hawksbill turtles, *Eretmochelys imbricata*, at Jumby Bay, Long Island, Antigua, West Indies. *Chelonian Conservation and Biology* 3(2):244-250.
- Rivalan, P., A.-C. Prevot-Julliard, R. Choquet, R. Pradel, B. Jacquemin, and M. Girondot. 2005. Trade-off between current reproductive effort and delay to next reproduction in the leatherback sea turtle. *Oecologia* 145(4):564-574.
- Rivas-Zinno, F. 2012. *Captura incidental de tortugas marinas en Bajos del Solis, Uruguay*. Universidad de la Republica Uruguay, Departamento de Ecología y Evolucion.
- Romanov, E. V. 2002. Bycatch in the tuna purse-seine fisheries of the western Indian Ocean. *Fishery Bulletin* 100(1):90-105.

- Rubin, R. D., K. R. Kumli, and G. Chilcott. 2008. Dive characteristics and movement patterns of acoustic and satellite-tagged manta rays (*Manta birostris*) in the Revillagigedos Islands of Mexico. American Elasmobranch Society, Montreal, Canada.
- Ryder, C. E., T. A. Conant, and B. A. Schroeder. 2006. Report of the Workshop on Marine Turtle Longline Post-interaction Mortality. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, NOAA Technical Memorandum NMFS-OPR-29, Silver Springs, MD.
- Santidrián Tomillo, P., E. Vélez, R. D. Reina, R. Piedra, F. V. Paladino, and J. R. Spotila. 2007. Reassessment of the leatherback turtle (*Dermochelys coriacea*) nesting population at Parque Nacional Marino Las Baulas, Costa Rica: Effects of conservation efforts. *Chelonian Conservation and Biology* 6(1):54-62.
- Sarti Martínez, L., A. R. Barragán, D. G. Muñoz, N. Garcia, P. Huerta, and F. Vargas. 2007. Conservation and biology of the leatherback turtle in the Mexican Pacific. *Chelonian Conservation and Biology* 6(1):70-78.
- Schmid, J. R., and J. A. Barichivich. 2006. *Lepidochelys kempii*–Kemp’s ridley. Pages 128-141 in P. A. Meylan, editor. *Biology and conservation of Florida turtles*. Chelonian Research Monographs, volume 3.
- Schmid, J. R., and A. Woodhead. 2000. Von Bertalanffy growth models for wild Kemp’s ridley turtles: analysis of the NMFS Miami Laboratory tagging database. U. S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, Florida.
- Schroeder, B. A., and A. M. Foley. 1995. Population studies of marine turtles in Florida Bay. J. I. Richardson, and T. H. Richardson, editors. *Twelfth Annual Workshop on Sea Turtle Biology and Conservation*.
- Schulz, J. P. 1975. Sea turtles nesting in Surinam. *Zoologische Verhandelingen* 143:3-172.
- Seminoff, J. A., C. D. Allen, G. H. Balazs, P. H. Dutton, T. Eguchi, H. L. Haas, S. A. Hargrove, M. P. Jensen, D. L. Klemm, A. M. Lauritsen, S. L. MacPherson, P. Opay, E. E. Possardt, S. L. Pultz, E. E. Seney, K. S. Van Houtan, and R. S. Waples. 2015. Status review of the green turtle (*Chelonia Mydas*) under the endangered species act. NOAA Technical Memorandum, NMFS-SWFSC-539.
- Shaver, D. J. 1994. Relative abundance, temporal patterns, and growth of sea turtles at the Mansfield Channel, Texas. *Journal of Herpetology* 28(4):491-497.
- Shenker, J. M. 1984. Scyphomedusae in surface waters near the Oregon coast, May-August, 1981. *Estuarine, Coastal and Shelf Science* 19(6):619-632.
- Shillinger, G. L., D. M. Palacios, H. Bailey, S. J. Bograd, A. M. Swithenbank, P. Gaspar, B. P. Wallace, J. R. Spotila, F. V. Paladino, R. Piedra, S. A. Eckert, and B. A. Block. 2008. Persistent leatherback turtle migrations present opportunities for conservation. *PLoS Biology* 6(7):1408-1416.
- Shoop, C. R., and R. D. Kenney. 1992. Seasonal distributions and abundances of loggerhead and leatherback sea turtles in waters of the northeastern United States. *Herpetological Monographs* 6:43-67.
- Snover, M. L. 2002. Growth and ontogeny of sea turtles using skeletochronology: Methods, validation and application to conservation. Duke University.
- Southwood, A. L., R. D. Andrews, F. V. Paladino, and D. R. Jones. 2005. Effects of diving and swimming behavior on body temperatures of Pacific leatherback turtles in tropical seas. *Physiological and Biochemical Zoology* 78:285-297.

- Spotila, J. 2004. *Sea Turtles: A Complete Guide to their Biology, Behavior, and Conservation*. Johns Hopkins University Press, Baltimore, Maryland.
- Spotila, J. R., A. E. Dunham, A. J. Leslie, A. C. Steyermark, P. T. Plotkin, and F. V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: Are leatherback turtles going extinct? *Chelonian Conservation and Biology* 2(2):209-222.
- Spotila, J. R., R. D. Reina, A. C. Steyermark, P. T. Plotkin, and F. V. Paladino. 2000. Pacific leatherback turtles face extinction. *Nature* 405:529-530.
- Stapleton, S., and C. Stapleton. 2006. Tagging and nesting research on hawksbill turtles (*Eretmochelys imbricata*) at Jumby Bay, Long Island, Antigua, West Indies: 2005 annual report. Jumby Bay Island Company, Ltd.
- Starbird, C. H., A. Baldrige, and J. T. Harvey. 1993. Seasonal occurrence of leatherback sea turtles (*Dermochelys coriacea*) in the Monterey Bay region, with notes on other sea turtles, 1986-1991. *California Fish and Game* 79(2):54-62.
- Starbird, C. H., and M. M. Suarez. 1994. Leatherback sea turtle nesting on the north Vogelkop coast of Irian Jaya and the discovery of a leatherback sea turtle fishery on Kei Kecil Island. Pages 143-146 in K. A. Bjorndal, A. B. Bolten, D. A. Johnson, and P. J. Eliazar, editors. Fourteenth Annual Symposium on Sea Turtle Biology and Conservation.
- Stewart, K., and C. Johnson. 2006. *Dermochelys coriacea*—Leatherback sea turtle. *Chelonian Research Monographs* 3:144-157.
- Stewart, K., C. Johnson, and M. H. Godfrey. 2007. The minimum size of leatherbacks at reproductive maturity, with a review of sizes for nesting females from the Indian, Atlantic and Pacific Ocean basins. *Herpetological Journal* 17(2):123-128.
- Stewart, J. D., E. M. Hoyos-Padilla, K. R. Kumli, and R. D. Rubin. 2016. Deep-water feeding and behavioral plasticity in *Manta birostris* revealed by archival tags and submersible observations. *Zoology* 119.
- Stewart, J. D., M. Nuttall, E. L. Hickerson, and M. A. Johnston. 2018. Important juvenile manta ray habitat at Flower Garden Banks National Marine Sanctuary in the northwestern Gulf of Mexico. *Marine Biology* 165:111.
- Steyermark, A. C., K. Williams, J. R. Spotila, F. V. Paladino, D. C. Rostal, S. J. Morreale, M. T. Koberg, and R. Arauz-Vargas. 1996. Nesting leatherback turtles at Las Baulas National Park, Costa Rica. *Chelonian Conservation and Biology* 2(2):173-183.
- Storelli, M. M., G. Barone, A. Storelli, and G. O. Marcotrigiano. 2008. Total and subcellular distribution of trace elements (Cd, Cu and Zn) in the liver and kidney of green turtles (*Chelonia mydas*) from the Mediterranean Sea. *Chemosphere* 70(5):908-913.
- Suchman, C., and R. Brodeur. 2005. Abundance and distribution of large medusae in surface waters of the northern California Current. *Deep Sea Research Part II: Topical Studies in Oceanography* 52(1-2):51-72.
- Tiwari, M., B. P. Wallace, and M. Girondot. 2013. *Dermochelys coriacea* (Northwest Atlantic Ocean subpopulation). The IUCN Red List of Threatened Species (e.T46967827A46967830. <http://dx.doi.org/10.2305/IUCN.UK.2013-2.RLTS.T46967827A46967830.en>).
- Turtle Expert Working Group. 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the western North Atlantic. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, NOAA Technical Memorandum NMFS-SEFSC-409, Miami, FL.

- Turtle Expert Working Group. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, NOAA Technical Memorandum NMFS-SEFSC-444, Miami, FL.
- TEWG. 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Turtle Expert Working Group.
- TEWG. 2009. An assessment of the loggerhead turtle population in the western North Atlantic ocean. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Turtle Expert Working Group, NMFS-SEFSC-575.
- Troëng, S., and E. Rankin. 2005. Long-term conservation efforts contribute to positive green turtle *Chelonia mydas* nesting trend at Tortuguero, Costa Rica. *Biological Conservation* 121:111-116.
- Troëng, S., D. Chacón, and B. Dick. 2004. Possible decline in leatherback turtle *Dermochelys coriacea* nesting along the coast of Caribbean Central America. *Oryx* 38:395-403.
- Troëng, S., E. Harrison, D. Evans, A. d. Haro, and E. Vargas. 2007. Leatherback turtle nesting trends and threats at Tortuguero, Costa Rica. *Chelonian Conservation and Biology* 6(1):117-122.
- Tucker, A. D. 1988. A summary of leatherback turtle *Dermochelys coriacea* nesting at Culebra, Puerto Rico from 1984-1987 with management recommendations. U.S. Fish and Wildlife Service.
- Tucker, A. D. 2010. Nest site fidelity and clutch frequency of loggerhead turtles are better elucidated by satellite telemetry than by nocturnal tagging efforts: Implications for stock estimation. *Journal of Experimental Marine Biology and Ecology* 383(1):48-55.
- USFWS and NMFS. 1998. Endangered Species Consultation Handbook. Procedures for Conducting Section 7 Consultations and Conferences. U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Arlington, VA.
- van Dam, R., and L. Sarti. 1989. Sea turtle biology and conservation on Mona Island, Puerto Rico. Report for 1989.
- Van Dam, R., L. Sarti M., and D. Pares J. 1991. The hawksbills of Mona Island, Puerto Rico: Report for 1990. Sociedad Chelonia and Departamento. Recursos Naturales, Puerto Rico.
- Van Dam, R. P., and C. E. Diez. 1997. Predation by hawksbill turtles on sponges at Mona Island, Puerto Rico. Pages 1421-1426 in *Eighth International Coral Reef Symposium*.
- Van Dam, R. P., and C. E. Diez. 1998. Home range of immature hawksbill turtles (*Eretmochelys imbricata* (Linnaeus)) at two Caribbean islands. *Journal of Experimental Marine Biology and Ecology* 220:15-24.
- Venables, S. 2013. Short term behavioural responses of manta rays, *Manta alfredi*, to tourism interactions in Coral Bay, Western Australia. Thesis. Murdoch University.
- Watson, J. W., S. P. Epperly, A. K. Shah, and D. G. Foster. 2005. Fishing methods to reduce sea turtle mortality associated with pelagic longlines. *Canadian Journal of Fisheries and Aquatic Sciences* 62(5):965-981.
- Weishampel, J. F., D. A. Bagley, L. M. Ehrhart, and B. L. Rodenbeck. 2003. Spatiotemporal patterns of annual sea turtle nesting behaviors along an East Central Florida beach. *Biological Conservation* 110(2):295-303.

- Weishampel, J. F., D. A. Bagley, and L. M. Ehrhart. 2004. Earlier nesting by loggerhead sea turtles following sea surface warming. *Global Change Biology* 10:1424-1427.
- Wershoven, J. L., and R. W. Wershoven. 1992. Juvenile green turtles in their nearshore habitat of Broward County, Florida: A five year review. Pages 121-123 *in* M. Salmon, and J. Wyneken, editors. Eleventh Annual Workshop on Sea Turtle Biology and Conservation.
- White, F. N. 1994. Swallowing dynamics of sea turtles. Pages 89-95 *in* G. H. Balazs, and S. G. Pooley, editors. Research Plan to Assess Marine Turtle Hooking Mortality: Results of an Expert Workshop held in Honolulu, Hawaii. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, NOAA-TM-NMFS-SWFSC-201, Honolulu, HI.
- Whiting, S. D. 2000. The foraging ecology of juvenile green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) sea turtles in north-western Australia. Northern Territory University, Darwin, Australia.
- Wilkinson, C. 2004. Status of Coral Reefs of the World: 2004. Australian Institute of Marine Science, ISSN 1447-6185.
- Witherington, B. E. 1992. Behavioral responses of nesting sea turtles to artificial lighting. *Herpetologica* 48(1):31-39.
- Witherington, B. E. 2002. Ecology of neonate loggerhead turtles inhabiting lines of downwelling near a Gulf Stream front. *Marine Biology* 140(4):843-853.
- Witherington, B. E., and K. A. Bjorndal. 1991. Influences of artificial lighting on the seaward orientation of hatchling loggerhead turtles *Caretta caretta*. *Biological Conservation* 55(2):139-149.
- Witherington, B. E., and L. M. Ehrhart. 1989a. Hypothermic stunning and mortality of marine turtles in the Indian River Lagoon System, Florida. *Copeia* 1989(3):696-703.
- Witherington, B. E., and L. M. Ehrhart. 1989b. Status, and reproductive characteristics of green turtles (*Chelonia mydas*) nesting in Florida. Pages 351-352 *in* L. Ogren, and coeditors, editors. Second Western Atlantic Turtle Symposium. .
- Witherington, B., M. Bresette, and R. Herren. 2006. *Chelonia mydas* - Green turtle. *Chelonian Research Monographs* 3:90-104.
- Witherington, B., S. Hirama, and A. Moiser. 2003. Effects of beach armoring structures on marine turtle nesting. U.S. Fish and Wildlife Service.
- Witherington, B., S. Hirama, and A. Moiser. 2007. Changes to armoring and other barriers to sea turtle nesting following severe hurricanes striking Florida beaches. U.S. Fish and Wildlife Service.
- Witt, M. J., A. C. Broderick, D. J. Johns, C. Martin, R. Penrose, M. S. Hoogmoed, and B. J. Godley. 2007. Prey landscapes help identify foraging habitats for leatherback turtles in the NE Atlantic. *Marine Ecology Progress Series* 337:231-243.
- Witt, M. J., B. J. Godley, A. C. Broderick, R. Penrose, and C. S. Martin. 2006. Leatherback turtles, jellyfish and climate change in the northwest Atlantic: Current situation and possible future scenarios. Pages 356-357 *in* M. Frick, A. Panagopoulou, A. F. Rees, and K. Williams, editors. Twenty-Sixth Annual Symposium on Sea Turtle Biology and Conservation. International Sea Turtle Society, Athens, Greece.
- Witzell, W. N. 1983. Synopsis of biological data on the hawksbill sea turtle, *Eretmochelys imbricata* (Linnaeus, 1766). Food and Agricultural Organization of the United Nations, Rome.

- Witzell, W. N. 2002. Immature Atlantic loggerhead turtles (*Caretta caretta*): Suggested changes to the life history model. *Herpetological Review* 33(4):266-269.
- Work, T. M. 2000. Synopsis of necropsy findings of sea turtles caught by the Hawaii-based pelagic longline fishery.
- Zug, G. R., and J. F. Parham. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea*: A skeletochronological analysis. *Chelonian Conservation and Biology* 2:244-249.
- Zug, G. R., and R. E. Glor. 1998. Estimates of age and growth in a population of green sea turtles (*Chelonia mydas*) from the Indian River lagoon system, Florida: A skeletochronological analysis. *Canadian Journal of Zoology* 76(8):1497-1506.
- Zurita, J. C., R. Herrera, A. Arenas, M. E. Torres, C. Calderón, L. Gómez, J. C. Alvarado, and R. Villavicencia. 2003. Nesting loggerhead and green sea turtles in Quintana Roo, Mexico. Pages 25-127 in J. A. Seminoff, editor *Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation*, Miami, Florida.
- Zwinenberg, A. J. 1977. Kemp's ridley, *Lepidochelys kempii* (Garman, 1880), undoubtedly the most endangered marine turtle today (with notes on the current status of *Lepidochelys olivacea*). *Bulletin Maryland Herpetological Society* 13(3):170-192.





## **PROTECTED SPECIES CONSTRUCTION CONDITIONS, NOAA FISHERIES SOUTHEAST REGIONAL OFFICE**

The action agency and any permittee shall comply with the following construction conditions for protected species under the jurisdiction of NOAA Fisheries Southeast Regional Office (SERO) Protected Resources Division (PRD):<sup>1</sup>

**Protected Species Sightings**—The action agency and any permittee shall ensure that all personnel associated with the project are instructed about the potential presence of species protected under the Endangered Species Act (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 listed species and all marine mammals. To determine which protected species and critical habitat may be found in the transit area, please review the relevant [marine mammal](https://www.fisheries.noaa.gov/find-species) and [ESA-listed species](https://www.fisheries.noaa.gov/find-species) at Find A Species (<https://www.fisheries.noaa.gov/find-species>) and the consultation documents that have been completed for the project.

1. **Equipment**—Turbidity curtains, if used, shall be made of material in which protected species cannot become entangled and be regularly monitored to avoid protected species entrapment. All turbidity curtains and other in-water equipment shall be properly secured with materials that reduce the risk of protected species entanglement and entrapment.
  - a. In-water lines (rope, chain, and cable, including the lines to secure turbidity curtains) shall 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, shall 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 shall be allowed in the water. All anchoring shall be in areas free from hardbottom and seagrass.
  - b. Turbidity curtains and other in-water equipment shall be placed in a manner that does not entrap protected species within the project area and minimizes the extent and duration of their exclusion from the project area.
  - c. Turbidity barriers shall be positioned in a way that minimizes the extent and duration of protected species exclusion from important habitat (e.g. critical habitat, hardbottom, seagrass) in the project area.
2. **Operations**—For construction work that is generally stationary (e.g., barge-mounted equipment dredging a berth or section of river, or shore-based equipment extending into the water):
  - a. Operations of moving equipment shall cease if a protected species is observed within 150 feet of operations.

---

<sup>1</sup> Manatees are managed under the jurisdiction of the U.S. Fish and Wildlife Service.

- b. Activities shall not resume until the protected species has departed the project area of its own volition (e.g., species was observed departing or 20 minutes have passed since the animal was last seen in the area).
3. **Vessels**—For projects requiring vessels, the action agency, and any permittee shall ensure conditions in the [Vessel Strike Avoidance Measures](#) are implemented as part of the project/permit issuance (<https://www.fisheries.noaa.gov/southeast/consultations/regulations-policies-and-guidance>).
4. **Consultation Reporting Requirements**—Any interaction with a protected species shall be reported immediately to NOAA Fisheries SERO PRD and the local authorized stranding/rescue organization.

To report to NOAA Fisheries SERO PRD, send an email to [takereport.nmfsser@noaa.gov](mailto:takereport.nmfsser@noaa.gov). Please include the species involved, the circumstances of the interaction, the fate and disposition of the species involved, photos (if available), and contact information for the person who can provide additional details if requested. Please include the project's Environmental Consultation Organizer (ECO) number and project title in the subject line of email reports.

To report the interaction to the local stranding/rescue organization, please see the following website for the most up to date information for reporting sick, injured, or dead protected species:

**Reporting Violations**—To report an ESA or MMPA violation, call the NOAA Fisheries Enforcement Hotline. This hotline is available 24 hours a day, 7 days week for anyone in the United States.

NOAA Fisheries Enforcement Hotline      (800) 853-1964

5. **Additional Conditions**—Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the project consultation and must also be complied with.

**For additional information, please contact NOAA Fisheries SERO PRD at:**

NOAA Fisheries Service  
Southeast Regional Office  
263 13<sup>th</sup> Avenue South  
St. Petersburg, Florida 33701  
Tel: (727) 824-5312

Visit us on the web at [Protected Marine Life in the Southeast](#)  
(<https://www.fisheries.noaa.gov/region/southeast#protected-marine-life>)

Revised: May 2021



## **VESSEL STRIKE AVOIDANCE MEASURES, NOAA FISHERIES SOUTHWEST REGIONAL OFFICE**

### **Background**

Vessel strikes can injure or kill species protected under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). NOAA Fisheries Southwest Regional Office (SERO) Protected Resources Division (PRD) recommends implementing the following identification and avoidance measures to reduce the risk of vessel strikes and disturbance from vessels to protected species under our jurisdiction.<sup>1</sup>

### **Protected Species Sightings**

All vessel operators and crews should be informed about the potential presence of species protected under the ESA and the MMPA and any critical habitat in a vessel transit area. All vessels should have personnel onboard responsible for observing for the presence of protected species. All personnel should be advised that there are civil and criminal penalties for harming, harassing, or killing listed species and all marine mammals. To determine which protected species and critical habitat may be found in the transit area, please review the relevant [marine mammal](https://www.fisheries.noaa.gov/find-species) and [ESA-listed species](https://www.fisheries.noaa.gov/find-species) at Find A Species (<https://www.fisheries.noaa.gov/find-species>) and any ESA Section 7 consultation documents if applicable.

### **Vessel Strike Avoidance**

The following measures should be taken when they are consistent with safe navigation to avoid causing injury or death of a protected species:

1. Operate at the minimum safe speed when transiting and maintain a vigilant watch for protected species to avoid striking them. Even with a vigilant watch, most marine protected species are extremely difficult to see from a boat or ship, and you cannot rely on detecting them visually and then taking evasive action. The most effective way to avoid vessel strikes is to travel at a slow, safe speed. Whenever possible, assign a designated individual to observe for protected species and limit vessel operation to only daylight hours.
2. Follow deep-water routes (e.g., marked channels) whenever possible.
3. Operate at “Idle/No Wake” speeds in the following circumstances:
  - a. while in any project construction areas
  - b. while in water depths where the draft of the vessel provides less than four feet of clearance from the bottom, or
  - c. in all depths after a protected species has been observed in and has recently departed the area.

---

<sup>1</sup> Manatees are managed under the jurisdiction of the U.S. Fish and Wildlife Service.

4. When a protected species is sighted, attempt to maintain a distance of 150 feet or greater between the animal and the vessel. Reduce speed and avoid abrupt changes in direction until the animal(s) has left the area.
5. When dolphins are bow- or wake-riding, maintain course and speed as long as it is safe to do so or until the animal(s) leave the vicinity of the vessel.
6. If a whale is sighted in the vessel's path or within 300 feet from the vessel, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area. *Please see below for additional requirements for North Atlantic right whales.*
7. If a whale is sighted farther than 300 feet from the vessel, maintain a distance of 300 feet or greater between the whale and the vessel and reduce speed to 10 knots or less. *Please see below for additional requirements for North Atlantic right whales.*

### **Injured or Dead Protected Species Reporting**

Vessel crews should report sightings of any injured or dead protected species immediately regardless of whether the injury or death is caused by your vessel. Please see [How to Report a Stranded or Injured Marine Animal](https://www.fisheries.noaa.gov/report) (<https://www.fisheries.noaa.gov/report>) for the most up to date information for reporting injured or dead protected species.

If the injury or death is caused by your vessel, also report the interaction to NOAA Fisheries SERO PRD at [takereport.nmfsser@noaa.gov](mailto:takereport.nmfsser@noaa.gov). Please include the species involved, the circumstances of the interaction, the fate and disposition of the animal involved, photos (if available), and contact information for the person who can provide additional details if requested. Please include the project's Environmental Consultation Organizer (ECO) number and project title in the subject line of email reports if a consultation has been completed.

### **Reporting Violations**

To report any suspected ESA or MMPA violation, call the NOAA Fisheries Enforcement Hotline. This hotline is available 24 hours a day, 7 days week for anyone in the United States.

NOAA Fisheries Enforcement Hotline: (800) 853-1964

### **Additional Transit and Reporting Requirements for North Atlantic Right Whales**

1. Federal regulation prohibits approaching or remaining within 500 yards of a North Atlantic right whale (50 CFR 224.103 (c)). All whales sighted within North Atlantic right whale critical habitat should be assumed to be right whales. Please be aware and follow restrictions for all Seasonal Management Areas along the U.S. east coast. These areas have vessel speed restrictions to reduce vessel strikes risks to migrating or feeding whales. More information can be found at [Reducing Vessel Strikes to North Atlantic Right Whales](https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel-strikes-north-atlantic-right-whales) (<https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel-strikes-north-atlantic-right-whales>).
2. Ships greater than 300 gross tons entering the WHALESOUTH reporting area are required to report to a shore-based station. For more information on reporting procedures consult 33 CFR Part 169, the Coast Pilot, or at [Reducing Vessel Strikes to North Atlantic](https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel-strikes-north-atlantic-right-whales)

[Right Whales](https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel-strikes-north-atlantic-right-whales) (<https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel-strikes-north-atlantic-right-whales>).

3. From November through April, vessels approaching/departing Florida ports of Jacksonville and Fernandina Beach as well as Brunswick Harbor, Georgia are **STRONGLY RECOMMENDED** to use Two-Way Routes displayed on nautical charts. More information on [Compliance with the Right Whale Ship Strike Reduction Rule](#) can be found at ([https://media.fisheries.noaa.gov/2021-06/compliance\\_guide\\_for\\_right\\_whale\\_ship\\_strike\\_reduction.pdf](https://media.fisheries.noaa.gov/2021-06/compliance_guide_for_right_whale_ship_strike_reduction.pdf))
4. Mariners shall check with various communication media for general information regarding avoiding vessel strikes and specific information regarding North Atlantic right whale sighting locations. These include NOAA weather radio, U.S. Coast Guard Broadcast to Mariners, Local Notice to Mariners, and NAVTEX. Commercial mariners calling on United States ports should view the most recent version of the NOAA/USCG produced training CD entitled “A Prudent Mariner’s Guide to Right Whale Protection” (contact the NOAA Fisheries SERO, Protected Resources Division for more information regarding the CD).
5. Injured, dead, or entangled right whales should be immediately reported to the U.S. Coast Guard via VHF Channel 16 and the NOAA Fisheries Southeast Marine Mammal Stranding Hotline at (877) WHALE HELP (877-942-5343).

**For additional information, please contact NOAA Fisheries SERO PRD at:**

NOAA Fisheries Service

Southeast Regional Office

263 13<sup>th</sup> Avenue South

St. Petersburg, Florida 33701

Visit us on the web at [Protected Marine Life in the Southeast](#)

(<https://www.fisheries.noaa.gov/region/southeast#protected-marine-life>)

Revised: May 2021

## STANDARD MANATEE CONDITIONS FOR IN-WATER WORK

2011

The permittee shall comply with the following conditions intended to protect manatees from direct project effects:

- a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.
- b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.
- c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.
- d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.
- e. Any collision with or injury to a manatee shall be reported immediately to the Florida Fish and Wildlife Conservation Commission (FWC) Hotline at 1-888-404-3922. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-731-3336) for north Florida or Vero Beach (1-772-562-3909) for south Florida, and to FWC at [ImperiledSpecies@myFWC.com](mailto:ImperiledSpecies@myFWC.com)
- f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Temporary signs that have already been approved for this use by the FWC must be used. One sign which reads *Caution: Boaters* must be posted. A second sign measuring at least 8 ½" by 11" explaining the requirements for "Idle Speed/No Wake" and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities. These signs can be viewed at [MyFWC.com/manatee](http://MyFWC.com/manatee). Questions concerning these signs can be sent to the email address listed above.



# CAUTION: MANATEE HABITAT

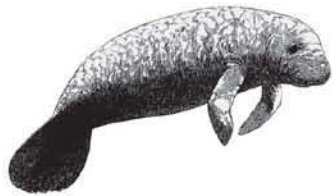
All project vessels

**IDLE SPEED / NO WAKE**

When a manatee is within 50 feet of work  
all in-water activities must

**SHUT DOWN**

Report any collision with or injury to a manatee:



**Wildlife Alert:**

**1-888-404-FWCC(3922)**

cell \*FWC or #FWC