Biological Assessment for the Preauthorized Use of Dispersant & *In-Situ* Burn Operations

For the Region 4 Regional Response Team

RRT4
REGION 4 REGIONAL RESPONSE TEAM

This RRT4 Biological Assessment for the Preauthorized Use of Dispersants and In-Situ Burn Operations (and appendices) represents the entire assessment; and supersedes and renders null and void all prior agreements, arrangements, or communications between the parties covering the same or similar subject matter, whether written or oral. The terms of this assessment may not be altered or modified except by written determination by the RRT4 or the Services. Such determinations must be recorded on the Record of Changes unless superseded by a complete revision.

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To the entire community of the Region 4 Regional Response Team, thank you for your support throughout the process in developing this biological assessment. Your guidance and support has made this effort possible, and has helped shape this multi-disciplinary biological assessment into a product that can be used by multiple users and at all levels of management, including field operations.

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Thank you for the time, support, and guidance you have provided to Region 4 in this consultation effort and in the construct of this Biological Assessment. You hosted a meeting in September 2015 for our Biological Assessment Workgroup where you highlighted important focus points and expected content to include in this assessment. Additionally, you lent your support throughout the construct and assembly of this biological assessment. We are grateful for your continued partnership.

<u>Research Planning, Inc.</u>

Dr. Jacqueline Michel, President

Dr. Adriana Bejarano, Senior Aquatic Eco-Toxicologist

Thank you for you professionalism, expertise, and teamwork provided as a member of the Biological Assessment workgroup. You guided the workgroup in the construct of the biological assessment, ensuring appropriate content was included, while also developing the vital background and analysis necessary to properly convey the impacts of the proposed federal actions on listed species, critical habitat, and essential fish habitat.

Additional Thanks To:

U.S. Army Corps of Engineers
Caribbean Regional Response Team
U.S. Coast Guard
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U.S. Environmental Protection Agency
U.S. Fish & Wildlife Service
Gulf of Mexico Fishery Management Council
National Marine Fisheries Service
National Oceanic & Atmospheric Administration
U.S. Navy
Region 9 Regional Response Team
Region 10 Regional Response Team
South Atlantic Fishery Management Council

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Annual Review Record

DATE	Request Updated Species & Habitats to the Services			RRT4 USCG Co-Chair Signature	RRT4 EPA Co-Chair Signature
	NOAA	USFWS	NOAA		
May 2016	√	√	√	**Mr. Forest Willis**	**Mr. James Webster**

*Annually, the RRT4 will review this biological assessment in order to validate that the information contained therein reflects the latest science, technology, plans, and listed species and habitats. As such, specific to ESA and EFH consultation, the RRT4 will request of the Services any updated listing of species, critical habitats, and essential fish habitats to ensure the latest information is contained in this biological assessment.

Record of Changes

ID (i.e. CH1)	DATE	Summary of Changes	Entry Made By
CH1			

List of Acronyms and Abbreviations

AC	Area Committee
ACHP	Advisory Council on Historic Preservation
ACOE	Army Corps of Engineers
ACP	Area Contingency Plan
AEGL	Acute Exposure Guideline Levels
AFTT	Atlantic Fleet Training and Testing
AL	State of Alabama
API	Oil Gravity
ADIOS2	Automated Data Inquiry for Oil Spills
ATSDR	Agency for Toxic Substances and Disease Registry
AVHRR	Advanced High Resolution Radiometer
BMP	Best Management Practices
BNP	Biscayne National Park
BSEE	Bureau of Safety and Environmental Health
CAPS	CAPS Rule 33 CFR § 155
CCW	Carolina Capes Water
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHA	U.S. Coast Guard Sector Charleston (Charleston, South Carolina)
CG-INV	United States Coast Guard, Office of Investigations & Compliance Analysis
CRRC	Coastal Response Research Center
CWA	Clean Water Act
DMF	Division of Marine Fisheries
DMP2	NOAA Dispersant Mission Planner
DOC	Department of Commerce
DOI	Department of the Interior
DOSS	Dioctyl sodium sulfosuccinate
DOT	Department of Transportation
DPnB	Dipropylene Plycol n-Butyl ether
DPS	Distinct Population Segment
DUECCG	RRT4 Dispersant Use Expedited Concurrence and Consultation Guide
DUOPIG	Dispersant Use Operational Planning and Implementation Guidance
DUPP	Dispersant Use Preauthorization Plan
DWH	Macondo/Deepwater Horizon/MC252Oil Spill
EC50	Median Effects Concentration
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFH-FMP	Essential Fish Habitat Fishery Management Plan
EFH-HAPC	Essential Fish Habitat-Habitat Areas of Particular Concern
EPA	U. S. Environmental Protection Agency
ERPG	Emergency Response Planning Guidelines
ESA	Endangered Species Act
EEZ	Exclusive Economic Zone
ESI	Environmental Sensitivity Index
EWS	Early Warning System
FAA	Federal Aviation Administration

FCW	Florida Current Water
FEIS	Fleet Training and Testing Environmental Impact Statement
FL	State of Florida
FLDEP	Florida Department of Environmental Protection
FMC	Fishery Management Council
FOSC	Federal On-Scene Coordinator
FWC	Florida Fish and Wildlife Commission
FWS	Fish and Wildlife Service
GA	State of Georgia
GADNR	Georgia Department of Natural Resources
GC/FID	Gas Chromatography/Flame Ionization Detector
GC/MS	Gas Chromatography/Mass Spectroscopy
GERG	Geochemical and Environmental Research Group
GIS	Geographic Information System
GNOME	General NOAA Oil Modeling Environment
GMFMC	Gulf of Mexico Fishery Management Council
GMFMC	Gulf of Mexico Fishery Management Council
GPS	Global Positioning System
GRNMS	Gray's Reef National Marine Sanctuary
GSW	Gulf Stream Water
GW	Georgia Water
HAZWOPER	Hazardous Waste Operations and Emergency Response
HC	Hazard Concentration
HC5	5th Percentile Hazard Concentration
IAP	Incident Action Plan
ICP	Incident Command Post
ICS	Incident Command System
ICW	Intracoastal Waterway
IPCC	Intergovernmental Panel on Climate Change
IRL	Indian River Lagoon
ISB	*In-Situ* Burning
JAX	U.S. Coast Guard Sector Jacksonville (Jacksonville, Florida)
JSL	Johnson-Sea-Link
KYW	U.S. Coast Guard Sector Key West (Key West, Florida)
LC50	Median Lethal Concentration
LOA	Letter of Agreement
LOA	Letter of Authorization
MA	State of Massachusetts
MASW	Mid-Atlantic Shelf Water
Mgal	Million gallons
MIA	U.S. Coast Guard Sector Miami (Miami, FL)
MISLE	Marine Information for Safety and Law Enforcement
MLW	Mean Low Water
MMHSRP	Marine Mammal Health and Stranding Response Program
MMPA	Marine Mammal Protection Act
MMPD	Maximum Most Probably Discharge
MMSN	Marine Mammal Stranding Network

MOB	U.S. Coast Guard Sector Mobile (Mobile, Alabama)
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSRC	Marine Spill Response Corporation
NAAQS	National Ambient Air Quality Standards
NC	State of North Carolina
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIMS	National Incident Management System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAA-OLE	NOAA Fisheries Office of Law Enforcement
NOAA-GC	NOAA Fisheries Office of General Counsel
NOS	National Ocean Service
NPS	National Park Service
NRC	National Response Center
NRC	National Research Council
NRDA	Natural Resource Damage Assessment
NRF	National Response Framework
NRS	National Response System
NRT	National Response Team
OCS	Outer Continental Shelf
OECD	Organization for Economic Co-operation and Development
OEIS	Oversees Environmental Impact Statement
OPA90	Oil Pollution Act of 1990
OPAREA	Operational Area
ORR-ARD	Response and Restoration, Assessment and Restoration Division
ORR-ERD	Response and Restoration, Emergency Response Division
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration
OSLTF	Oil Spill Liability Trust Fund
OSRP	Oil Spill Response Plans
PAH	Polycyclic Aromatic Hydrocarbon
PCE	Primary Constituent Element
PEL	Permissible Exposure Limits
RAR	Resources at Risk
RCP	Regional Contingency Plan
REL	Recommended Exposure Limits
RP	Responsible Party
RPI	Research Planning, Inc.
RPIC	Responsible Party Incident Commander
RRT	Regional Response Team
RRT4	Region 4 Regional Response Team
RRT6	Region 6 Regional Response Team
SAB	South Atlantic Bight
SAV	Submerged Aquatic Vegetation
SAV	U.S. Coast Guard Marine Safety Unit Savannah (Savannah, Georgia)

SAFMC	South Atlantic Fishery Management Council
SC	State of South Carolina
SCDNR	South Carolina Department of Natural Resources
SCMARP	South Carolina Marine Artificial Reef Program
SFR	Sport Fish Restoration
SMART	Special Monitoring and Applied Response Technologies
SMART	Special Monitoring of Applied Response Technologies
SMZ	Special Management Zone
SSC	Scientific Support Coordinator
SSD	Species Sensitivity Distributions
SSW	Slope Sea Water
SOSC	State On-scene Coordinator
STEL	Short-term Exposure Limit
STP	U.S. Coast Guard Sector St. Petersburg (St. Petersburg, Florida)
TAC	Total Allowable Catch
TAMU	Texas A&M University
TEEL	Temporary Emergency Exposure Limit
THC	Total Hydrocarbon Content
TPH	Total Petroleum Hydrocarbons
TVRP	Tank Vessel Response Plan
UC	Unified Command
USA	United States of America
USACOE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOI	United States Department of the Interior
USFWS	U. S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VCW	Virginia Coastal Water
VFR	Visual Flight Rules
WCD	Worst Case Discharge
WBUC	Western Boundary Under-Current

Units of Measure

bbl	barrel	42 gallons
nm	nautical mile	1.1 mile
Mgal	million gallons	
mg/L	milligrams per liter	
lb	pounds	
km	kilometer	
kg	kilogram	
TEU	Twenty-foot equivalent unit	
ppt	parts per thousand	
µm	micrometer	
µg/L	microgram per liter	
mg/L	milligrams per liter	
m	meter	
lb	pound	
nm	nautical mile	
in	inches	
gal	gallon	
ft	feet	
ftm	fathom	6 ft
cm	centimeter	
bbl	barrel	42 gallons
Hz	hertz	
dB	decibel	

Chapter 1. Introduction

Section 1.1. Background

This Biological Assessment evaluates the potential effects of the preauthorized use of chemical dispersants[1] and *in-situ* burning during an oil spill response on federally listed species and designated critical habitats protected under the Endangered Species Act (ESA) that occur, or are located, off the coast of Federal Region IV states in the Gulf of Mexico and Atlantic Ocean. Preauthorized use of dispersants in Federal Region 4 is described in the Regional Response Team 4 (RRT4) Dispersant Use Preauthorization Plan (DUPP). Preauthorized use of *in-situ* burning and appropriate burning agents is described in the RRT4 *In-Situ* Burning Plan (ISBP). These plans provide a decision and action framework for the preauthorized application of dispersants and the conduct of *in-situ* burning to a surface oil spill. Preauthorized use of these tactics are geographically and operationally limited and includes important protocols designed for the protection of wildlife and other natural resources.

Consultation on this Biological Assessment will be requested from the Department of Commerce (DOC) National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) and the Department of Interior (DOI) U.S. Fish and Wildlife Service (USFWS) (referred to as the Services) in accordance with the requirements of Section 7 of the Endangered Species Act, 16 U.S.C. § 1536. Consultation will also be requested from the NMFS in accordance with Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), 16 U.S.C. §1855.

Preauthorization for Federal On-scene Coordinator (FOSC) authority to use dispersants or conduct *in-situ* burning may be temporarily suspended if the DOI or DOC advises the FOSC that the consultation provided to the preauthorization plan is inadequate or inapplicable to the response. In this event, an emergency consultation must be completed for dispersant[2] or burning operations to be conducted or to continue at the response. DOI and DOC and all other RRT4 member agencies retain the authority to convene RRT4 to discuss concerns about a response.

Section 1.2. History of Dispersant Preauthorization Plan for RRT4

1.2.A. Consultation History

The initial RRT4 Dispersant Use Plan became effective October 8, 1996; the final draft was distributed in August of 1995. The plan was prepared by the RRT4 Response and Technology Committee Dispersant Workgroup and accompanying biological assessments were prepared both by the workgroup and assisting participants from NMFS and USFWS. A change was issued in July 1999 that updated language to the introductory section of the plan and the appendix on dispersant use monitoring, but this change did not impact critical components of the policy or its implementation.

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[1] For the purposes of this Biological Assessment, all use of chemical dispersants is limited to water surface application only, which is a key restriction of the RRTIV Dispersant Use Preauthorization Plan

[2] Nonpreauthorized dispersant activities must be conducted according to the RRT4 Dispersant Use Expedited Concurrence and Consultation Guide (DUECCG)

Biological assessments were sent to NOAA NMFS and USFWS on January 31, 1996. The assessments addressed the status of species and effects of physically dispersed oil regarding relevant species for the jurisdiction of each service agency. The assessment prepared for NMFS addressed five whale species, six turtle species, two sturgeon species, and Johnson's seagrass. The assessment prepared for USFWS addressed species of six turtles, one manatee, nine birds, two sturgeon, four reptiles, six mammals, and one herbaceous plant. Most federally listed species listed within Federal Region 4 were determined to rarely occur within the proposed Action Area (the *Green Zone*, where dispersant would be pre-authorized) while sea turtles and cetaceans were identified as present within the *Green Zone* seasonally. In each assessment, analysis of the proposed action included evaluation of direct contact with chemically dispersed oil as well as ingestion, prey contamination, and prey abundance. Impacts of chemically dispersed oil to specific listed species were addressed based on information regarding a general exposure pathways and similar biota.

The NMFS response was issued on March 13, 1996 and records that NMFS concurred with the findings of the biological assessment that the proposed policy for preauthorization of dispersant use was unlikely to adversely affect endangered or threatened species. Within this response, NMFS issued special stipulations including: 1) Horizontal distance limitation for dispersant application of 100 yards for vessels and 500 yards for aircraft from any sighted individuals of listed species; and, 2) The right whale early warning system should be contacted for operations in or near the right whale critical habitat between December 1 and March 31 to obtain information on recent sightings and no effort should be made to relocate, deter or otherwise interfere with the whales.

The USFWS response was issued on April 4, 1996 and records that the USFWS found the biological assessment sufficiently supports that the action would not likely adversely affect listed species and concurred with this determination. USFWS pointed out the response did not represent a biological opinion but did fulfill the requirements of ESA Section 7. USFWS did not issue special stipulations but made several recommendations: 1) Issue revised color-coded maps for preauthorized and non-preauthorized zones; 2) Fund a contingency study for post-application research sampling in the event of dispersant use; and 3) Fund studies to focus on the persistence of chemically dispersed oil in sediments.

On December 16, 2010, following the unprecedented use of dispersants in response to the Deepwater Horizon (DWH, a.k.a. Macondo or MC252) incident, the National Response Team (NRT) issued a memorandum[3] to NRT members and RRT co-chairs requesting review and revision of all dispersant preauthorization plans. RRT4 immediately responded by reviewing its dispersant use plan and determined that only minor revisions were necessary; most conspicuously to include clarification that preauthorization would be limited to surface application methods. However, during this review process, it was proposed that the consultations for ESA Section 7 may also require revisions to determine if new species should be considered or if new effects data should be evaluated. Additionally, it was proposed that the assessment should be prepared to request consultation under both Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (aka Essential Fish Habitat) and Section 106

[3] National Response Team Memorandum. December 6, 2010. Use of Dispersants on Oil Spills – Interim Actions. Dana S. Tulis, Chair, National Response Team. Captain John Caplis, Vice Chair, National Response Team. To NRT Members and RRT Co-Chairs.

of the National Historic Preservation Act (NHPA). After slow progress in determining the magnitude and necessity of changes that would be required and which entity would be responsible for authoring them, representatives from both RRT4 and RRT6 met with representatives from the Services in February 2014 for a meeting to address these issues. Within part of this discussion, it was agreed that updates to the consultations would be necessary; yet it was also determined that both of the existing RRT4 and RRT6 dispersant preauthorization plans and their corresponding consultations would be considered valid and operable until revisions could be finalized.

1.2.B. Letters of Agreement

Letters of agreement were solicited from each relevant member of RRT4 prior to finalization of the original RRT4 dispersant use plan. Only the State of Georgia and NOAA responded to this request for letters. Georgia's letter, issued in 1996, provided specific protocols for requesting and implementing dispersant operations in Georgia state waters but did not provide or propose preauthorization of dispersant use in Georgia state waters. NOAA's letter, issued in 1994 and in coordination with a draft letter prepared by the state of Georgia, specified that Gray's Reef National Marine Sanctuary be excluded from the preauthorized zone.

On May 5, 2011, Florida Department of Environmental Protection (FLDEP) issued a letter to RRT4 re-affirming that Florida state waters would not be considered part of the preauthorized zone.

Section 1.3. History of *In-Situ* Burn Planning in RRT4

1.3.A. Consultation History

The initial RRT4 *In-Situ* Burning plan became effective April 20, 1995. The plan was prepared by the RRT4 Response and Technology Committee *In-Situ* Burn Workgroup and accompanying biological assessments were prepared both by the workgroup and assisting participants from NMFS and USFWS. Changes were issued on August 10, 1995, August 15, 1995 and January 15, 1999 which added letters of agreement from the states of South Carolina, Georgia, and North Carolina, respectively.

Biological assessments were sent to NOAA NMFS and USFWS on February 3, 1995 and March 31, 1995, respectively. The assessments addressed the status of species and effects of burning including heat, residues, and combustion products. The assessment prepared for NMFS addressed five whale species, six turtle species, and one sturgeon species. The assessment prepared for the USFWS addressed species of six turtles, one manatee, eight birds, one sturgeon, two reptiles, three mammals, and one herbaceous plant. Endangered species within RRT4 were determined to rarely occur or not occur within the proposed Action Area (the *Green Zone*, where use of *in-situ* burning and appropriate burning agents would be preauthorized). Discussions of exposure to oil spills focused on turtles, manatees, sturgeon, and birds (birds were evaluated as a group). Any potential impacts due to burning were determined to be minor and temporary and generally beneficial due to reduced overall operational activities relating to the response.

The NMFS response was issued on June 14, 1995 and records that NMFS concurred with the findings of the biological assessment that the proposed policy for *in-situ* burning was unlikely to adversely affect endangered or threatened species. Within this response, NMFS issues special stipulations including: 1) The right whale early warning system should be contacted for information on most recent sightings; 2) Burns may be conducted only during daytime after aerial surveys have confirmed no right whales are present within one nautical mile of the burn; 3) Should whales be present, no attempts should be made to relocate, deter, or "haze" the animal out of the operations area.

The USFWS response was issued on April 19, 1995 and records that USFWS found the biological assessment sufficiently supports that the action would not likely adversely affect listed species and concurred with this determination. USFWS pointed out that this response did not represent a biological opinion but did fulfill the requirements of ESA Section 7. USFWS did not issue special stipulations or recommendations.

1.3.B. Letters of Agreement

Letters of agreement were solicited from each relevant member of RRT4 prior to finalization of the original RRT4 *in-situ* burn plan. The States of North Carolina, South Carolina, and Georgia responded to this request for letters.

North Carolina's letter, issued on February 8, 1994, provided contact information to inform the State of the FOSC's intent to perform *in-situ* burn operations. The letter also directed the Department of Emergency Management to obtain input from Air and Water Quality Sections and Marine Fisheries then respond to the FOSC. A timeframe of 4 hours was stated for this coordination and response to take place.

The State of South Carolina issued a letter in August of 1995 which summarized the limitations and requirements of preauthorization and notification for preauthorized use of burning agents with *in-situ* burning. The State of Georgia issued a letter in August of 1995 which was identical to the letter from South Carolina. Both letters were circulated for signature by the USCG, EPA, the DOI, DOC and the respective state environmental department.

Section 1.4. Approach to Assessment

1.4.A. Management & Outline of Biological Assessment

The RRT4 approach in the construct of this Biological Assessment was to bring together management, scientific, academia, and response communities from federal, state, local, and private agencies, trustees, and stakeholders to evaluate the potential, actual, and extent of impacts resulting from the preauthorized use of dispersants or the preauthorized use of i*n-situ* burning to Federally listed species, designated critical habitats, and Essential Fish Habitat. The result of such partnerships helped shape this Biological Assessment into a document that not only conveys the actions, species, science, and analysis surrounding the Federal Actions, but also captures the information in a manner that can be used by scientific, management, and field responders for their specific needs, and formatted in such a way to possibly make changes without building an entire new Biological Assessment as additional information arises on resources, species, and scientific information.

The following shows the outline used in the construct of this biological assessment, and highlights key features:

- **Chapter 1. Introduction**
    - Provides Background & History of RRT4 Dispersant and In-Situ Burn operations and need for consultation
    - Provides Approach to the consultation and biological assessment construct
- **Chapter 2. Description of Proposed Federal Action**
    - Describes the Proposed Federal Actions of Preauthorized Dispersant and Preauthorized In-Situ Burn Operations
    - Describes the "Green Zone"
    - Describes the Protocols and Conservation Measures
    - Offers latest science describing toxicity of dispersants and in-situ burn ops
- **Chapter 3. Status of Listed Species, Critical Habitat, and Essential Fish Habitat**
    - Provides organized listing and description of Listed Species, Critical Habitat, and Essential Fish Habitat divided between the NMFS-ESA, USFWS-ESA, and NMFS-EFH resource management divisions.
    - Provides 1-2 page layouts describing the species and habitats, including appearance, diet, population, range, current threats, and distribution (species and habitat).
    - Provides Area Committee specific range reference for quick applicability to respective areas of operation.
    - Identifies EFH-Habitat Areas of Particular Concern, both as specific features as they apply to designated EFH, or as geographic areas based on the features of one or more types of EFH.
- **Chapter 4. Environmental Baseline**

    Augments Chapter 3 by describing other actions separate from the proposed federal actions. In particular, the increased risk of oil spills is substantiated through increased oil production, transportation, and port expansion. Furthermore, specific threats currently impacting federally listed species and habitats are augmented in this chapter (specific topics selected for inclusion by NOAA and USFWS, as well as by the RRT4 S&T workgroup responsible for the development of this biological assessment).
- **Chapter 5. Effects of Preauthorized Use of Dispersants on Listed Species**
    - Summarizes the Effects, Cumulative Effects
    - Provides determination of impact
- **Chapter 6. Effects of Preauthorized In-Situ Burn Operations on Listed Species, Critical Habitats, and Essential Fish Habitats**
    - Summarizes the Effects, Cumulative Effects
    - Provides determination of impact

- **Appendix I. Literature Cited**
- **Appendix II. Oil Spill Trends Based on Historical Data**
- **Appendix III. Summary of Listed Species, Critical Habitats, and Essential Fish Habitat Considered in this Assessment**
    - Quick snapshot of species and habitats, including status and range specific to local Area Committee area of operation.
- **Appendix IV. Conservation Measures**
    - Identified conservation measures to be implemented for the protection of ESA species/habitats, and EFH/EFH-HAPCs
    - Users are able to quickly incorporate conservation measures into regional & area contingency plans, operation plans, incident action plans, ICS-204s, and other communications as appropriate to the management of the incident.

1.4.B. Accountability of Federally Listed Species, Designated Critical Habitats, and Essential Fish Habitat

Paramount to any biological assessment is the accurate identification and terminology of federally listed species, designated critical habitat, and Essential Fish Habitat (EFH). This accountability was accomplished through an initial request to NMFS and USFWS for an accurate listing within the Action Area, or *Green Zone*. In addition, separate meetings were conducted to clarify terminology, extent, accuracy, and reference materials surrounding the listed species and designated critical habitat, of which are conveyed in Chapter 3 of this assessment. To account for future changes to this listing, RRT4 will initiate a request for updates from the Services annually, where any changes will be evaluated to determine the impact on the overall Biological Assessment including minor updates to existing species layouts, removal/replacement of existing species layouts, and addition of new species layouts.

Specific to the accountability of EFH in this assessment, three key points must be made related to their identification and description.

> First, the target of our assessment was to accurately portray and define the EFH types (or features) designated by the South Atlantic and Gulf of Mexico Fishery Management Councils (SAFMC and GMFMC, respectively). This approach, as offered by NMFS, allows this assessment to concentrate specifically on the impacts of the proposed Federal action on specific features (i.e. water column, *Sargassum*, coral, etc.), where should our analysis require, further connection can be made to specific geographic ranges of such habitat or features; and even further to specific fishery management plans if necessary.
>
> Second, while similar in features, the title and description of EFH are different between the SAFMC and GMFMC. Out of respect for the communities responsible for the management, enforcement, and utility between these two regions, the list and description of EFH is divided in this assessment between the South Atlantic and Gulf of Mexico regions, where outcomes from this assessment specific to these regions can be effectively conveyed and incorporated into respective plans serving the South Atlantic, Gulf of Mexico, or both regions.

> Third and final, with respect to the National Marine Fisheries Service and their management of EFH, this biological assessment assumes that the National Marine Fisheries Services uses the terminology and description of EFH as described by the applicable fishery management councils. While EFH terminology and descriptions are shared between NMFS and Fishery Management Councils, Habitat Areas of Particular Concern are not shared (HAPC); presently, the NMFS Southeast Region manages HAPC for Highly Migratory Species.

A quick summary of all federally listed species, critical habitats, essential fish habitats, and habitat areas of particular concern (including their status if applicable) can be found in Appendix III of this assessment.

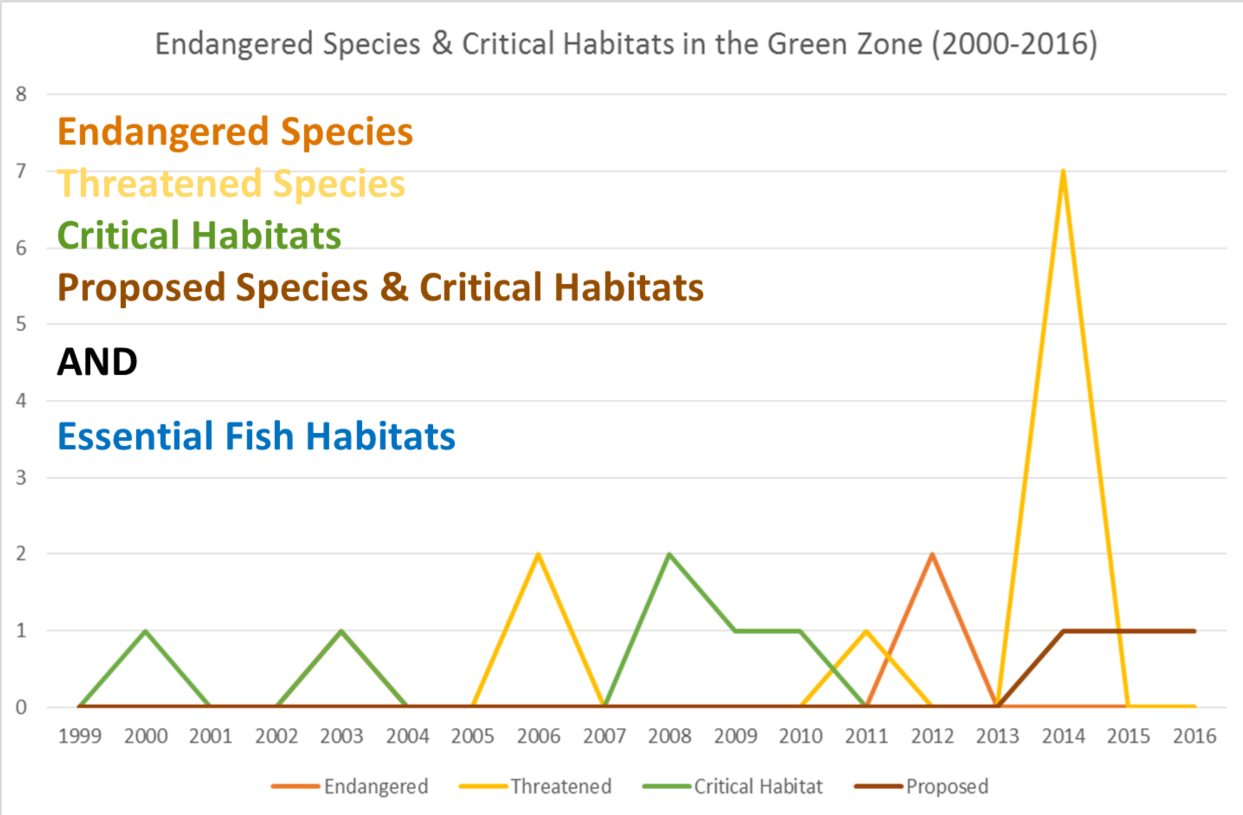
1.4.C. Respect for the Services and Field Response Community

This Biological Assessment is assembled and maintained at the regional level in consideration of the limited resources both at the level of the Services and among the field response community. Given the overlap both of the geographic area of the proposed actions ("Green Zone") and the species and habitat distribution, this Biological Assessment is intended to reduce repetition in description of action, species, and analysis through completion at the regional level, thereby reducing a requirement for the development of eight separate biological assessments for each Area Committee[4] on the same actions, and reducing the workload from the Services in having to review eight separate assessments. This consideration is not intended to refrain from a more localized assessment if necessary, where future partnership with the applicable trustees may be recommended as a result of the review of this assessment or the availability of new information that may arise in the future.

Changes to listed species and critical habitats occur regularly. The structure of this Biological Assessment considers these changes, allowing for quick incorporation of minor changes as they arise, and accountability of such changes in a record found at the beginning of this document. Each change in listed species or habitat will be reviewed by the Science & Technology Workgroup for a decision on impacts to this assessment, and the appropriate communication and strategy to properly capture the change into this existing Biological Assessment, or in a new biological assessment.

[4] Area Committees within Federal Region 4 include Mobile (MOB), St. Petersburg (STP), Key West (KYW), Miami (MIA), Jacksonville (JAX), Charleston (CHA), Savannah (SAV), and North Carolina (NC)

Figure 1-1. Additions of Federally Listed and Proposed Species and Critical Habitats in the Green Zone Under the Endangered Species Act, Counted Annually



1.4.C(1) Possible Oil Spill Scenarios

The assumption served by this Biological Assessment is that there does exist the risk of an oil spill at the water surface in the *Green Zone* and that the resources for the use of dispersants and *in-situ* burning are available should these actions be considered as an appropriate response strategy. Chapter 4 and Appendix 2 provide extensive analysis of oil spill incidents (historic and present) using The Marine Information for Safety and Law Enforcement (MISLE). These data are used in Section 2.1.H to develop oil spill scenarios using the General NOAA Oil Modeling Environment (GNOME) these sections offer ten scenarios and the availability of dispersants to effectively respond to these scenarios.

While historic data of actual oil spills from MISLE was used to inform possible oil spill scenarios, it has been discussed by RRT4 the possibility of adding data to this assessment that captures incidents that have occurred but did not result in an oil spill, but where potential did exist. Further discussion on this matter will continue at the RRT4 level within the Science & Technology Committee.

1.4.C(2) Environmental Baseline

The environmental baseline, as assembled in Chapter 4 of this assessment, is a description of existing conditions that are related to the Federal Action, Action Area (*Green Zone*), and species/habitats therein, that may add or alleviate certain stressors on listed species, critical habitats or Essential Fish Habitat. For this assessment, the following conditions have been identified and described:

- Oil Production & Transportation
- Maritime Transportation & Port Expansion
- Pollution & Environmental Toxicants
- Invasive Species
- Habitat Degradation
- Climate Change & Ocean Acidification
- Fishery Impacts
- Military Training
- Environmental Restoration Projects

The construct of this list was a result of a meeting conducted between RRT4, NOAA, USFWS and NMFS in September 2015, as well as the research by the Science & Technology Committee.

1.4.D. Maintenance and Update of the Biological Assessment

Annually, the RRT4 will review this biological assessment in order to validate that the information contained therein reflects the latest science, technology, plans, and listed species and habitats. As such, specific to ESA and EFH consultation, the RRT4 will request of the Services any updated listing of species, critical habitats, and essential fish habitats to ensure the latest information is contained in this biological assessment.

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Chapter 2. Description of Proposed Federal Action

The proposed action for this Biological Assessment is divided into two parts. Section 2.1 describes the Proposed Action associated with preauthorized use of dispersants. Section 2.2 describes the Proposed Action associated with preauthorized use of *in-situ* burning. The permissible geographic conditions for use of each tactic are the same. There are similarities with the required protocols for implementation of dispersants and *in-situ* burning, yet there are also differences which reflect the nuances of each operation. Finally, information is provided on the physical and toxicological effects that each activity may cause to listed species, critical habitats and Essential Fish Habitat.

Section 2.1. Description of the Preauthorized Dispersant Plan within the *Green Zone*

The RRT4 DUPP describes the policies and protocols for dispersants developed under the authorities described in the NCP 40 CFR 300.910(a). The objective of the DUPP is to provide for meaningful, environmentally safe, and effective dispersant operation under parameters that have been established by the RRT4 member agencies.

2.1.A. Authorization for the Use of Dispersants

Subpart J of the NCP provides that the RRT4 representatives from EPA, DOC, DOI and affected state(s) may preauthorize the use of chemical agents for oil spill response [40 CFR 300.910(a)]. Commandant, U.S. Coast Guard, has pre-designated the USCG Captains of the Port as FOSCs for coastal spills, and delegated authority and responsibility for compliance with Section 311 of the Federal Water Pollution Control Act, as amended, to them. The EPA, DOI, and DOC have delegated their authority for approval of preauthorization of dispersants to their RRT4 representatives.

RRT4 representatives from the states of North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi have been delegated authority by their respective agencies or state governments to represent natural resource concerns and to serve as consultants to the FOSC on these matters.

2.1.B. Preauthorized Area for the Use of Dispersants

Preauthorization is limited to geographical boundaries described in the *Green Zone* of section of the RRT4 DUPP.

2.1.B(1) Geographic Limitation

Per the RRT4 DUPP, two zones, "*Green Zone*" and *Yellow Zone*, have been established to delineate locations and conditions under which dispersant application operations may take place. Preauthorization for dispersant use is limited to the geographical boundaries outlined in the *Green Zone* only.

2.1.B(1)(a) *Green Zone* – Preauthorized Dispersant Use

The *Green Zone* is defined as any offshore waters within Federal Region 4 for which ALL of the following conditions apply:

2.1.B(1)(a)(i) Other Zone

The waters are not classified within a *Yellow Zone* as defined under section 2.1.B(1)(b)0;

2.1.B(1)(a)(ii) Distance

The waters are at least 3 nautical miles (nm) seaward of any shoreline (and is 9 nmi from Florida's Gulf Coastline) and are within the United States' Exclusive Economic Zone (EEZ); and,

2.1.B(1)(a)(iii) Depth

The waters are beyond the 30-foot (ft) isobath (approximately 10 meters [m] or 5 fathoms [ftm]).

Within *Green Zone*s, the USCG and EPA, DOC and DOI natural resource trustees, and the state(s) agree that the decision to apply dispersants rests solely with the USCG FOSC, and that no further approval, concurrence or consultation on the part of the USCG or the USCG FOSC with EPA, DOC and DOI natural resource trustees, or the state(s) is required for dispersant application. All dispersant operations within the *Green Zone* will be conducted in accordance with the policies and protocols set forth in the RRT4 DUPP.

2.1.B(1)(a)(iv) Special Case for West Coast of Florida:

Florida state waters extend seaward into the Gulf of Mexico to a distance of nine nautical miles and do not include any preauthorized dispersant use areas.

2.1.B(1)(b) *Yellow Zone* – Dispersant Use Not Preauthorized:

The *Yellow Zone* is defined as any area within Federal Region 4 for which ANY of the following conditions apply:

2.1.B(1)(b)(i) Special Jurisdiction

The area is under special management jurisdiction. This includes any waters designated as marine reserves, state parks, National Marine Sanctuaries, National or State Wildlife Refuges, or units of the National Park Service;

Critical Habitat

Proposed or designated critical habitats are not inherently part of the *Yellow Zone*; however, special Emergency Consultation is required under DUPP Protocol 4.7 for application in a geographic area which meets all the criteria of a *Green Zone* in Section 2.1.B(1)(a) and is also within a proposed or designated Critical Habitat.

Known critical habitats that meet these criteria are:

- Loggerhead Sea Turtle Northwest Atlantic Distinct Population Segment (DPS)

- Four segments of critical habitat management units (N-01, N-02, N-17, and N-18; 79 FR 39856) extend through the *Green Zone* due to migratory habitat features.
- Two management units (S-01 and S-02; 79 FR 39856) are within the *Green Zone* for *Sargassum* habitat features.

- North Atlantic Right Whale
  - One critical habitat delineated in regards to winter calving (81 FR 4837).
- Elkhorn and Staghorn Corals
  - One critical habitat delineated in regards to marine habitat (73 FR 72210).

2.1.B(1)(b)(ii) State Jurisdiction

The area is under state jurisdiction;

2.1.B(1)(b)(iii) Distance

The area is within 3 nm of a shoreline (or is within 9 nm from the Florida Gulf coastline);

2.1.B(1)(b)(iv) Depth

The waters are within the 30-foot isobaths (approximately 10 m or 5 ftm); and,

2.1.B(1)(b)(v) Habitats

The waters are in mangrove or coastal wetland ecosystems, or directly over living coral communities or hard bottom communities. Coastal wetlands include submerged algal beds and submerged sea grass beds. If the FOSC determines that the use dispersants may be beneficial in response to a release or discharge within the Yellow Zone, concurrence from EPA and affected states as well as consultation = DOI and DOC will be needed [40 CFR 300.910(b)]. The FOSC will submit a request for concurrence to the RRT4 representatives of EPA and the affected state(s) and request for emergency consultation to DOI and DOC. Procedures and requirements for dispersant use in the *Yellow Zone* are set forth in the RRT4 Dispersant Use Expedited Concurrence and Consultation Guide (DUECCG).

2.1.C. Dispersants Considered for the Preauthorization

Only those products specifically listed in the EPA's NCP Product Schedule of dispersants and which are considered appropriate by the FOSC for existing environmental and physical conditions will be considered for use during dispersant application operations.

The September 2016 version of the EPA NCP Product Schedule lists a total of 19 dispersants that have met the submission requirements of 40 CFR 300.915(a) and 40 CFR 300.920(a). Confirmed dispersant resources staged within or near Federal Region 4 consists mostly of Nalco Environmental Solutions, LLC, COREXIT® EC9500A (formerly COREXIT 9500) (see Table 2-1). While RRT4 does not promote or favor any brand or dispersant product, it is reasonable to anticipate that the most likely product to be deployed in a preauthorization capacity will be EC9500A. By November of 2015, at least one contract company operating within or near Federal Region 4 is stockpiling Advanced BioCatalytics Corp., Accell Clean® DWD.

Table 2-1. Dispersant Resources Available In, or Near, Federal Region 4

Product	Storage Method	Location	Unit	Aircraft
Accell Clean DWD	5,000 gal (approx.) [5]	Houma, LA	Clean Gulf Associates[6]	(1) Basler-67 (modified DC-3), and (2) DC-3; operated by Airborne Support Inc. (also has spotter aircraft)
COREXIT EC9527A	4 x 330-gal totes			
COREXIT EC9500A	33,000 gal			
	31,961 gal	Houma, LA	Airborne Support, Inc.[7]	
	493 x 330-gal totes	Fort Lauderdale, FL	Oil Spill Response Ltd. (formerly Clean Caribbean)[8]	ADDS-pack payload operated by Clean Caribbean utilizes C-130H on contract
	36 x 330 gal totes	Kiln, MS	Marine Spill Response Corp.[9]	C-130A operated by Marine Spill Response Corp. locations in Kiln, MS; and Mesa, AZ King Air BE-90 operated by Marine Spill Response Corp. locations in Kiln, MS; San Juan, PR; and Salisbury, MD.
	4,129 gal in 5k-gal ISO Tank			
	35 x 330-gal totes	Galveston, TX		
	10 x 330-gal totes	Ingleside, TX		
	21 x 330-gal totes	Savannah, GA		
	16 x 330-gal totes	Tampa, FL		

2.1.D. Application of Dispersants Applicable to the Preauthorization

In addition to geographic limitations within the *Green Zone*, preauthorization is limited to initial application activities defined by method and resource.

2.1.D(1) Method Limitation – Surface Application:

Preauthorization is limited to application of dispersants to surface waters using aircraft or vessel spraying systems. Subsurface, injection, or alternative dispersant application methods that do not meet these criteria are not approved by RRT4 for preauthorized use. Platforms should be properly maintained and meet ASTM standards F1413[10], F1460[11], and F1737[12].

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[5] Began adding to Clean Gulf Associates stockpile in November, 2015; M. Huyser confirmed with CGA by email
[6] Information confirmed over phone by M. Huyser with Clean Gulf Associates, September 30, 2015
[7] Information confirmed by M. Huyser with Clean Gulf Associates by phone, September 30, 2015
[8] Information confirmed by M. Huyser with Oil Spill Response Ltd. by phone, September 25, 2015
[9] Information confirmed by M. Huyser with Marine Spill Response Corp. by email, September 28, 2015
[10] ASTM F1413 "Standard Guide for Oil Spill Dispersant Application Equipment: Boom and Nozzle Systems"
[11] ASTM F1460 "Standard Practice for Calibrating Oil Spill Dispersant Application Equipment Boom and Nozzle Systems"
[12] ASTM F1737 "Standard Guide for Use of Oil Spill Dispersant Application Equipment during Spill Response: Boom and Nozzle Systems"

2.1.D(2) Resource Limitation – Contracts:

The Responsible Party is limited to dispersant resources identified in their Vessel and Facility Response Plan required under 33 CFR § 155 ("CAPS Rule"). Contracted dispersant operations shall have the organization and capability to provide the first application of dispersant over the designated response zone as rapidly as possible. However, the ability of the FOSC to exercise preauthorized use of dispersants will not be limited by the responsible party's requirement for pre-established contracts.

2.1.D(3) Aerial Application

Five aircraft staged within or near Federal Region 4 are equipped with aerial spraying systems capable of deploying dispersants. These aircraft are capable of deploying volumes from 425 to 3,250 gallons (gal) of dispersant in a single flight and can deploy more than 19,000 gal of dispersant to a discharge event during an operational period of 12 hours. For preauthorized use, RRT4 requires that spray operations be conducted during daylight hours only and that weather conditions be limited to winds less than 25 knots, visibility greater or equal to 3 nmi, and a ceiling of greater than or equal to 1,000 ft. Operations for dispersant application should employ airborne spotters for control of spray patterns and airborne monitors or observers for documentation of efficacy and impacts.

2.1.D(4) Vessel Application

Vessel mounted spray systems may be capable of deploying dispersant "neat" or diluted with water. Fire monitor systems may also be configured to deploy diluted dispersant but should comply with ASTM F2465[13]. As with aerial application, RRT4 requires that spray operations be conducted during daylight hours only but does not specify weather conditions for vessel application; the FOSC and Safety Officer should be capable of determining if weather conditions are suitable and safe for the proposed platform. Additionally, operations for vessel-based dispersant application should still employ airborne monitors or observers for documentation of efficacy and impacts and employ airborne spotters where surface oil is not easily distinguished by the vessel.

2.1.E. Preauthorized Agreements (Federal, State, Local)

Letters of agreement were solicited from each relevant member of RRT4 prior to finalization of the original RRT4 dispersant use plan. Only the State of Georgia and NOAA responded to this request for letters. Georgia's letter, issued in 1996, provided specific protocols for requesting and implementing dispersant operations in Georgia state waters but did not provide or propose preauthorization of dispersant use in Georgia state waters. NOAA's letter, issued in 1994 and in coordination with a draft letter prepared by the state of Georgia, specified that Gray's Reef National Marine Sanctuary be excluded from the preauthorized zone.

[13] ASTM F2465 "Standard Guide for Oil Spill Dispersant Application Equipment: Single-point Spray Systems"

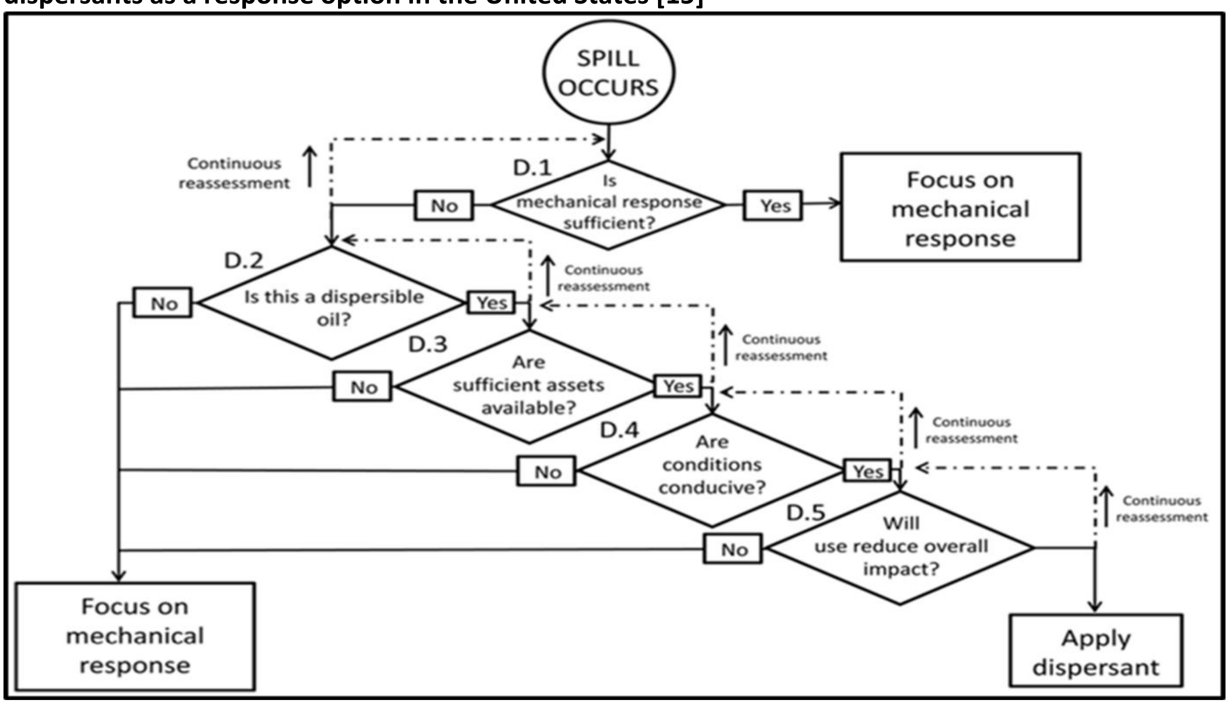
On May 5 of 2011, Florida Department of Environmental Protection issued a letter to RRT4 re-affirming that Florida state waters would not be considered part of the preauthorized zone.

2.1.F. Preauthorized Use of Dispersants Protocols & Protective Measures

2.1.F(1) Dispersant Use Preauthorization Plan (DUPP) Protocols

The DUPP contains protocols which must be followed as part of the conditions for preauthorization. Evaluation of continued use, implementation of environmental monitoring, and consideration of trajectory are collectively intended to minimize the volume of dispersant used while maximizing its effectiveness. Trajectory of oil slicks and dispersed oil must be evaluated to ensure that sensitive receptors such as species, critical habitats, or special management areas are protected to the greatest extent possible; this evaluation should be conducted regardless of whether dispersants are used but particular consideration is needed where proposed dispersant application is near the boundary of the prescribed *Green Zone*. A proximity of 10 nmi or less from the *Green/Yellow Zone* boundary is recommended as a vicinity for critical evaluation but this distance does not constitute an additional boundary line.

Figure 2-1. Idealized decision flow chart for evaluating the appropriateness of using chemical dispersants as a response option in the United States [15]



Environmental monitoring initially focuses on Special Monitoring of Applied Response Technologies (SMART) protocols and is at minimum necessary to evaluate the efficacy of the dispersant application but should be expanded as soon as is feasible to begin evaluation of chemically dispersed oil toxicity. The evaluation of continued use is based on information received by the FOSC from monitoring and trajectory results, as well as other response elements.

A mandatory dispersant use form must be completed prior to use and is accompanied by a flow diagram which provides direction on whether a given scenario qualifies for preauthorization. RRT4 has also developed a Dispersant Use Operational Planning and Implementation Guidance (DUOPIG), which is an optional document that provides information on multiple elements of a dispersant operation including spray platforms, job aids, and Incident Command System (ICS) positions.

2.1.F(2) Additional Protective Measures Identified During the Biological Assessment

Additional recommended measures must be taken to prevent risk of any injury to wildlife, especially endangered or threatened species, critical habitat, and Essential Fish Habitat are to be identified through the formal consultation process. Additional protective measures provided in Appendix IV have been identified during the construct of this Biological Assessment, in consultation with NOAA, NMFS, USFWS, South Atlantic Fishery Management Council (SAFMC), Gulf of Mexico Fishery Management Council (GMFMC), EPA, and USCG. These measures must be employed where the conditions identified by the service agency apply.

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2.1.G. Overview of the Toxicity of Dispersants and Chemically Dispersed Oil

This section discusses the best available scientific and commercial information on the acute toxicity of dispersants and chemically dispersed oil, with greater emphasis on the latter. These discussions focus on dispersants for use in Region 4, which are those listed on the Subpart J of the NCP Product Schedule ([40 CFR §300.9150 and 40 CFR §300.920[14]] (23 dispersants total). As discussed in Chapter 2, the most likely product to be deployed in a pre-authorization capacity would likely be COREXIT EC9500A (formerly COREXIT 9500). Thus, this Biological Assessment evaluates the best available data on the listed[15] dispersant products, but focusing primarily on data from the new and old formulation of COREXIT EC9500A.

2.1.G(1) The Toxicity of Dispersants and their Constituents

The exact chemical composition of most commercially available dispersants is proprietary, but they generally contain a high percentage of surfactant chemicals that enhance the miscibility of oil with water, facilitating its weathering and biodegradation. For example, the listed COREXIT dispersants consist of surfactants (e.g., Tween 80, Tween 85, Span 80, sodium dioctyl sulfosuccinate or DOSS) in a solvent base (e.g., propylene glycol, Dipropylene glycol n-butyl ether or DPnB)[16] [1], with COREXIT 9500 lacking the ingredient 2-butoxy ethanol, an ingredient that comprises up to 60% by wet weight of COREXIT 9527. Most of these chemical constituents are considered to have low aquatic toxicity (based on chemical structure and limited toxicity data)[17]. For example, propylene glycol, DPnB, and DOSS were detected in a few samples collected during DWH's surface and sub-surface dispersant application periods, but none exceeded the recommended benchmarks [2].

The initial federal listing of dispersants for inclusion in the NCP Product Schedule requires the manufacturers to submit the results of chemical analyses conducted on dispersant to test for the presence and concentration of heavy metals, cyanide, and chlorinated hydrocarbons (summarized in Table 2-2). Based on relatively recent analyses, the concentrations of heavy metals in pure undiluted dispersant products are generally below metal concentration in oceanic seawater[18] [2][19]. When dispersants are used in response to an oil spill, concentrations of all chemical

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[14] USEPA Emergency Management, NCP Product Schedule – Subpart J: http://www2.epa.gov/emergency-response/national-contingency-plan-subpart-j

[15] The term "listed dispersant(s)" in this document shall refer only to those dispersants currently listed on the NCP Product Schedule [40 CFR §300.905]; any use of the term "preauthorized dispersant(s)" or "pre-approved dispersant(s)" is technically inaccurate [40 CFR §300.920(e)] and should be interpreted to refer to listed dispersants.

[16] Some of the components of COREXIT are listed by the manufacturer: http://www.nalcoesllc.com/nes/1602.htm

[17] Screening levels for selected chemical components in COREXIT were established by the USEPA in response to the Deepwater Horizon oil spill (archive: http://www.epa.gov/bpspill/dispersant-methods.html).

[18] Concentrations of trace metals in surface oceanic seawater are summarized in http://www.mbari.org/chemsensor/pteo.htm

[19] The original source of this information was provided by Schultz et al. 2012, Pacific Northwest National Laboratory (unpublished report, available by special permission) to the University of New Hampshire's Coastal Response Research Center, the National Oceanic and Atmospheric Administration and Research Planning, Inc., in preparation for the 2012 Oil Spill Dispersant Research Forum (https://crrc.unh.edu/sites/crrc.unh.edu/files/media/docs/Workshops/dispersant_future_11/Dispersant_Initiative_FIN

constituents in dispersants, including metals, are further diluted into the water column (e.g., [3-16]; refer to Section 2.1.H for details) likely falling below proposed aquatic criteria values (e.g., [17]).

Table 2-2. Concentration of heavy metals, cyanide, and chlorinated hydrocarbons (mg/L or ppm) in pure undiluted dispersants as reported by the manufacturers[20].

Dispersant Compound	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Cyanide	Chlorinated Hydrocarbons
COREXIT EC9527A	<0.005	<0.01	1	<0.2	<0.1	<0.003	<0.1	0.1	<0.01	<0.01
NEOS AB3000	<0.1	<0.1	0.26	<0.05	0.21	<0.001	0.076	1.1	<0.05	<0.10
MARE CLEAN 200	<0.50	<0.100	<0.500	<0.250	<2.50	<0.0200	<0.250	0.611	<0.01	<0.10
COREXIT EC9500A	0.16	ND	0.03	0.1	ND	ND	ND	ND	ND	ND
DISPERSIT SPC 1000	<1.00	<2.00	<2.00	<2.00	<1.00	<0.04	<10.00	<2.00	<2.00	<5.00
JD-109	<10	<10	<10	<10	<10	<1	<10	<10	<0.5	<1.4
JD-2000	<0.24	<0.10	<0.10	<0.10	0.43	<0.10	<0.10	0.11	<0.20	<2.00
NOKOMIS 3-F4	0.3	<5.00	<10.00	<10.00	<10.00	<0.05	<10.00	<10.00	<2.00	<1.00
BIODISPERS	<2.50	<0.75	<0.75	<0.50	<5.00	NR	<1.20	<0.50	3.90[1]	<5.00
SEA BRAT #4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.0002	<0.05	0.215	<0.05	<0.05
FINASOL OSR 52	<10.0	<10.0	<10.0	<10.0	<10.0	<1.0	<10.0	<10.0	<0.4	<4.4
SAF-RON GOLD	<0.01	<0.005	0.14	0.324	<0.005	<0.020	<0.005	0.0671	<0.20	<0.80
ZI-400	<10	<10	<10	<10	<10	<1	<10	<10	<0.5	<1.0
NOKOMIS 3-AA	<0.12	<0.25	<0.25	<0.25	<0.12	<0.0016	<0.25	<1.0	0.034	<0.10
SUPERSPERS	<0.25	<0.25	<0.25	<0.25	<0.25	<2.00	<0.25	<0.25	<0.50	ND
ACCELL CLEAN DWD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FFT-SOLUTION	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MARINE D-BLUE CLEAN	<0.25	<0.005	<0.08	<0.30	<0.015	<0.0025	<0.350	<2.015	<0.050	ND
COREXIT EC9500B	0.0108	<0.0020	<0.0060	<0.0060	<0.0040	<0.001	<0.0100	<0.0060	<0.0100	1.76

[1] Possibly an analytical artifact

ALREPORT.pdf). The interpretation of the information related to trace metal analysis of COREXIT 9500A and COREXIT 9527 by Schultz et al. 2012 is the sole responsibility of Research Planning, Inc.

[20] Table modified from http://www2.epa.gov/sites/production/files/2013-08/documents/notebook.pdf

Toxicity values[21] of undiluted, listed dispersants provided by the manufacturers[22] and summarized in Figure 2-2 include test results with two standard test marine species, *Menidia beryllina* (the inland silverside fish; 96 h exposure tests) and *Americamysis bahia*, previously known as *Mysidopsis bahia* (a mysid shrimp; 48 h exposure tests). These data are consistent with an independent toxicity testing performed on eight of the listed dispersants [18]. As shown in Figure 2-2, and relative to the standard toxicity categories used by the USEPA[23], all toxicity values fall within the range of what is considered moderately to practically nontoxic, with most test results falling within the slightly toxic range. Based on these data the listed dispersants exhibit similar toxicities to the two standard test species.

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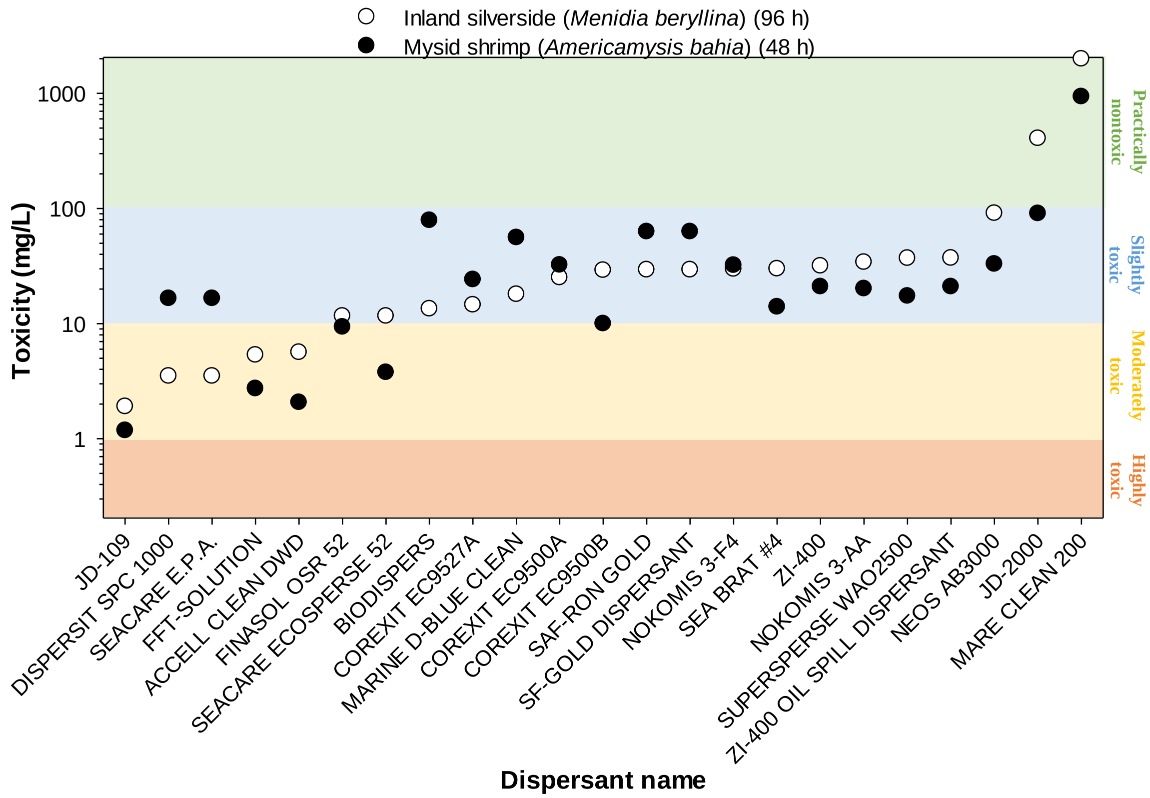
[21] Toxicity values are commonly reported as the concentration of the product in the aqueous exposure media that is lethal to 50% (median lethal concentration, LC50) or that causes an adverse effect to 50% (median effects concentration, EC50) of the exposed test population. As a general rule, the smaller the LC50 or EC50 values, the greater the toxicity.

[22] USEPA Emergency Management http://www2.epa.gov/emergency-response/national-contingency-plan-product-schedule-toxicity-and-effectiveness-summaries

[23] Toxicity LC50 and EC50 categories for aquatic organisms are as follows: Very highly toxic <0.1 mg/L, Highly toxic 0.1-1 mg/L, Moderately toxic >1-10 mg/L, Slightly toxic >10-100 mg/L and Practically nontoxic >100 mg/L Source: http://www2.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0

Figure 2-2. Toxicity data (LC50 values, mg/L or ppm) for all preauthorized dispersants listed on the Subpart J of the NCP24 using two standard test species. This figure is displayed over a color-coded background of standard toxicity categories used by the USEPA[25].



2.1.G(2) Standard Toxicity testing: Spiked vs. Constant Exposure Conditions

The vast majority of dispersant and chemically dispersed oil toxicity testing has been done under laboratory test conditions by exposing test animals to constant concentrations over periods of 48 to 96 hours (h) (2 to 4 days). During an oil spill and as demonstrated via trajectory modeling of oil spills scenarios (Section 2.1.H), organisms are not exposed to a constant concentration of either the dispersant or chemically dispersed oil, even if entrained within the moving water mass. Instead, animals are exposed to a spike in concentration that rapidly declines over time due to natural mixing and spreading in three dimensions within open waters in areas preauthorized for dispersant use. As a result, LC50 and EC50 values generated from constant exposures under laboratory test conditions produce conservative measure of toxicity. More environmentally realistic toxicity values can be obtained from spiked or spiked flow-through tests as these types

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[24] Source: http://www2.epa.gov/emergency-response/national-contingency-plan-product-schedule-toxicity-and-effectiveness-summaries

[25] Toxicity LC50 and EC50 categories for aquatic organisms are as follows: Very highly toxic <0.1 mg/L, Highly toxic 0.1-1 mg/L, Moderately toxic >1-10 mg/L, Slightly toxic >10-100 mg/L and Practically nontoxic >100 mg/L Source: http://www2.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0

of exposures address the dilution that occurs in open waters by reproducing under laboratory conditions rapid changes in concentrations within the water column (e.g., [1, 15, 19, 20]).

Toxicity data (48 h and 96 h LC50 and EC50) from different sources for the most studied dispersants, COREXIT 9527 and COREXIT 9500, displayed in the form species sensitivity distributions (SSDs[26]) (Figure 2-3 top) show that most existing data for a wide range of species from *constant* exposures fall within moderately to practically nontoxic range, with most data falling within the slightly toxic range. Estimated Hazard Concentrations or HC5s[27] for COREXIT 9527 and COREXIT 9500 are 4.56 mg/L and 1.6 mg/L, respectively, which are slightly more conservative than those published elsewhere (COREXIT 9527 and COREXIT 9500 HC5s 6.64 mg/L and 4.4 mg/L, respectively) [21]. Comparable data based on *spiked* exposures show that most data fall within the slightly to practically nontoxic range, with most data falling within the practically nontoxic range (Figure 2-3, bottom). Even for sensitive species, most toxicity values for COREXIT 9527 and COREXIT 9500 regardless of exposure conditions are in excess of 20 mg/L, falling within the range of what is considered slightly toxic. Estimated HC5s for COREXIT 9527 and COREXIT 9500 are 8.38 mg/L and 4.04 mg/L, respectively. While HC5s from constant exposures fall within the moderately toxic range, these concentrations are assumed to be worst case, as exposure concentrations under standard dispersant applications [22, 23] are not expected to remain constant in the water column. Consequently, when using the generally accepted dispersant application rate (5 gallons/acre at a prescribed 1:20 dispersant to oil ratio; ca. 5 mg/L instantaneous dispersant concertation in the water column), dispersants are generally not expected to cause toxicity to most water column organisms. Studies that conducted toxicity tests for the same species under constant and spiked laboratory conditions [24-29] reported LC50 and EC50 values for COREXIT dispersants up to 63 times higher (lower toxicity) under spiked exposures compared to values from constant exposures.

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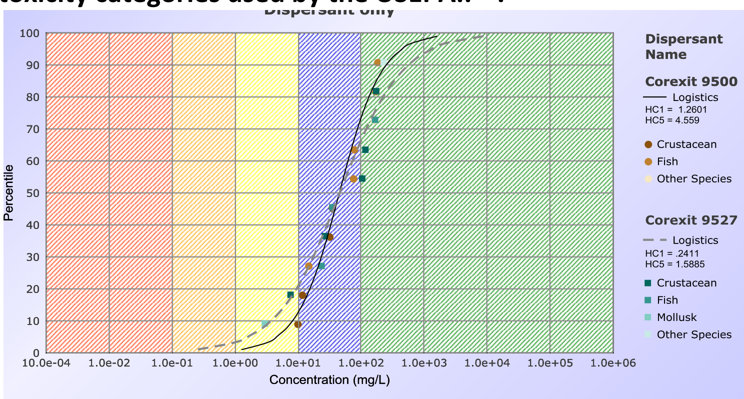
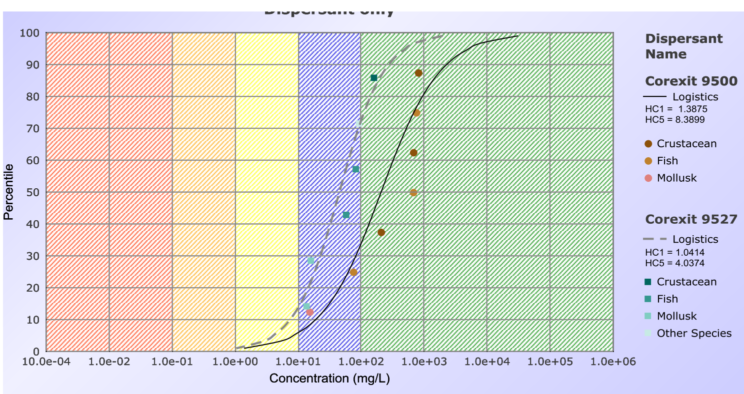
[26] SSDs are cumulative distributions of toxicity data allowing for comparisons of the sensitivities of aquatic species to the same chemical.

[27] The HC5, or 5th percentile hazard concertation refers to the concentration that is assumed to be protective of 95% of all the species in the SSD.

Figure 2-3. Toxicity data (48 h and 96 h combined; LC50 and EC50 values) for COREXIT 9500 and COREXIT 9527 based on constant exposures (worst case exposure scenario) (top) and more environmental realistic exposures (bottom; insufficient data to generate an SSD for COREXIT 9527) [30]. As a reference, the maximum dispersant concentrations under standard dispersant application rates is estimated at 5 mg/L. Toxicity values are displayed over a color-coded background of standard toxicity categories used by the USEPA.. [28].





[28] Toxicity LC50 and EC50 categories for aquatic organisms are as follows: Very highly toxic <0.1 mg/L, Highly toxic 0.1-1 mg/L, Moderately toxic >1-10 mg/L, Slightly toxic >10-100 mg/L and Practically nontoxic >100 mg/L Source: http://www2.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0

2.1.G(3) The Toxicity of Chemically Dispersed Oil[29]

Crude oil consists of a complex mixture of hydrocarbon compounds (aliphatic, aromatic, and asphaltic hydrocarbons), with different chemical and physical properties. After an oil is released onto the water, the oil is dispersed into the water column by several physical forces (spreading and advection through wind, currents, and vertical and horizontal water column mixing), and undergoes weathering via processes such as volatilization, oxidation and biodegradation) [14, 15]. Depending on the size of a spill, floating oil poses potential fouling risks to surface water wildlife (seabirds, sea turtles, marine mammals) and nearshore and shoreline habitats [14, 15]. The use of dispersants is intended to reduce impacts to these resources by dispersing portions of the floating oil into the top few meters of the water column [14, 15], resulting in increased risks of oil exposures for a period of minutes to hours (see Section 2.1.H) to entrained organisms (e.g., plankton, embryos of many aquatic species) found near the water surface. Adverse effects from both physically and chemically dispersed oil can result from exposures to accommodated[30] or dissolved oil fractions, physical smothering from direct contact with oil droplets, and oil ingestion [14, 15]. While the use of dispersants results in greater oil loading in the top few meters of the water column, generally, vertical and horizontal water mixing rapidly dilutes oil concentrations (see Section 2.1.H) [14, 15, 19].

Toxicity of No. 2 fuel oil chemically dispersed with the listed dispersants to the inland silverside fish and the mysid shrimp, provided by the manufacturers[31] and summarized in Figure 2-4, show that toxicity values range from moderately to slightly toxic. Most test results show a greater sensitivity (lower toxicity values) by the mysid shrimp, which based on the reported toxicity values are up to six times more sensitive to the toxicity of No. 2 fuel oil. Comparing these toxicity results to the toxicity data for dispersants only (Figure 2-2) and relative to the toxicity of toxicity of No. 2 fuel oil without dispersants, the greatest contribution to the overall toxicity of chemically dispersed oil comes from the oil itself, and not the dispersant. In other words, dispersants alone are generally much less toxic than physically or chemically dispersed oil.

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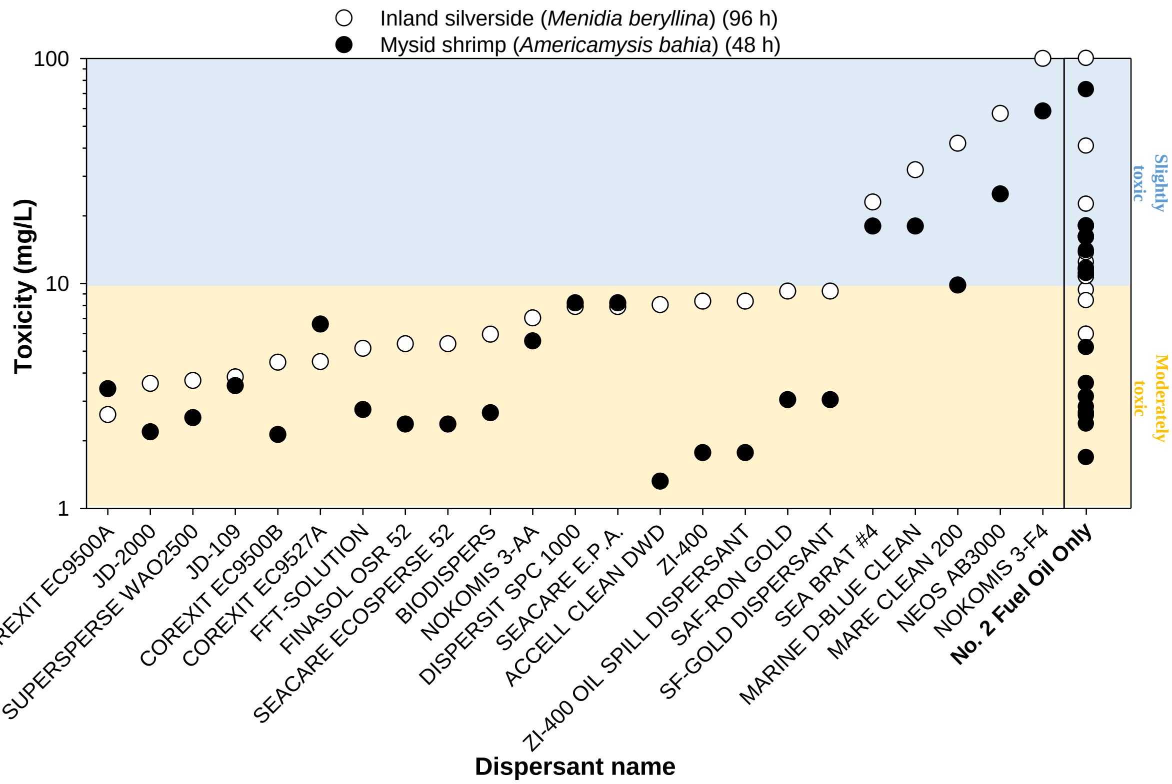
[29] For the purpose of this Biological Assessment, a clear distinction is made between physically and chemically dispersed oil. Physically dispersed oil refers to oil that is naturally dispersed or entrained in water by physical processes (e.g., water column mixing in open waters; controlled mixing energy under laboratory conditions), while chemically dispersed oil refers to oil that has been treated with chemical dispersants to enhance its partitioning into water (e.g., under open water or laboratory conditions).

[30] The term “accommodated” (as opposed to “soluble”) refers to exposures to media of poorly soluble material such as oil potentially containing particles (e.g., oil droplets).

[31] USEPA Emergency Management http://www2.epa.gov/emergency-response/national-contingency-plan-product-schedule-toxicity-and-effectiveness-summaries

Figure 2-4. Toxicity data (LC50 values, mg/L or ppm) of No. 2 fuel chemically dispersed with each of the authorized dispersants listed on the Subpart J of the NCP32 using two standard test species. The toxicity of physically dispersed No. 2 fuel (without dispersants) is also displayed as a reference. This figure is displayed over a background of standard toxicity categories used by the USEPA[33].



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The toxicity of both physically and chemically dispersed oil has been studied using a variety of experimental designs, many of which may not represent the types of exposures that occurs in open waters following the use of dispersants to treat oil slicks, which are short and acute exposures to high oil concentrations declining rapidly over time and accounting for dilution [14, 15, 19, 20, 24, 31] (see Section 2.1.H). As a result, and similar to the studies on dispersants alone, tests performed under constant static exposures tend to be conservative estimates of toxicity when compared to spiked or flow through tests, which represent more realistic environmental exposures [14, 15, 19, 20, 24, 31].

Another important consideration regarding existing toxicity data is that many studies (e.g., [32] report toxicity data based on the amount of oil added to the aqueous exposure media (nominal concentrations of whole oil), and not on the basis of the actual measurement by analytical

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[32] Source: http://www2.epa.gov/emergency-response/national-contingency-plan-product-schedule-toxicity-and-effectiveness-summaries

[33] Toxicity LC50 and EC50 categories for aquatic organisms are as follows: Very highly toxic <0.1 mg/L, Highly toxic 0.1-1 mg/L, Moderately toxic >1-10 mg/L, Slightly toxic >10-100 mg/L and Practically nontoxic >100 mg/L Source: http://www2.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0

methods of oil constituents in the exposure media (e.g., polycyclic aromatic hydrocarbons [PAH] or total hydrocarbon content [THC]). This practice has been discouraged for several decades and is no longer acceptable [15, 33]. Accordingly, in this analysis, only studies reporting toxicity values on the basis of measured THC or PAH in the aqueous media were included. Reporting toxicity data on the basis of measured oil concentrations in water is important because dispersants influence the distribution or partitioning of individual hydrocarbon constituents of oil, such that more hydrocarbons, particularly those more soluble, enter the dissolved phase at a higher rate (e.g., [19]). Consequently, oil exposure media prepared with dispersants result in higher oil concentrations in water than those prepared without dispersants, without altering the inherent toxicity of the oil. Consistently, several studies [18, 25, 34-37] and reviews of large data compilations [14, 15, 19] found that when comparisons are made based on measured oil concentrations in the aqueous exposure media, generally, the toxicity of chemically dispersed oil is not greater than that of physically dispersed oil.

Toxicity data (48 h and 96 h LC50 and EC50; measured concentrations) from different sources for Alaska North Slope and Prudhoe Bay oils dispersed with COREXIT 9500 displayed in the form SSDs (Figure 2-5) show that most existing data for a wide range of species from constant exposures fall in and between the highly to slightly toxic ranges, with most of that data falling inside the moderately toxic range (estimated HC5=0.11 mg/L). Comparable data based on spiked exposures show that most data fall in and between the moderately to practically nontoxic ranges, with most of that data falling inside the slightly toxic range (estimated HC5=2.06 mg/L). Studies have reported LC50 and EC50 values from spiked exposures to oil chemically dispersed with COREXIT dispersants between 3 and >95 times higher (lower toxicity) than LC50 and EC50 values from constant exposures for the same species (Table 2-3; data in summarized in [30] and [38]).

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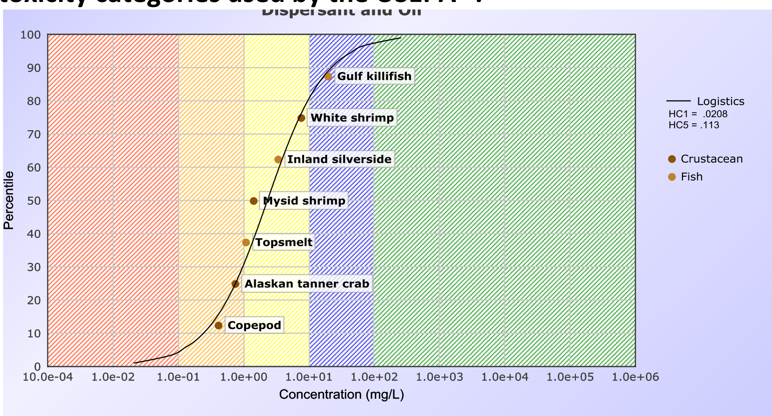
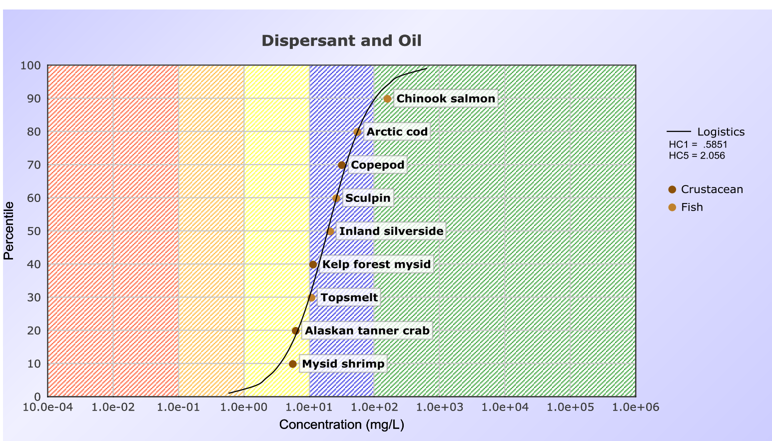
Figure 2-5. Toxicity data (48 h and 96 h combined; LC50 and EC50 values based on measured THC concentrations) for Alaska North Slope and Prudhoe Bay oils chemically dispersed with COREXIT 9500 based on constant exposures (worst case exposure scenario) (top) and more environmentally realistic exposures (bottom) [30]. Toxicity values are displayed over a color-coded background of standard toxicity categories used by the USEPA[34].





[34] Toxicity LC50 and EC50 categories for aquatic organisms are as follows: Very highly toxic <0.1 mg/L, Highly toxic 0.1-1 mg/L, Moderately toxic >1-10 mg/L, Slightly toxic >10-100 mg/L and Practically nontoxic >100 mg/L Source: http://www2.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0

Table 2-3. Range of toxicity values (LC50 and EC50; 96 h constant and spiked exposures combined; measured THC concentrations) from physically dispersed oils, and oils chemically dispersed with COREXIT 9500 and COREXIT 9527. Data summarized from [30] and [38]; n= number of observations.

Oil Dispersion Method	LC50 and EC50 in ppm (mg/L)	
	Constant Exposure	Spiked Exposure
Alaska North Slope + Physical	0.27 – 16 (n=12)	0.40 – 26 (n=37)
Alaska North Slope + COREXIT 9500	0.36 – 21 (n=12)	2.22 – 80 (n=38)
Arabian Light + Physical	0.53 – 19 (n=4)	83 (n=1)
Arabian Light + COREXIT 9500	1.50 – 2.50 (n=2)	25 – 61 (n=4)
Arabian Medium + Physical	0.56 – 5.50 (n=14)	0.42 – 83 (n=5)
Arabian Medium + COREXIT 9500	0.64 – 2.50 (n=5)	8.90 – 61 (n=13)
Bass Strait + Physical	0.21 – 1.28 (n=5)	NA
Bass Strait + COREXIT 9500	0.32 – 1.37 (n=5)	NA
Kuwait + Physical	0.10 – 193 (n=14)	175–231 (n=14)
Kuwait + COREXIT 9527	0.11 – 1.09 (n=6)	1.3 – 111 (n=13)
Prudhoe Bay + Physical	15 (n=1)	0.95 – 40 (n=22)
Prudhoe Bay + COREXIT 9527	45 – 162 (n=6)	11 – 74 (n=8)
Prudhoe Bay + COREXIT 9500	1.07 – 4.57 (n=2)	1.07 – 166 (n=28)
South Louisiana + Physical	2.70 – 17 (n=9)	NA
South Louisiana + COREXIT 9500	4.84 – 18 (n=8)	NA
Venezuelan + Physical	0.15 – 0.40 (n=3)	0.59 – 0.89 (n=5)
Venezuelan + COREXIT 9500	0.50 – 0.68 (n=4)	2.84 – 121 (n=8)

In summary, the acute toxicity values of the dispersants are larger (lower toxicity) (in excess of 20 mg/L even for sensitive species; shown Figure 2-2 and Figure 2-3) when compared to the toxicity values of crude oil (in excess of 2 mg/L even for sensitive species; shown in Figure 2-4, Figure 2-5 and Table 2-3) (see also [14, 15]). For example, the ranges of toxicity values for COREXIT 9500 and COREXIT 9527 to inland silverside larvae under spiked exposures are 41-674 mg/L, and 43-58 mg/L, respectively, while toxicity values of oil chemically dispersed with COREXIT 9500 and COREXIT 9527 under spiked exposures are 3-62 mg/L, and 7-11 mg/L, respectively.

2.1.G(4) Effects of Dispersants and Chemically Dispersed Oil on Species and Habitats

This section is intended to provide a general overview on what is known about the effects of dispersants and chemically dispersed oil on species and habitats, but it is not a comprehensive review of all available studies. It is important to note that most research has focused on studying the impacts of oil spills on species and habitats, with relatively few studying the impacts of dispersant or chemically dispersed oil. With a few exceptions, most studies have not contrasted the impacts of chemically versus physically dispersed oil, and consequently, most of the discussions below focus on all relevant literature.

2.1.G(4)(a) Invertebrates

Within the context of this Biological Assessment, invertebrate species that may be at increased risk of exposure to dispersants and chemically dispersed oil are primarily those associated with the water column, particularly those entrained within the top few meters (e.g., 10 m) and traveling with the water mass containing the oil (e.g., small species, embryos, larvae, zooplankton), followed by slow-moving invertebrates. Species associated with the bottom (e.g., corals, crabs), invertebrates in nearshore and estuarine waters, and highly mobile species (e.g., shrimp) may be less likely to be exposed to high concentrations of dispersants and chemically dispersed oil due to dilution under the preauthorization conditions of the Proposed Federal Action (see Section 2.1.H).

It is well accepted, and as discussed previously, that dispersants alone are less toxic than oil alone (e.g., [15, 18]). Under controlled laboratory conditions, recent studies on the toxicity of dispersants to invertebrates (e.g., mysid shrimp, early life stages of blue crabs) have found that dispersants generally range in the practically nontoxic to slightly toxic categories [18, 39]. A study on corals [40] found that under spiked exposures conditions, COREXIT 9500 in excess of 1,000 mg/L significantly reduced survival of the mountain tar coral (*Orbicella faveolata*, formerly *Montastraea faveolata*) (96-hr LC50= 343.8 mg/L), but these concentrations are well above the maximum expected environmental concentrations following dispersant application in open waters (ca. 5 mg/L instantaneous dispersant concertation in the water column). While there are differences in the relative sensitivity of invertebrate species to dispersants, generally, early life stages (e.g., embryos, larvae) appear to be more sensitive than adults of the same species. Earlier work with COREXIT 9527 [25] found that this dispersant is moderately toxic to oyster larvae (*Crassosstrea gigas*) under constant exposures (LC50= 3 mg/L), but slightly toxic to the same species under spiked exposures (LC50= 13.9 mg/L). Among all invertebrate species tested (oyster, kelp mysid- *Holmesimysis costata*, gulf mysid- *Americamysis bahia*), oysters were the most sensitive [25].

Compared to the effects of dispersants alone, exposure of many invertebrate species, and in particular early life stages, to physically and chemically dispersed oil can lead to lethal and non-lethal but ecologically important impacts (e.g., reduced growth and development, skin lesions, behavioral changes, cytotoxicity) [15, 41, 42]. However, the onset of these impacts varies across studies and depends among other factors on exposure conditions (e.g., oil concentrations, exposure duration). The zooplankton is one of the taxonomic groups more likely to be exposed to chemically dispersed oil, including dissolved hydrocarbons and small oil droplets, as well as UV-mediated phototoxicity. However, field studies have shown either no impacts or short-term (i.e., days) impacts on zooplankton biomass following oil spills [43-47]. A relatively rapid recovery of the zooplankton community may be attributed to short life cycles, relatively fast turn-over rates, high reproductive rates, and the colonization by unimpacted populations.

In contrast to zooplankton, there are great concerns on the impacts of oil spills in the proximity of coral reefs, as these communities are not only sensitive to stressors, but also recover slowly from impacts. There are several studies on the impacts of oil and hydrocarbon toxicity on corals but relatively little information on the impacts on corals of chemically dispersed oil with modern dispersants. A recent study found that larvae of the mustard hill coral (*Porites astreoides*) and mountain tar coral (*Orbicella faveolata*, formerly *Montastraea faveolata*) exposed under constant exposures to multiple concentrations of physically or oil chemically dispersed with COREXIT 9500 showed decreased settlement and survival with increasing concentrations [40].

The effects of physically dispersed oil started at constant concentrations of 0.62 mg/L. Under spiked exposures, physically and chemically dispersed oil had 96-h LC50 of 0.45 mg/L and 0.12 mg/L, respectively [40]. This study [40] also found differences in sensitivity of these coral species, with a greater tolerance exhibited by larger larvae corals (*P. astreoides*). Earlier work with COREXIT 9527 [48] found that an 8 h exposure of the symmetrical brain coral (*Diploria strigose*) to chemically dispersed Arabian Light crude oil (1:19 dispersant to oil ratio; average oil concentrations 17-20 mg/L) under flow-through exposures altered lipid synthesis and reduced photosynthesis by 85%, but these impacts were reversible after exposure cessation [48]. Another laboratory study performed under flow-through conditions with exposures to chemically dispersed oil lasting between 6-24 hours with recoveries documented over a 1 month period found sub-lethal impacts with concentrations of 20 mg/L leading to mesenterial filament extrusion, extreme tissue contraction, tentacle retraction and localized tissue rupture, with normal behavior observed between 2 and 96 hours post exposure [49].

Field studies simulating worst-case exposures to chemically dispersed oil (i.e., chemical dispersion in nearshore shallow waters [<1 m depth]; target oil concentrations of 50 mg/L over 24 hours) found declines in the abundance of corals and associated fauna, and reduced coral growth rate in one species [50]. Long-term monitoring of a large-scale field study simulating worst-case exposures, the TROPICS[35], found that coral cover and growth of some coral species were reduced in the area where dispersants were used, and full recovery of the impacted area occurred after 10 years [51]. Another study designed to assess long-term impacts to the symmetrical brain coral from a passing water mass containing chemically dispersed oil (i.e., oil concentrations in the 1-50 mg/L range for 6-24 hours), and similar to the simulations used in Section 2.1.H, found comparable growth and calical shape parameters between treated and control in field-deployed corals one year post exposure [52].

Spills of opportunity have provided valuable information on the impacts of oil on coral, but most have focused on incidents in nearshore waters not involving the use of dispersants or directly addressing dispersant use[36]. Oil spills in shallow waters and nearshore environments are more likely to impact coral reefs, as floating and physically dispersed oil can smother corals during low tides or via the deposition of oiled particles [53, 54]. As a frame of reference, this Biological Assessment focuses on oil spills in offshore waters in water depths of at least 10 m (Section2.1.B(1)(a)). Field studies following oil spills have documented widespread reef mortality, impaired reproduction, altered larval development, reduced recruitment, and increased

[35] The TROPICS (Tropical Oil Pollution Investigations in Coastal Systems) was an oil spill experiment conducted in 1984 in Panama to assess the impacts of crude and dispersed crude oil (Prudhoe Bay with and without COREXIT 9527) on nearshore habitats (intertidal mangrove and subtidal seagrass, corals) with oil released in two separate boom-enclosed areas (900 m^2). These field studies simulating worst-case exposures not necessarily representative of the exposure conditions covered under this Biological Assessment.

[36] COREXIT 9527 was used during the 1987 oil spill in Panama, but its contribution to the impacts observed on corals was not directly studied 53. Guzmán, H.M., J.B. Jackson, and E. Weil, *Short-term ecological consequences of a major oil spill on Panamanian subtidal reef corals.* Coral Reefs, 1991. **10**(1): p. 1-12.53. Guzmán, H.M., J.B. Jackson, and E. Weil, *Short-term ecological consequences of a major oil spill on Panamanian subtidal reef corals.* Coral Reefs, 1991. **10**(1): p. 1-12.53. Guzmán, H.M., J.B. Jackson, and E. Weil, *Short-term ecological consequences of a major oil spill on Panamanian subtidal reef corals.* Coral Reefs, 1991. **10**(1): p. 1-12.53.

Guzmán, H.M., J.B. Jackson, and E. Weil, *Short-term ecological consequences of a major oil spill on Panamanian subtidal reef corals.* Coral Reefs, 1991. **10**(1): p. 1-12.53. Guzmán, H.M., J.B. Jackson, and E. Weil, *Short-term ecological consequences of a major oil spill on Panamanian subtidal reef corals.* Coral Reefs, 1991. **10**(1): p. 1-12.

stress response (e.g., loss of symbiotic zooxanthellae, tissue damage) including changes in lipid biochemistry, as well as impacts on the coral associated sessile fauna [55-59], with great contribution of oil leaching from nearby oiled sediments to the impacted reefs as oiled sediment particles and detritus settle on, or are consumed by, coral polyps [55, 56].

The impacts arising from oil spills on invertebrates in open waters likely varies by species and with the rate at which oil partitions and dilutes in the water column, and with the co-occurrence of sensitive life stages and both physically and chemically dispersed oil.

2.1.G(4)(b) Fish

Within the context of this Biological Assessment, fish species that may be at increased risk of exposure to dispersants and chemically dispersed oil are primarily those associated with the water column, particularly those early life stages entrained within the top few meters (e.g., 10 m) of the water column. Fish species associated with the bottom as well as those found in nearshore and estuarine waters may be less likely to be exposed to high concentrations of dispersants and chemically dispersed oil due to dilution and water column depth (see Section 2.1.H). Highly mobile life stages of many fish species (e.g., juveniles, adults) may be exposed to both physically and chemically dispersed oil, but these exposures are anticipated to be short given their ability to escape the water masses containing the entrained oil.

Under controlled laboratory conditions, recent studies on the toxicity of dispersants to fish (e.g., inland silversides) have found that dispersants generally range in the practically nontoxic to slightly toxic categories [18]. However, the use of dispersants enhance the bioavailable fractions of oil constituents in the water column (e.g., [15, 19, 37, 60-62]) temporarily increasing the risk of exposure to the toxic fractions of oil. Regardless of the use of chemical dispersants, the primary exposure pathways of fish to oil and oil constituents are via gill surface and ingestion of contaminated food [63-65]. The soluble components of oil are taken up efficiently across the gills and readily depurated or metabolized via mixed function oxygenase complex (i.e., cytochrome P-450 enzymes in liver tissues, and aryl hydrocarbon hydroxylase in liver and kidney tissues) [63, 64, 66] with slower metabolization rates occurring for high molecular weight compounds [67, 68], some of which (i.e., 3 ring compounds, such as fluorene, dibenzothiophene, and phenanthrene) are associated with sub-lethal cardiotoxicity in fish embryos [69]. Both physically or chemically dispersed oil can cause lethal and sub-lethal, but ecologically important, impacts on fish including abnormal and reduced growth [70, 71], reduced hatch [62, 72], blue sac disease [62, 73], alteration of normal gill functioning and smothering of gills [74, 75], and death [76]. A large body of literature (e.g., [61, 69, 77-83]) has shown that under controlled laboratory conditions early life stages of fish, and in particular embryos, are sensitive to low concentrations levels of oil (>1 mg/L oil, dissolved PAHs in the low µg/L range) leading to a suit of gross abnormalities (e.g., cardiac dysfunction, edema, spinal curvature, and malformation of the jaw and other craniofacial structures), with permanent oil-induced impacts potentially causing reduced survival later in life [78]. These impacts have been documented under laboratory conditions on embryos of pelagic species (i.e., yellowfin tuna [*Thunnus albacares*], Southern bluefin tuna [*T. maccoyii*], kingfish [*Seriola lalandi*], and mahi [*Coryphaena hippurus*]) in the Gulf of Mexico [61, 83, 84] exposed to constant concentrations of particulate and dissolved oil (ΣPAHs ≤15 µg/L) for several hours post hatch. There is irrefutable evidence on the impacts of low PAH concentrations on fish embryos; however, field extrapolations are challenging given differences in the exposures conditions between laboratory (i.e., constant exposures for 48 hours) and field conditions (e.g., rapid dilution in space and time). Consequently, these types of impacts may be more likely associated with worst-case exposure conditions. Related studies [62] under more realistic exposure conditions (i.e., wave tanks accounting for dilution) found an increased risk of embryo malformation with exposure time, with relatively short exposures (2.4 h) causing blue-sac disease and reduced hatching of normal embryos. Consequently, the impacts arising from oil spills on fish embryos in open waters and their recruitment to later life stages likely varies with the rate at which oil partitions and dilutes in the water column, as well as with the co-occurrence of fish embryos and both physically and chemically dispersed oil.

2.1.G(4)(c) Cetaceans

The large majority of studies on the impacts of oil spills on cetaceans have focused on characterizing impacts from physically dispersed oil and, consequently, most of the discussions below focus on all relevant information.

As noted by others [85-87] the vulnerability of marine mammals to the exposure and effects associated with oil spills varies by species and depends on their spatial distribution relative to that of the spill, the co-occurrence of critical habitat, the status of the species (i.e., endangered, threatened), the degree of oil avoidance, the loss and/or contamination of prey items, the likelihood of maternal transfer of contaminants, and the current environmental conditions of the population (i.e., presence/ absence of diseases, co-occurrence of stressors). Species particularly vulnerable to adverse impacts are those with spatially restricted distributions (e.g., coastal species) as well as those with restricted habitats for feeding and reproduction.

Cetaceans are obligatory surface breathers susceptible to the inhalation of the volatile fractions of oil concentrated above the water’s surface, which may cause inflammation of mucous membranes of the eyes and airways, lung congestion, and possibly pneumonia [86-88]. Immersion of cetaceans in the proximity of physically dispersed oil has been linked to increased concentrations of hydrocarbon residues in several tissues (blubber, brain, muscle, kidney, and liver) [88] with oil exposures inducing liver damage and neurological disorders [89-91]. Despite these reported impacts, some of the most commonly reported effects are related to behavior including changes in locomotion and breathing frequency, and disruption of feeding [88]. Other direct impacts from oil spills may include fouling of the baleen plates while feeding at or near the water surface. Laboratory studies have shown that oil fouling of the haired fringes and feeding apparatus of baleen whales can temporarily restrict the flow of water [88, 92]. However, studies have shown that 70% of the oil was removed within 30 minutes and >95% was removed by flowing water within 24 hours, leading to the conclusion that oiling of the baleen has a relatively short-term and reversible impact to feeding capabilities within a few days following exposure [89, 92]. In a free-ranging whale, reduced feeding filtering and efficiency could impact the available energy storage to meet the requirements associated with migration and reproduction [93], but these effects are likely to be short term.

Cetaceans can metabolize oil via mixed function oxygenase complex by inducing cytochrome P-450 enzymes in liver tissues, and aryl hydrocarbon hydroxylase in liver and kidney tissues [88] reducing the likelihood of adverse toxicological impacts. Despite their metabolization capacity, impacts to marine mammals following oil spills have been documented. Following the *Exxon*

Valdez oil spill [94, 95] studies suggested that humpback whales were not severely affected, whereas killer whale (*Orcinus orca*) showed declined numbers. Studies conducted sixteen years after the spill showed that a resident population had not recovered to pre-spill numbers, partially because of the indirect effects of the spill (i.e., increased number of orphans with higher mortality rates, loss of young females, reduced reproductive potential), while a transient population continued to decline [95]. Health assessments on bottlenose dolphins (*Tursiops truncatus*) from a heavily oiled area (Barataria Bay) with persistent oil concentrations undertaken in the wake of the DWH oil spill revealed a high prevalence of moderate to severe lung disease and evidence of hypoadrenocorticism in dolphins [96]. A follow up study on the same population found that, compared to the reference success rate (83%), only a relatively small percent (20%) of pregnant dolphins produced viable calves, with over half of pregnant females previously diagnosed with moderate to severe lung disease unable to successfully produce a calf [97]. The impacts arising from oil spills in open water on cetaceans stages likely varies by species, as well as with the co-occurrence of their habitat with floating oil and both physically and chemically dispersed oil.

2.1.G(4)(d) Sea Turtles

There is little information on the impacts of dispersants and chemically dispersed oil on sea turtles, and most information has been generated following oil spills not involving the use of dispersants, or through controlled laboratory exposures. Exposure to oil can have several adverse effects on sea turtles, including toxic responses to vapor inhalation or ingestion, skin irritation and lesions, alteration of respiration and diving patterns, interference with osmoregulation and ion balance, changes in blood chemistry, and reduced hatching success [98-102]. Following the IXTOC oil spill [103], oil was found in the upper alimentary system of several marine sea turtles with ingestion of oil and disrupted feeding possible leading to poor body condition. Exposure of sea turtles to volatile chemicals of dispersants (i.e., petroleum distillates, 2-butoxyethanol) and chemically dispersed oil through inhalation is expected to be less than that of the volatile compounds of the untreated oil [104, 105]. While PAHs have been shown to significantly impact developing turtles [101, 106], the only available study observing the impacts of chemically dispersed oil on sea turtle embryos resulted in no adverse impacts [106]. Although reptiles are able to efficiently metabolize and excrete ingested hydrocarbons [101], limiting the bioaccumulation of oil, sea turtles are susceptible to oil fouling because of they spend hours on the surface to breath, rest, and warm, and they are indiscriminant feeders and are known to ingest tar balls while feeding. The impacts arising from oil spills in open water on sea turtles depend on the co-occurrence of their habitat with floating oil and both physically and chemically dispersed oil.

2.1.G(4)(e) Birds

There is little information on the impacts of dispersants and chemically dispersed oil on birds, and most information has been generated following oil spills not involving the use of dispersants, or through controlled laboratory exposures. Exposures of birds to oil can have several adverse effects, including toxic responses to vapor inhalation or ingestion, skin irritation and lesions, alteration of respiration and diving patterns, drowning, and hyperthermia, among others. Laboratory studies have found that dispersants and chemically dispersed oil altered the feather structure and geometry of common murre (*Uria aalge*) causing a disruption of the waterproofing properties [107]. Direct application of undiluted COREXIT 9500 to mallard (*Anas platyrhyncos*) eggs caused embryotoxicity (i.e., reduced hatching success, altered development) [108]. However, these laboratory exposure pathways are not expected to occur under the preauthorization conditions of the Proposed Federal Action, as direct application of dispersants on adult birds or developing eggs is unlikely.

A number of studies under laboratory conditions (e.g., [109-113]) have also documented adverse impacts following direct ingestion of oil leading to stress-related exhaustion, changes in blood chemistry, lost osmoregulation, reduced egg production, changes in shell thickness, and reduced hatch success. However, the most commonly reported impact associated with dermal exposure to oil is disruption of thermoregulation causing hypothermia [107, 114-116]. Following the *Exxon Valdez* oil spill a study found that harlequin ducks (*Histrionicus histrionicus*) had elevated levels of ethoxyresorufin-O-deethylase (EROD) compared to birds from nearby, un-oiled areas, indicating exposure to oil-related hydrocarbons [117]. A follow up study emphasized that cumulative mortality associated with chronic exposure to residual oil may actually exceed the initial acute impacts as survival rates of the harlequin ducks remained depressed in oiled areas 6 to 9 years after the spill [118]. The impacts arising from oil spills in open water on birds likely varies by species, and depends on the co-occurrence of their habitat with floating oil and both physically and chemically dispersed oil.

2.1.G(4)(f) Vegetated Habitats

There is relatively little information on the impacts of dispersants and chemically dispersed oil on vegetated habitats, and most information has been generated through data collection following oil spills not involving the use of dispersants, or through controlled laboratory exposures to oil. For the purpose of this Biological Assessment, discussions on the effects of physically and chemically dispersed oil, with the exception of floating *Sargassum*, focus on exposures through the oil contained in the water column, as dispersants are not intended for use on oil stranded on shorelines.

One of the primary direct impacts of oil spills on vegetated habitats is smothering of plant surfaces causing suffocation, with sublethal impacts ranging from alteration of enzyme systems, reduced photosynthesis and respiration, among others. A relatively recent review and data synthesis on decades of literature related to the phytotoxicity of oils and dispersants on aquatic plants[37] [119] found that most exposures have been performed as single-dose static and static-renewal tests. Regarding mangroves, there are no reported toxic effect concentrations for dispersants and, based on a few studies, chemically dispersed oil is not very toxic [119]. Seagrasses are considered to be less vulnerable to the impacts of oil than other nearshore vegetated habitats (i.e., mangroves) except when exposures occur in shallow waters or at low tide (see references in [119]).

Seagrass habitats were monitored following the TROPICS[38] field study. Compared to the chemically dispersed and reference sites, seagrass beds of *Thalassia testudinum* at the oiled only

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[37] The data set includes data for at least 53 species of marine and freshwater microalgae, 32 macroalgae species, 28 wetland plant species, 13 mangrove species and 9 seagrass species exposed to 41 crude oils and 56 dispersants.
[38] The TROPICS (Tropical Oil Pollution Investigations in Coastal Systems) was an oil spill experiment conducted in 1984 Panama to assess the impacts of crude and dispersed crude oil (Prudhoe Bay with and without COREXIT

(no dispersant) site had a 58% decrease in coverage and slower growth rates, and were colonized by finger coral (*Porites porites*) [51], due to leaching of oil from the adjacent mangrove shoreline. In these habitats, core samples contained elevated levels of aromatic hydrocarbons (naphthalenes) [51]. In contrast, there were no short- or long-term impacts to seagrass in the chemically dispersed site [51, 120]. Early studies on seagrasses showed that *T. testudinum* is relatively resistant to low concentrations of dispersed or whole oil (5 ppm) for short periods [120, 121]. For this species, the estimated 96 h LC50 values for physically and chemically dispersed Prudhoe Bay crude oil and COREXIT 9527 are 3.8 mg/L, 202.4 mg/L and 200 mg/L, respectively [120]. A more recent study with the seagrass *Zostera marina* [122] found the dispersants COREXIT 9527 and Superdispersant-25 reduced photosynthetic efficiency at concentrations of 55 mg/L and 386 mg/L, which are well above the maximum expected environmental concentrations following dispersant application in open waters (ca. 5 mg/L instantaneous dispersant concentration in the water column). To date, one study has been published on the impacts of the DWH oil spill on the pelagic *Sargassum* complex (*Sargassum natans* and *S. fluitans*) [123]. Based on mesocosm experiments (72 h constant static exposures), it was determined that *Sargassum* accumulated floating oil and that the use of dispersant changed the vertical distribution of the plants [123]. However, these exposures do not account for the dilution that occurs following dispersant use (see Section 2.1.H).

2.1.G(4)(g) Critical Habitat and Essential Fish Habitat

There is no information on the impacts of dispersants and chemically dispersed oil on critical habitat and Essential Fish Habitat. Most relevant information (summarized in Sections 2.1.G(4)(a) through 2.1.G(4)(f)) has been generated through data collection following oil spills not involving the use of dispersants, or through controlled laboratory exposures to oil, and used in this Biological Assessment to help imform possible impacts on critical habitat and Essential Fish Habitat.

2.1.G(5) Bioaccumulation of Dispersants and Chemically Dispersed Oil

There is evidence that non-ionic and anionic surfactants (e.g., linear alkylbenzene sulfonates, alcohol ethoxylates) found in chemical dispersants are readily metabolized and eliminated via the gall bladder resulting in little potential for bioaccumulation [124-126]. Consistently, comprehensive reviews have shown no evidence of surfactant biomagnification through the food web [127]. Studies have demonstrated that dispersants enhance the bioaccumulation potential of oil [66, 128, 129], but in most cases, aquatic organisms are able to metabolize and excrete these compounds, particularly when exposed to clean water [66, 130, 131]. Invertebrates, particularly filter-feeding species (e.g., bivalves) are known to bioaccumulate hydrocarbons[39] [63, 132, 133], and the rate of bioaccumulation and depuration depends on the species' capacity to metabolize oil constituents [132-134]. Although PAH bioaccumulation can lead to behavioral (e.g., decreased feeding rates) and physiological impairments at a cellular or individual level (e.g., decreased growth) [132, 133, 135-139], these impacts are more likely the result of chronic

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9527) on nearshore habitats (intertidal mangrove and subtidal seagrass, corals) with oil released in two separate boom-enclosed areas (900 m^2). In the case of seagrasses, the average depth was approximate 0.48 m. These field studies simulating worst-case not necessarily representative of the exposures conditions covered under this Biological Assessment.

[39] There is a large body of literature on the impacts of oil (e.g., PAH, hydrocarbons) on filter feeding species (e.g., bivalves), but none of these deal specifically with chemically dispersed oil.

exposure to oil. Because of the metabolization potential of many aquatic species, food-chain biomagnification of oil constituents is likely limited (e.g., [140]). While there is a risk of transfer of parent PAHs (i.e., non-metabolized PAHs) from invertebrate species with limited metabolization capacity to marine mammals, this pathway is likely not significant [101] because intermediate trophic levels (i.e., fish) as well as marine mammals and sea turtles are able to efficiently metabolize these compounds [66, 67, 101, 141].

2.1.G(6) Fate and Biodegradation of Dispersant and Chemically Dispersed Oil

Dispersants undergo similar fate processes as those of the spilled oil: evaporation, dissolution, and biodegradation. Studies on the fate and biodegradation of dispersants have largely focused on specific components (surfactants and solvents). Similar to the challenges in experimental settings used to generate toxicity data, biodegradation studies are often performed under conditions that may not represent the conditions of the typical oil spill. For example, the use of high surfactant concentrations may lead to marginally relevant results regarding their biodegradation in the environment. Several studies [142-149] suggest that chemical components of COREXIT dispersants range in biodegradability from marginally to readily biodegradable (Table 2-4). For instance, the environmental half-live of propylene glycol ranges between 2.5 and 14 days under aerobic conditions [148-150], and that of DPnB ranges between 10.3 and 28 days [147]. The latter studies are consistent with assessment of large data compilations concluding that DPnB is readily biodegradable [151]. Span-80 and 2-butoxy ethanol are also expected to biodegrade within a time frame of days (BIOWIN[40]). Rates of anaerobic degradation are also influenced by pH such that the half-life of dioctyl sodium sulfosuccinate (DOSS) is 240 days at pH 8 but 6.7 years at pH 7, in the absence of microbial degradation [152]. Because these chemicals have shorter biodegradation half-lives than those under abiotic conditions [153, 154], it is not expected that abiotic degradation pathways play a major role in initial degradation of chemical components of COREXIT.

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[40] BIOWIN calculates the biodegradability of organic chemicals based on their structural fragments (http://www.epa.gov/oppt/exposure/pubs/episuite.htm).

Table 2-4. Microbial biodegradation of chemical components of COREXIT. Information supplemented from data in CAFE [38].

Chemical Abstracts Service Number	Chemical Name	Biodegradability	Half-Life (Days)	Percent Loss[1] (%), Duration (d)	Source
57-55-6	1,2-propanediol (propylene glycol)	Readily biodegradable	13.6	81%, 28 days	[38, 148-150]
111-76-2	2-butoxyethanol[2]	Readily biodegradable	Timeframe of days	>60%, 28 days	[38, 146]
577-11-7	Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1), dioctyl sulfosuccinate sodium (DOSS)	Readily biodegradable	Timeframe of hours to days	66.4%, 28 days 91 to 97.7%, 3 to 17 days 99%, 8 days	[38, 143, 152, 155]
1338-43-8	Sorbitan, mono-(9Z)-9-octadecenoate (Span™ 80)	Readily biodegradable	Timeframe of days	58 to 62%, 14 to 28 days	[38, 142, 144, 152]
9005-65-6	Sorbitan, mono-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs. (Polysorbate 80)	Not readily biodegradable	Timeframe of weeks	52%, 28 days	[38, 156]
9005-70-3	Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs (Polysorbate 85)	Readily biodegradable	Timeframe of hours to days	60 to 83%, 28 days	[38, 142]
29911-28-2	1-(2-butoxy-1-methylethoxy)-2-propanol, dipropylene glycol n-butyl ether (DPnB)	Readily biodegradable	10.3-28	> 60%, 28 days	[147, 157-159]
64742-47-8	Petroleum distillates, hydro-treated, light	Readily biodegradable	Not reported/Not available	> 97%, 4.7 days	[160]

[1] The percent loss over time is used in determining biodegradability. Readily biodegradable chemicals are considered to have a >60% loss within 28 days; 2 Not a chemical component of COREXIT 9500.

Dispersants are designed to reduce the interfacial tension between oil and water causing oil slicks to break into smaller droplets (<70 microns [µm] diameter[41]) that are permanently entrained within the first few meters of the water column. Because of the large surface area to volume ratio of these small oil droplets, the natural biodegradation process of oil and hydrocarbon constituents by naturally occurring oil-biodegrading bacteria and microbes in the water column is generally enhanced [15, 161-163]. This is particularly the case when dispersants are used to treat oil slicks at the water surface in waters that are not nutrient-limited, as long as these slicks do not coalesce into thick layers of emulsified oil. A greater surface area of oil droplets also enhances dissolution of soluble and semi-volatile compounds into surrounding waters [15, 164]. Oil biodegradation has generally been well studied under a variety of laboratory conditions (e.g., [153, 160, 162, 163, 165-176]) and, in general, results show that the use of chemical dispersants enhances the rate of oil degradation. One study conducted during the DWH oil spill [153] reported that, in the absence of chemical dispersants, only 20% of the oil degraded within 20 days in contrast to a 60% oil degradation in the presence of COREXIT 9500. However, the rates of oil biodegradation vary among studies (e.g., [15]), with some studies documenting enhanced biodegradation rates [153, 177, 178], while others showing either inhibited or no effects on biodegradation rates [169, 179]. The effect of chemical dispersants on oil biodegradation is been further complicated by differences in the experimental test conditions, causing biodegradation of individual hydrocarbons to be enhanced or inhibited by chemical dispersants [180, 181]. Hence, representative biodegradation studies of environmental application should consider the rapid dilution that occurs in field conditions leading to low chemically dispersed oil concentrations, as well as a stable composition of oil droplets in the 70-100 µm range with enough mixing energy to keep droplets from resurfacing (e.g., [182]).

Both physically and chemically dispersed oil can be a source of contamination of shoreline, bottom sediments, and benthic-dwelling organisms. Shorelines could be oiled by the physical transport by wind-driven currents of treated or untreated oil slicks, while the benthos could accumulate oil via organic (e.g., plankton, fecal pellets, detritus) and inorganic (e.g., minerals) particles, transporting oil from surface waters onto the bottom sediments [46, 183]. This type of “marine snow” process is attributed the vertical transport of particles through the water column and deposition of the ocean’s sea floor [184]. One potential mechanism of physically and chemically dispersed oil transfer to the benthos and benthic-dwelling organisms could be via the production of fecal pellets by zooplankton [46, 183]. Estimates derived from laboratory exposures suggest that indicated that fecal pellets alone can transport 200 mg oil/m^3/day to the benthos [183]. However, the role of this process in oil transferring to deeper waters is not well understood and, depending on the size of the spill, a likely minor oil transfer mechanism. Oil can also be transferred to deeper waters by the adhesion of oil droplets to suspended particles, although this type of transport is more like to occur in areas enriched with suspended particles (e.g., estuaries, river deltas) [185]. Under preauthorization conditions in the Proposed Federal Action, it is expected that suspended sediment concentrations will be relatively low; therefore, transfer of chemically dispersed oil to the benthos by fecal pellets would be the most likely mechanism.

[41] Physical dispersion of oil into the water column tends to create larger oil droplets (≥100 µm diameter) that rise and recoalesce on the water surface once the mixing energy diminishes.

While the rate of oil biodegradation varies from system to system, natural environments have communities of microorganisms capable of degrading oil, though slower degradation rates may occur under oxygen- and/or nutrient-limited conditions [15, 161, 186, 187]. There is a large body of literature on the fate, weathering and biodegradation of oil in sediments (e.g., [186, 188-191]), but the large majority has focused on studies in the absence of dispersants. Only one study from field trials has documented that the biodegradation rates of chemically dispersed oil in sediments are comparable to those of physically disperse oils in sediments (e.g., [192]), but related studies are largely missing in the scientific literature. *In-situ* studies conducted after the DWH oil spill have documented high biodegradation potential by indigenous microbial communities of marsh sediments impacted by the spill [193, 194]. One of these studies conducted 18-36 months after the DWH oil spill found substantial biodegradation of individual saturated hydrocarbons and PAHs accumulated in the top 2 cm of marsh sediments impacted by the spill [193]. Relative populations of oil-degrading microorganisms (*Desulfococcus oleovorans*, *Marinobacter hydrocarbonoclasticus*, *Mycobacterium vanbaalenii*) declined in abundances with declined concentrations of hydrocarbons in the sediments [193]. Evidences from other oil spills have also found, particularly in anoxic sediments, high persistence (years to decades) of the less biodegradable and more recalcitrant oil fractions [195-198], many of which are not typically associated with adverse toxicological effects to benthic organisms [197].

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2.1.H. Modeled Environmental Concentrations of Oil Spill Scenarios

In order to inform the determinations of this Biological Assessment, maximum most probable non-continuous discharge volumes (discussed in Appendix II) were used to estimate environmental concentrations of oil (as total petroleum hydrocarbons; TPH). Model outputs were generated using the General NOAA Oil Modeling Environment (GNOME) [199], a model that estimates the trajectory and spreading of oil, and generates trajectory outputs based on horizontal and vertical mixing (i.e., local hydrodynamics, water column turbulence) [200, 201]. Because GNOME incorporates oil-specific fate and behavior information (e.g., evaporation, dispersion) from an oil weathering model (Automated Data Inquiry for Oil Spills, ADIOS2) [202], oil trajectories can be used to quantitatively describe the average concentration of oil within the water column. Estimated oil concentrations from GNOME were compared to time-varying hazard concentrations (reported as TPH) derived from species sensitivity distributions (SSDs[42]) [203]. SSDs were derived for several exposure durations and used to estimate the 5th percentile hazard concentrations (HC5[43]) [203]. HC5s were then used to estimate time-varying HC5 values via regression analysis, producing a function that allows for the estimation of time-varying HC5 values [203]. Six-hour HC5 values averages were then compared to the environmental concentrations of oil for each of the maximum most probable non-continuous spill scenarios in the Gulf and Atlantic regions to generate quantitative metrics of potential impacts to aquatic organisms. The GNOME's input parameters used on all scenarios are summarized in Table 2-5. For the purpose of this Biological Assessment, all oceanographic parameters in GNOME were set to represent the typical summer condition of the open ocean with models developed for an area with water depths greater than 10 m. In addition, model parameters were set when appropriate, to worst-case conditions generating conservative estimates of oil concentrations in the water column. GNOME outputs are interpreted relative to aquatic organisms entrained within the moving water mass containing the chemically dispersed oil (e.g., fish embryos, plankton), and relative to slow moving and sessile benthic organisms exposed to a passing water mass containing the chemically dispersed oil (e.g., corals, benthic fauna). While comparisons are made relative HC5 values derived from empirical toxicity data, these HC5 values may not be necessarily protective of all aquatic organisms, and particularly of those known to be sensitive to stressors (e.g., coral eggs and larvae, early life stages of fish).

[42] SSDs are cumulative distributions of toxicity data allowing for comparisons of the sensitivities of aquatic species to the same chemical.
[43] The HC5, or 5th percentile hazard concertation refers to the concentration that is assumed to be protective of 95% of all the species in the SSD.

Table 2-5. Summary of key GNOME model parameters used to generate environmental concentrations of oil for several maximum most probable spill scenarios in the Gulf and Atlantic regions. See GNOME's documentation for details [199].

Parameter		Value	Justification/Source
Model settings [simulation duration and calculation time steps]	Run duration (h)	120	Per guidance from the National Response Team (2013)[44] preauthorized use of dispersant use is generally allowed (during day light hours) for a period of 96 hours after the first application. Beyond a 96-hour period, dispersant application is considered "atypical" and may require preauthorization. Based on the CAPS rule[45], vessel and facility response plans are required to have the capability to apply the minimum volumes of dispersants at 12, 36, and 60 hours post spill
	Time step (h)	0.5	This time step (used to calculate environmental concentrations of oil over time) value is appropriate given the selected run duration
Universal movers [physical parameters that cause movement of oil in water]	Horizontal diffusion coefficient (cm^2/sec)	50,000	This three dimensional diffusion coefficient value is appropriate for oceanic conditions
	Vertical diffusion coefficient (cm^2/sec)	100	This three dimensional diffusion coefficient value is appropriate for oceanic conditions
	K_z through the pycnocline (cm^2/sec)	0.11	This three dimensional diffusion coefficient value is appropriate for oceanic conditions
Bathymetry map [characteristics that define the distribution of oil in the water column]	Contour depth range (m)	0-5	Oil concentrations in the water column following an oil spill are generally higher within the first few meters of the water column (e.g., [15, 19]). In addition, this value is appropriate for oceanic conditions
	Wave height (m)	0.008804 (computed from wind speed)	This value is appropriate for oceanic conditions
	Mixed layer depth (m)	10	This value is appropriate for mid latitudes, and consistent with the average pycnocline depth reported elsewhere [204]
Thresholds of concern for aquatic species	Contour levels (mg/L)	HC5= $5.67*Exp^{-0.03*h}$	For the purpose of this Biological Assessment, a more realistic approach, using time-varying HC5s based on quantitative TPH toxicity data (after [203]), is preferred over the standard contour levels from historic consensus guidelines [205]

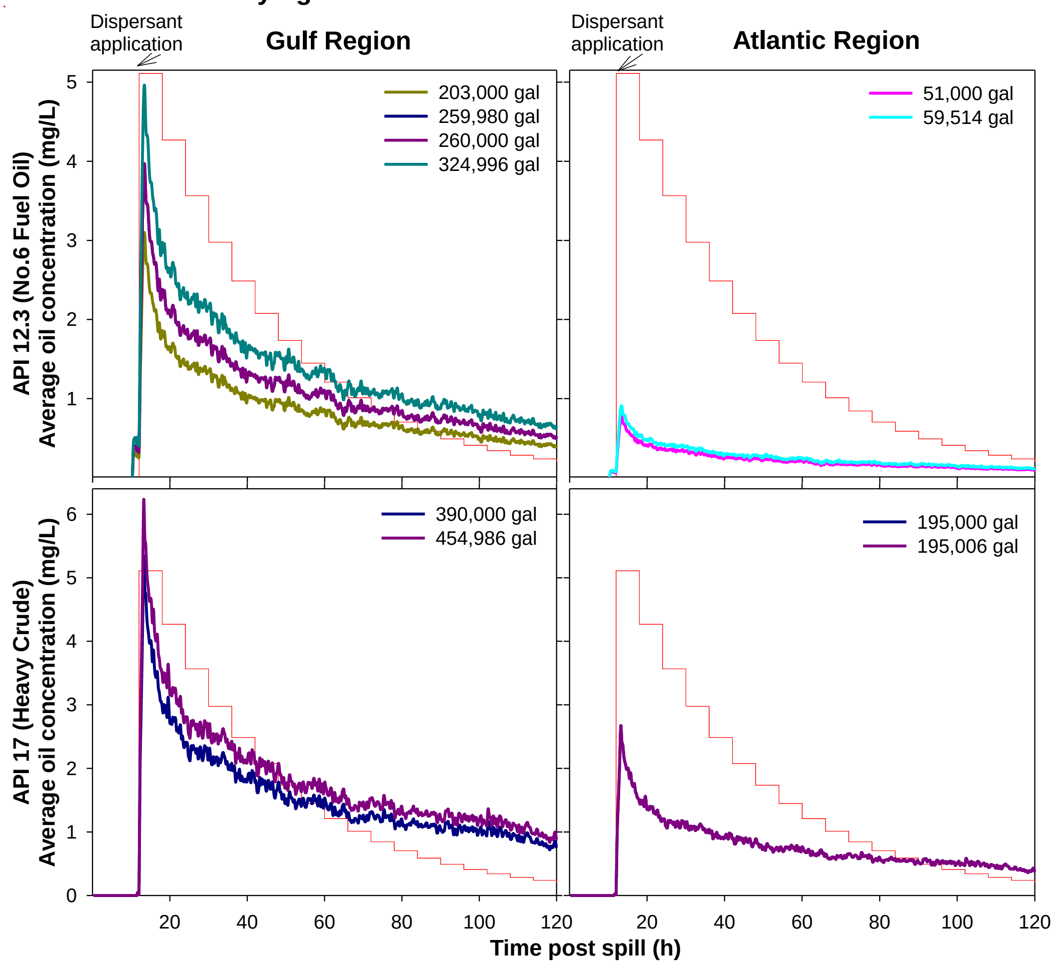
[44] U.S. National Response Team (NRT): http://www.nrt.org/production/NRT/NRTWeb.nsf/AllAttachmentsByTitle/SA-1086NRT_Atypical_Dispersant_Guidance_Final_5-30-2013.pdf/$File/NRT_Atypical_Dispersant_Guidance_Final_5-30-2013.pdf?OpenElement

[45] Removal Equipment Requirements and Alternative Technology Revisions" or "equipment capability limits" CAPS (33 CFR 155.1050)

Parameter		Value	Justification/Source
Current mover	Velocities (m/s)	1	This value is appropriate for oceanic conditions
Spills [oil spill scenario characteristics]	Splots	10,000	The number of trajectory splots (e.g., small scale representations of the spilled oil, or spill dots) is appropriate for large areas
	Chemical dispersant Duration (h)	1	The amount of oil to be disperse is set to reflect a high operational limits of dispersant effectiveness (5-35%) [15, 203], hence adopting a conservative (worst-case) approach. Since oil dispersibility decreases as a function of time and oil weathering, it is assumed that all dispersible oil will be dispersed within the first hour post dispersant treatment (worst-case). The selection of oil gravity (API) is based on the likely oils to be spilled in the areas of interest (See Table VI 17)
	Amount of oil to disperse (%)	35%	
	API	12.3 (i.e., No. 6 fuel) 17 (heavy crude oil)	
	Amount treated (gallons)	Variable (scenario specific)	All maximum most probable non-continuous oil spill scenarios and treated oil volumes are based on the MISLE data as well as on operational knowledge of dispersant use in Region IV (See Table VI 17)

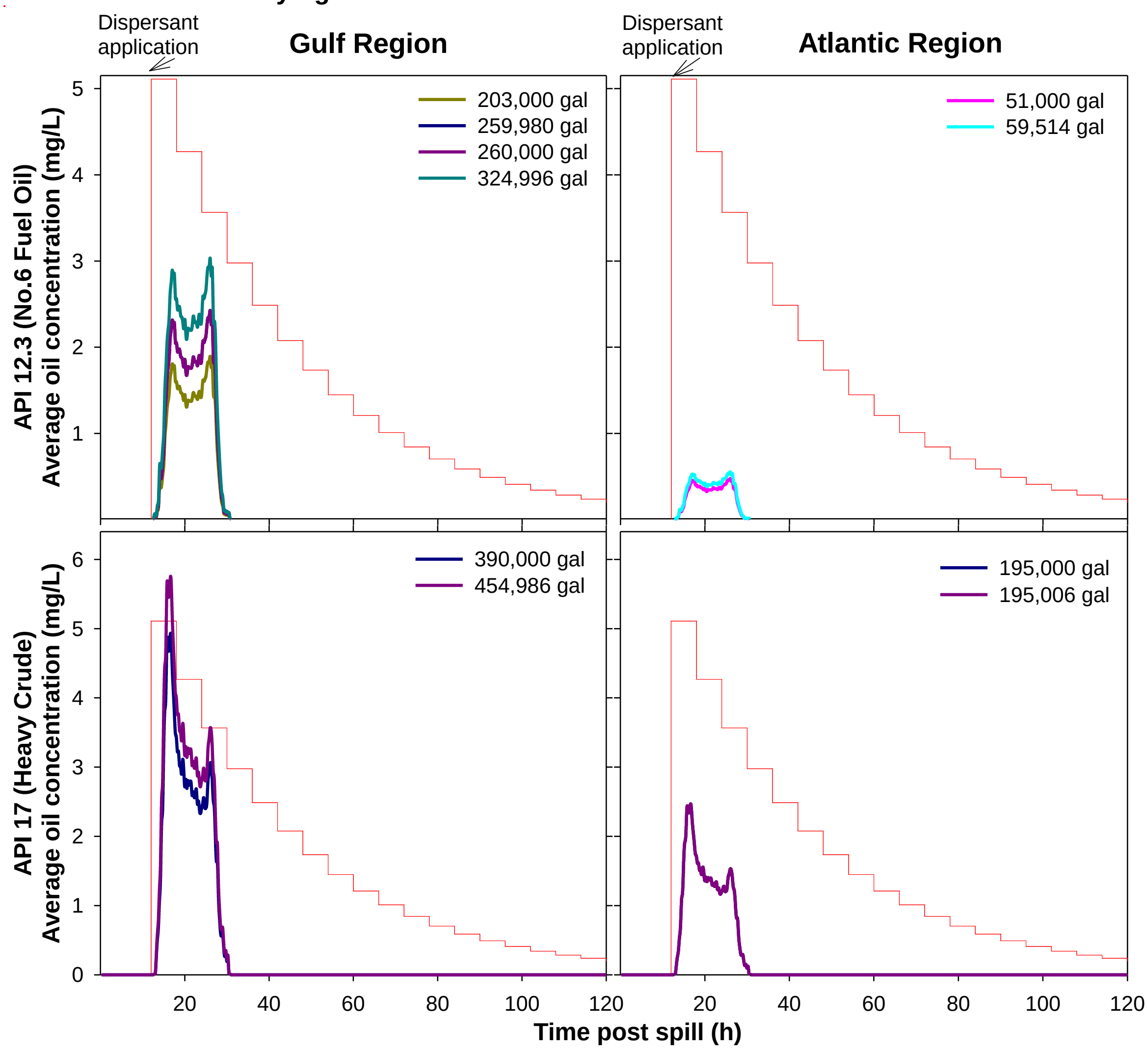
Estimated average oil concentrations in the top 5 m of the water column are as high as 4.9 mg/L and 6.23 mg/L for the highest No. 6 fuel and heavy crude oil spills, respectively (Figure 2-6). In all cases, estimated oil concentrations in the water column peak immediately after dispersant use (12 h post-spill) with concentrations rapidly declining during the simulation period (120 h). Although under all maximum most probable scenarios oil concentrations are elevated during the first 24-48 h, exceedances of the time-varying HC5 values for organisms entrained within the water column and traveling with the plume generally occur later during the simulations (≥60 h) (Table 2-6). Average oil concentrations for the oil spill scenarios in the Atlantic Region are substantially smaller than for those of larger oil spill scenarios in the Gulf Region, with exceedances of HC5 values only occurring for the heavy crude oil scenarios. Average oil concentrations of No. 6 fuel at the end of the 120 h simulation range between 0.41 mg/L and 0.66 mg/L for the hypothetical spills in the Gulf Region, and between 0.10 mg/L and 0.12 mg/L for the hypothetical spills in the Atlantic Region. Average oil concentrations of heavy crude at the end of the 120 h simulation range between 0.75 mg/L and 0.87 mg/L for the hypothetical spills in the Gulf Region, with an average oil concentrations of 0.37 mg/L for the hypothetical spills in the Atlantic Region.

Figure 2-6. Oil concentrations (reported as TPH) by treated oil volume within the Gulf and Atlantic Regions following dispersant use (12 h post-spill; 35% assumed dispersant effectiveness) relative to time-varying hazard concentrations (HC5s) for organisms entrained within the water column and traveling with the plume. Oil concentrations within the red-hashed areas indicate exceedances of time-varying HC5s.



Estimated average oil concentrations of a passing water mass containing the chemically dispersed oil at an area in close proximity to the chemical dispersion of the oil slick are as high as 3 mg/L and 5.71 mg/L for the highest No. 6 fuel and heavy crude oil spills, respectively (Figure 2-7). In all cases, oil concentrations in the passing water mass at point locations followed a rapid increase and decline in concentrations to background levels, with exposures lasting approximately 14 h. Exceedances of the time-varying HC5 values for slow moving or sessile organisms are only noted for the larger heavy crude oil spill scenario in the Gulf Region, with exceedances lasting approximately 1 h (Table 2-6). Average oil concentrations in the passing water mass for the maximum most probable oil spills scenarios in the Atlantic Region are substantially smaller than for those of larger oil spill scenarios in the Gulf Region.

Figure 2-7. Oil concentrations (reported as TPH) by treated oil volume within the Gulf and Atlantic Regions following dispersant use (12 h post spill; 35% assumed dispersant effectiveness) relative to time-varying hazard concentrations (HC5s) for sessile organisms in the immediate proximity of the oil treated with dispersants. Oil concentrations within the red-hashed areas indicate exceedances of time-varying HC5s.



Conservative and likely overestimated areas exceeding HC5s changed as a function of spill duration, consistent with the dilution and expansion of the chemically dispersed oil water mass over time. The maximum area above thresholds across all scenarios do not exceed 5 km^2 at the beginning of the oil treatment with dispersants or 30 km^2 at the end of the entire simulation period. Areas above HC5s for the maximum most probable spill scenarios in the Atlantic Region were substantially smaller than those for the Gulf Region (Figure 2-8).

Figure 2-8. Approximate area (km^2) with oil concentrations (reported as TPH) by treated oil volume within the Gulf and Atlantic Regions exceeding the time-varying hazard concentrations (HC5s). Estimated areas are conservative given upward rounding of oil concentrations for ease of area calculations.

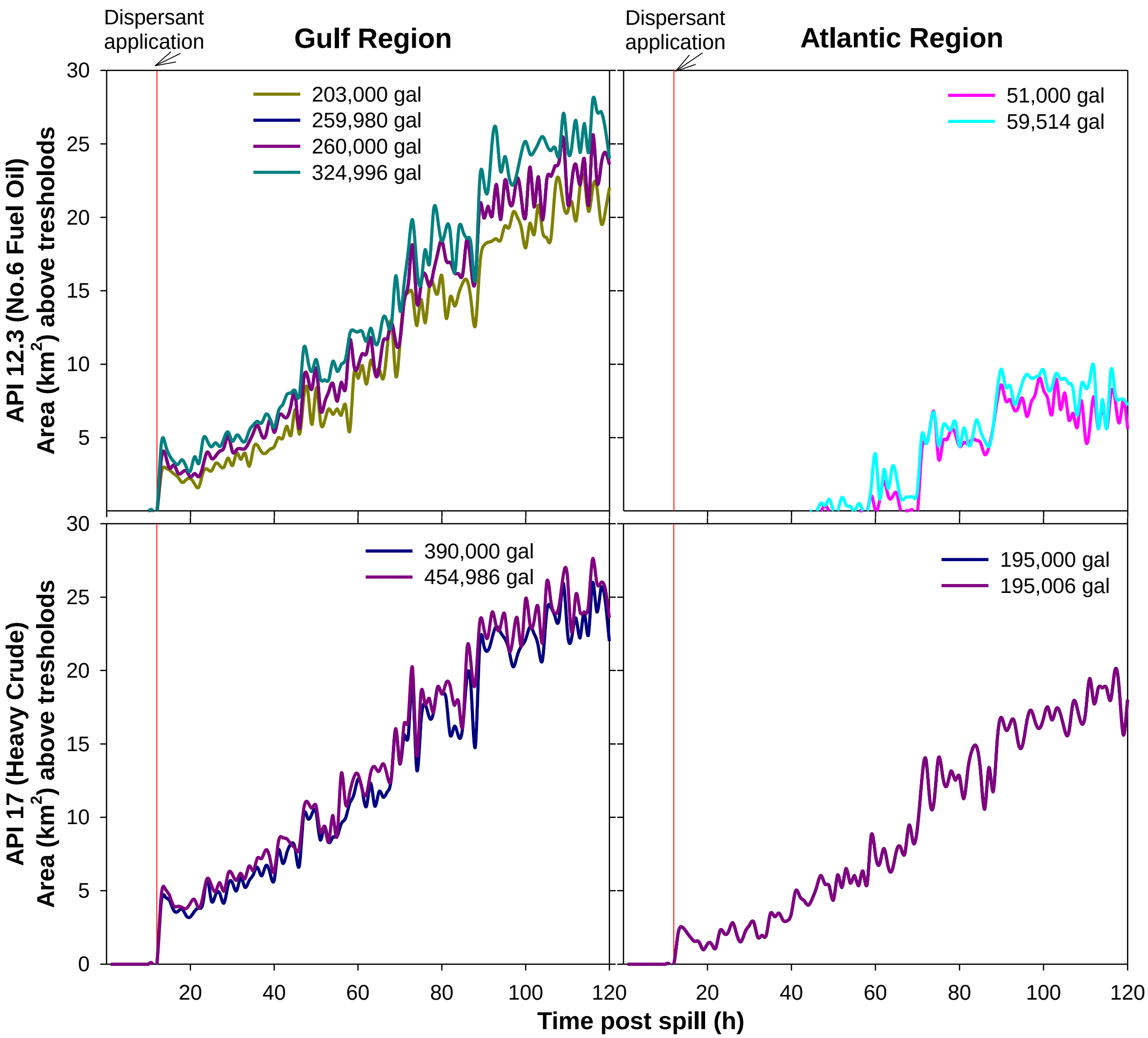


Table 2-6. Summary of the maximum most probable non-continuous oil spill scenarios in the Gulf and Atlantic regions. Oil concentrations are reported as TPH.

Oil Type	Region	Treated Oil Volume (gal)	Entrained organisms: Average (min-max) oil concentration in the water mass (mg/L) over entire the simulation period	Entrained organisms: Time to HC5 Exceedance (h)	Entrained organisms: Total area above HC5s (km^2)[1]	Sessile organisms: Average (min-max) oil concentration in the passing water mass (mg/L) over the entire simulation period[2]	Sessile organisms: Time to HC5 Exceedance (h)[2]	Total area above HC5s (km^2)
API 12.3 (No. 6 Fuel Oil)	Gulf	203,000	0.87 (0.25-3.06)	84	28	1.12 (0.04-1.89)	None	0
		259,980	1.12 (0.32-3.92)	78	29	1.43 (0.05-2.43)	None	0
		260,000	1.12 (0.32-3.92)	78	29	1.43 (0.05-2.43)	None	0
		324,996	1.40 (0.40-4.90)	60	30	1.79 (0.06-3.03)	None	0
	Atlantic	51,000	0.22 (0.06-0.77)	>120	11	0.28 (0.01-0.48)	None	0
		59,514	0.26 (0.07-0.90)	>120	12	0.33 (0.01-0.56)	None	0
API 17 (Heavy Crude)	Gulf	390,000	1.56 (0.72-5.34)	54[3]	28	2.48 (0.19-4.89)	None[4]	0
		454,986	1.83 (0.84-6.23)	60[3]	29	2.89 (0.22-5.71)	None	0
	Atlantic	195,000	0.78 (0.36-2.67)	84	24	1.24 (0.10-2.45)	None	0
		195,006	0.78 (0.36-2.67)	84	24	1.24 (0.10-2.45)	None	0

[1] Areas are conservative given upward rounding of oil concentrations for ease of area calculations; [2] Within the immediate vicinity of the point of dispersant application, which is the area expected to have the greatest concentrations of oil for the entire simulation period; [3] A first exceedance occurs immediately after dispersant application, with concentrations falling below the HC5 value within <1 h; [4] An exceedance occurs immediately after dispersant application, with concentrations falling below the HC5 value within <1 h.

2.1.H(1) Environmental Concentrations from Field Trials and Oil Spills of Chemically Dispersed Oil

Chemical dispersants enhance the dispersion of oil into the water column, which, depending upon area-specific oceanographic conditions (i.e., degree of mixing energy in the water column), results in the horizontal spreading and vertical mixing of oil within the upper meters of the water column (typically <10 m depths) [3, 8, 10, 11, 15]. As a result, and as demonstrated through several oil spills scenarios in the Atlantic and Gulf Regions (see Section above), oil concentrations following the use of chemical dispersants decrease rapidly from the initial peak concentrations. Data collected through multiple field trials in open water have shown rapid declines in the concentration of chemically dispersed oil to background levels within hours of dispersant treatment of oil slicks [4-6, 9, 12, 13, 16]. A recent review of available field data [19] showed that the maximum reported oil concentrations within the top few meters of the water column following chemical dispersion was as high as 54 mg/L, with concentrations declining within minutes to hours (≤4 h) to oil concentrations ≤1 mg/L. Similarly, the concentration of Forties crude oil (7,100 gallons) chemically dispersed with COREXIT 9500 were less than 4 mg/L within the top meter of the water column, with lower concentrations at 4 m depth 45 minutes after dispersant application [8, 15, 206]. Other field studies have shown maximum concentration of oil in the 20-100 mg/L range in the top 1 m of the water column within 30 minutes of after dispersant use [13] with typical concentrations over this period ranging between 20 and 50 mg/L [4, 5, 9, 12, 16, 207] for treatment of approximately 21,000 gallons of oil. Analysis of dispersant monitoring data collected during the DWH oil spill found that most water samples collected at 1 m depth 30 minutes after dispersant application were generally below 1 mg/L [3]. The same study [3] reported that 96 of 102 water samples collected during dispersant use and analyzed for total petroleum hydrocarbons (TPH) had concentrations below a conservative HC5 value for TPHs (0.81 mg/L). As demonstrated by the existing evidence, dispersant operations are expected to result in a localized pulse (spiked) exposure of chemically dispersed oil in the upper few meters of the water column (10 m depth), followed by rapid dilution in three dimensions (minutes to hours). As discussed in other sections, comparisons with toxicity data derived from laboratory exposures are challenging because most of the existing toxicity data were generated using experimental designs that do not address dilution and water-column mixing (vertical and horizontal). Despite this limitation, assessments of potential effects from dispersants and chemically dispersed oil to listed species are based on conservative assumptions.

Section 2.2. Description of the Preauthorized In-Situ Burning Plan within the *Green Zone*

The RRT4 *In-Situ* Burn Plan describes the policies and protocols for *in-situ* burning operations developed under the authorities described in the NCP 40 CFR 300.910(a). The objective of the *In-Situ* Burn Plan is to provide for meaningful, environmentally safe, and effective *in-situ* burning operations under parameters that have been established by the RRT4 member agencies.

2.2.A. Authorization for the Use of *In-Situ* Burning Activity

The Region IV *In-Situ* Burn Policy is comprised of the RRT4 *In-Situ* Burn Plan, including *in-situ* burning in ocean waters and recommended guidance for burning in the inland zone. The underlying precept is that *in-situ* burning of oil in offshore waters can reduce impacts of oil on sensitive environments inshore. Therefore, the effective use of *in-situ* burning often requires that preauthorization be given prior to an incident. The RRT4 *In-Situ* Burning Policy includes preauthorization agreements for the use of appropriate burning agents, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

Preauthorization, as defined in the NCP, is contingent on the evaluation of potential impacts to natural resources with formal assessments conducted under Section 7(a)(2) of the Endangered Species Act (ESA), Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and Section 106 of the National Historic Preservation Act (NHPA) with consultations from U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS) and the Advisory Council on Historic Preservation (ACHP). Within areas designated for preauthorization of the use of *in-situ* burning, further consultation by the U.S. Coast Guard Federal On-Scene Coordinator (FOSC) is not required for initial use, as long as the appropriate RRT agencies are immediately notified and the relevant protocols of the plan are followed.

RRT4 recognizes that in some instances the physical collection and removal of oil is infeasible or inadequate, and the effective use of *in-situ* burning as an oil spill response technique must be considered. Preauthorization within the set guidelines of this agreement allows FOSC to conduct on-water burns to:

1) Prevent or substantially reduce a hazard to human life,
2) Minimize the environmental impact of the spilled oil or,
3) Reduce and/or eliminate economic or aesthetic losses which would otherwise presumably occur without the use of this technique.

Subpart J of the NCP provides that the FOSC, with the concurrence of the EPA representative to RRT4 and the State(s) with jurisdiction over affected waters, and in consultation with the DOC and DOI trustee representatives to the RRT4, may authorize the use of *in-situ* burns, including the use of burning agents, as an oil spill response tactic [40 CFR 300.910(c)]. Preauthorization of burning agents may be adopted with concurrence from all of the above-mentioned RRT4 representatives [40 CFR 300.910(a)].

The USCG, EPA, DOI, DOC, and the coastal states of RRT IV have adopted *in-situ* burning as an approved tool to remove discharged oil from ocean and coastal waters within the jurisdiction of RRT IV. This agreement covers protocols under which appropriate burning agents are preauthorized for use by the USCG FOSC on state and federal coastal and ocean waters. Concerns over *in-situ* burning operations in a neighboring region which may impact Federal Region IV will be addressed with the neighboring RRT and mediated by the National Response Team if necessary. Offshore *in-situ* burning to remediate oil spills occurring in Federal Region 4 will be conducted in accordance with this plan and, in addition, where applicable, in accordance with Letters of Agreement established among the USCG, EPA, DOI, DOC and the affected state(s).

The preauthorization for burning agents in the plan is in effect for the predesignated USCG FOSC only. Limitations on continued use of *in-situ* burning after the initial response may be adopted by RRT IV on a case-by-case basis.

The NCP does not require RRT approval for the use of *in-situ* burning as a response technology when burning agents are not utilized. However, the USCG, EPA, DOI, DOC, and member states of RRT IV have agreed that the protocols, preauthorization restrictions, and implementation guidance within this plan are appropriate for all oil spill responses in Federal Region IV where *in-situ* burning is conducted. In-situ burning to remediate oil spills occurring in Federal Region IV will be conducted in accordance with this plan and, in addition, where applicable, in accordance with Letters of Agreement established between the USCG, EPA, DOI, DOC and the affected state(s). This policy includes:

1) *In-situ* burning at offshore, near-shore, and/or inland oil spills;
2) *In-situ* burning where burning agents (aka "accelerants") are not utilized; and/or,
3) Federal and State responses where a FOSC is not present for *in-situ* burning activities.

This policy and this plan are not intended to cover debris burning of stockpiled materials. Concerns over *in-situ* burning operations in a neighboring region which may impact Federal Region IV will be addressed with the neighboring RRT and mediated by the National Response Team if necessary.

2.2.B. Preauthorized Area for *In-Situ* Burning

Three Zones, Green, Yellow, and Red, have been established to delineate locations and conditions under which burning operations may take place in waters of Federal Region 4. Preauthorization for *in-situ* burning is limited to the geographical boundaries outlined in the *Green Zone* only.

2.2.B(1) *Green Zone* – Preauthorization Zone for Open Water Burning

The *Green Zone* is defined as any offshore waters within Federal Region 4 in which ALL of the following conditions apply:

2.2.B(1)(a) Jurisdiction

The waters fall exclusively under federal jurisdiction;

2.2.B(1)(b) Zones

The waters are not classified within a "Yellow" zone as defined under Section 2.2.B(2);

2.2.B(1)(c) Distance

The waters are at least 3 nmi seaward of any shoreline (and is 9 nmi from the West coast of Florida[46]) and are within the United States' Exclusive Economic Zone (EEZ); and,

2.2.B(1)(d) Depth

The waters are beyond the 30-foot isobath (approximately 10 m or 5 ftm).

Within *Green Zone*s, the USCG, EPA, DOC, DOI, and the state(s) agree that the decision to use *in-situ* burning rests solely with the predesignated USCG FOSC, and that no further approval, concurrence or consultation on the part of the USCG or the USCG FOSC with EPA, DOC, DOI, or the state(s) is required for initial burning. Preauthorization is otherwise invalid for areas or circumstances where ESA, EFH, or NHPA consultations are missing, inapplicable, and/or determined by the service agency (USFWS, NMFS, or ACHP) to be inadequate.

All burning operations within the *Green Zone* will be conducted in accordance with the Protocols outlined in the ISBP. It is imperative that the USCG FOSC make every reasonable effort to continuously evaluate *in-situ* burning within the *Green Zone*, and will allow RRT IV agencies and the affected state(s) the opportunity to comment as outlined in ISBP protocol 4.2.

2.2.B(2) *Yellow Zone* – Case-by-Case Approval for Open Water Burning

The *Yellow Zone* is defined as any area within Federal Region IV for which ANY of the following conditions apply:

2.2.B(2)(a) Special Jurisdiction

The area is under state or special federal management jurisdiction. This includes any waters designated as marine reserves, state parks, National Marine Sanctuaries, National or State Wildlife Refuges, units of the National Park Service, or proposed or designated critical habitats;

2.2.B(2)(a)(i) Critical Habitat

Proposed or designated critical habitats are not inherently part of the *Yellow Zone*; however, special Emergency Consultation is required under ISBP Protocols for application in a geographic area which meets all the criteria of a *Green Zone* in Section 2.2.B(1) and is also within a proposed or designated critical habitat.

Known critical habitats which meet this criteria are:

[46] Special Case for West Coast of Florida: Florida state waters extend seaward into the Gulf of Mexico to a distance of nine nautical miles whereas all other state coastal waters in RRT IV, including Florida's east coast, extend seaward to a distance of three nautical miles.

- Loggerhead Sea Turtle Northwest Atlantic Distinct Population Segment (DPS)
    - Four segments of Critical Habitat management units (N-01, N-02, N-17, and N-18; 79 FR 39856) extend through the *Green Zone* due to migratory habitat features.
    - Two management units (S-01 and S-02; 79 FR 39856) are within the *Green Zone* for *Sargassum* habitat features.
- North Atlantic Right Whale
    - One critical habitat delineated in regards to winter calving (81 FR 4837).

2.2.B(2)(b) Distance

The area in 3 nmi of a shoreline (or within 9 nmi of the west coast of Florida) and/or falling under State jurisdiction;

2.2.B(2)(c) Depth and Living Reefs

The waters are within the 30-foot isobaths (approximately 10 m or 5 ftm) AND contain living reefs; and,

2.2.B(2)(d) Habitats

The waters are in mangrove or coastal wetland ecosystems, or directly over living coral communities. Coastal wetlands include submerged algal beds and submerged sea grass beds.

Where a Letter of Agreement (LOA) is in effect between the USCG, EPA, DOI, DOC, and the affected state(s), the policy for authorization established by the LOA will become the primary guidance for application in the *Yellow Zone*. Established LOAs are provided in Appendix I of the plan. In the event that a LOA is not in effect for areas falling within the *Yellow Zone*, the following protocols shall apply:

1) If the FOSC feels that *in-situ* burning should be used in areas falling within the *Yellow Zone*, a request for authorization must be submitted to the RRT IV representatives of EPA, DOI, DOC, and affected state(s), along with the required information listed in the *In-Situ* Burning Documentation and Application Form, found in Appendix VI;
2) The FOSC's decision to use *in-situ* burning shall be made after consulting with RRT IV representatives of state and federal trustee agencies to ensure that the best available information pertaining to the presence or absence of natural resources at the burn site is obtained;
3) The FOSC is only granted authority to conduct *in-situ* burning in the *Yellow Zone* when concurrence has been given by EPA and the affected state(s), and after consultation with DOI and DOC;
4) RRT IV will respond to the FOSC's request for authorization to burn in the *Yellow Zone* within four hours from the time of notification. If a decision by RRT IV members cannot be

reached within four hours, the FOSC should be notified and informed of the delay, and the issues causing it. States may elect to grant assumed approval, and DOI and/or DOC may elect to grant assume concurrence, for use of *in-situ* burning in the event that their respective representative to RRT IV cannot respond to the FOSC's request within four hours. Assumed approval procedures and limitations should be documented in the member agency's LOA to this plan.

All burning operations within the *Yellow Zone* will be conducted in accordance with the Protocols outlined in this plan. It is imperative that the USCG FOSC make every reasonable effort to continuously evaluate *in-situ* burning within the *Yellow Zone*, and will allow RRT IV agencies and the affected state(s) the opportunity to comment as outlined in the protocol.

2.2.C. Preauthorized *In-Situ* Burning Protocols & Protective Measures

The ISBP contains protocols which must be followed as part of the conditions for preauthorization. Evaluation of continued use, implementation of environmental monitoring, and restrictions to favorable conditions are collectively intended to minimize the impact of burning activities while maximizing its effectiveness. Trajectory of oil slicks and smoke plumes must be evaluated to ensure that sensitive receptors such as species, critical habitats, special management areas and populated areas are protected to the greatest extent possible; this evaluation should be conducted regardless of whether burning is implemented but particular consideration is needed where proposed burning is near the boundary of the prescribed *Green Zone*. A proximity of 10 nmi or less from the *Green/Yellow Zone* boundary is recommended as a vicinity for critical evaluation but this distance does not constitute an additional boundary line.

Environmental monitoring initially focuses on Special Monitoring of Applied Response Technologies (SMART) protocols and is at minimum necessary to evaluate the efficacy of the burn and condition of the smoke plume but should be expanded as soon as is feasible to begin evaluation of contaminant residuals both the air and water. The evaluation of continued use is based on information received by the FOSC from monitoring and trajectory results, as well as other response elements.

A mandatory *in-situ* burning use form must be completed prior to use and is accompanied by a flow diagram which provides direction on whether a given scenario qualifies for preauthorization.

2.2.C(1) Additional Protective Measures identified during the Biological Assessment

Protective measures must be taken to prevent risk of any injury to wildlife, especially endangered or threatened species, critical habitat, and Essential Fish Habitat are to be identified through the formal consultation process. Additional protective measures provided in Appendix IV have been identified during the construct of this Biological Assessment, in consultation with NOAA, NMFS, USFWS, SAFMC, GMFMC, EPA, and USCG. These measures must be employed where the conditions identified by the service agency apply.

2.2.D. Physical and Chemical Toxicity of *In-Situ* Burning

Concerns related to *in-situ* burning include changes in temperature of the underlying water, exposure to toxic combustion products in air or water, and contact with burn residues. During in-situ burning in open waters, most of the heat produced during a burn (>97%) is directed upward and outward with little to no heat absorption by the underlying water. Heat from the burning oil is rapidly dissipated by the continuous movement of water below the burning oil, and as shown in mesoscale burn tests, there were no noticeable changes in temperature below the water surface [208]. Consequently, thermal effects on the water underlying the burn are negligible and pose little risk to aquatic species.

During in-situ burning, oil is combusted into carbon dioxide and water, as well as into small amounts of carbon monoxide, nitrogen dioxide, and sulfur dioxide, smoke particulates, and residue byproducts [209, 210] (hereafter combustion byproducts). The heat generated by the burning oil causes the smoke to rise several hundred to several thousand feet where the smoke plume dissipates as it is carried away by winds [209, 210]. Potential exposure to combustion byproducts by air-breathing marine species is likely concentrated within the immediate footprint of the burn area, but there is little information on smoke exposure levels and durations to air-breathing marine animals (e.g., cetaceans, birds, sea turtles) within the immediate vicinity and downwind from a burn. For example, a typical crude oil burn (500 m^2) most burn emissions would not exceed health limits beyond 500 m from the fire, except for particular matter, which at ground level (1 m) can be above health concern levels (35 $\mu g/m^3$) (Fingas, 2014). However, under preauthorized conditions of the Proposed Federal Action, the risk of exposure to the gases and particulates generated during a burn could be reduced by several actions. These actions include: an on-site survey prior to the burn to determine if any threatened or federally listed species are present in the burn area or otherwise at risk from any burn operations, fire, or smoke; and measures to prevent risk of injury to any wildlife, especially endangered or threatened species, such as moving the location of the burn to an area where listed species are not present, and cessation of burn operations until the animal(s) has departed the area. Physical removal of sea turtles may be considered the authority of the trustee agency.

Although there are limited studies on the aquatic toxicity of burn residues, the existing empirical evidence [211-214] shows that water from laboratory and field-generated burn residues had little to no acute toxicity to several species (e.g., sand dollars, oyster larvae, and inland silversides, rainbow trout, three-spine stickleback, sea urchin fertilization, marine snails, copepods). The concentrations of petroleum hydrocarbons from the water collected in the vicinity of unburned and burned crude oil slicks in the open sea were low with no significant differences between these two water sample types [211]. Studies have shown that *in-situ* burning substantially reduced the total amount of PAHs on the water generated by surface oil spills [215]. Analyses of residues following 20 *in-situ* burns during the DWH oil spill showed a slight increase in the concentration of asphaltenes in post-burn residues compared to pre-burn levels, with greater increases in the concentrations of pyrogenic compounds [216]. Based on these limited studies, burn residues are expected to yield little or no chemical toxicity, and water quality is expected to be comparable to pre-burn conditions.

There are concerns on the potential contact hazards to wildlife and vegetated habitats of sticky floating, stranded, and sinking burn residue. The burning process of oil leaves a small fraction (1-10%) of viscous and dense residues with the potential to sink. However not all oils may pose the same risk of exposure. There is a correlation between sinking properties of oil residues and the original oil, such that light to medium crude oils generally produce floating burn residues, while heavy crude and heavy refined oils generally producing sinking burn residues [217]. Small-scale tests with several oils [218] reported that burn residues from the heavier oils formed non-sticky residues, while lighter crude oils and diesel produced sticky burn residues with the potential to adhere to feathers and rugged skin surfaces. Field trials have also shown that the concentrations of pyrogenic compounds is enriched in burned residues, but this enrichment is outweighed by the mass of oil consumed in the burn [215]. Ingestion of burn residues is a potential pathway of exposure. Marine birds could ingest residues during preening, and sea turtles could ingest residues during feeding. Impacts would likely be comparable to those resulting from the ingestion of oil as discussed in Section 2.1.G(4).

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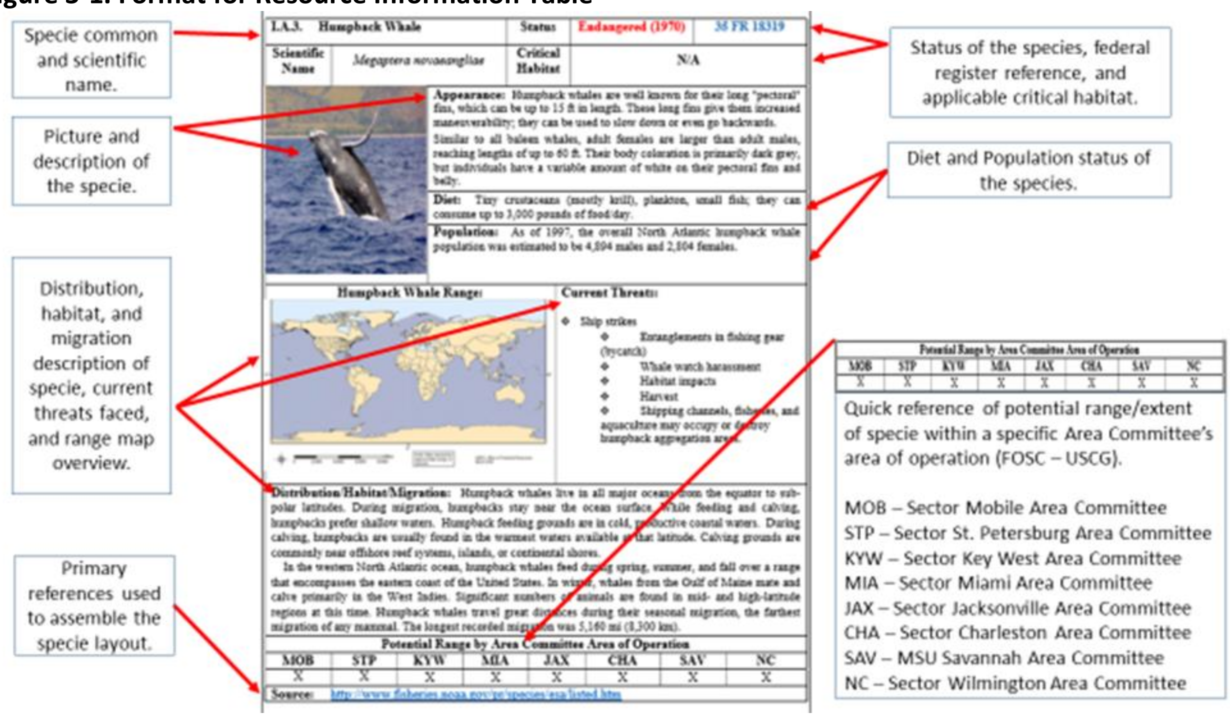
Chapter 3. Status of Listed Species, Critical Habitat, and Essential Fish Habitat

The purpose of this chapter is to identify the species listed (threatened and endangered) and proposed for listing under the ESA, including any designated critical habitats, and essential fish habitats within the preauthorized area for the potential aerial or surface application of dispersants. The *Green Zone* will be considered the Action Area[47] for the purposes of this Biological Assessment; whereas the *Yellow Zone* will be addressed independently and where applicable but is not considered a part of the Action Area. Section 3.1 covers the applicable species listed as endangered, threatened, or proposed for listing, as well as their designated critical habitats, which are managed by NMFS. Section 3.2 covers the applicable species listed as endangered, threatened, or proposed for listing, as well as their designated critical habitats, which are managed by the USFWS. Finally, Section 3.3 will provide a list of applicable Essential Fish Habitats as overseen by NMFS in conjunction with the SAFMC and GMFMC.

For each species, critical habitat, and Essential Fish Habitat found within the Green Zone, the information illustrated in Figure 3-1 is provided. The intent of this layout approach is to bridge interests among field, management, policy, legal, scientific, academia, reviewer, and others of our environmental community. Feedback which furthers application of this Biological Assessment, including modification to species layouts is encouraged throughout all area committees and members of the RRT4.

Figure 3-1. Format for Resource Information Table



[47] Action Area - all areas to be affected directly or indirectly by the Proposed Federal Action and not merely the immediate area involved in the action. [50 CFR §402.02]

Section 3.1. Species and Designated Critical Habitat under the Jurisdiction of the National Marine Fisheries Service

The purpose of this section is to highlight the marine species listed and proposed for listing under the ESA, and their designated critical habitat, that have been identified within the preauthorized area (see Section 2.1.B and Section 2.2.B) where potential use of dispersants may occur during a response to an oil spill. For each of these listed species, the name (common and scientific), photo identifying the appearance of the species, status, distribution, threats, and the particular Area Committee areas of operation where the species could be found are included.

NMFS will inform the RRT4 regarding any new listing, including proposed or candidate, of species as endangered or threatened within the *Green Zone* or *Yellow Zone* and any updates to the current listing of species identified in this section. The RRT4 will confirm the information contained in this section at least annually with NMFS.

Validation of the information presented for each of the species in this section, as well as additional information, may be found within the NMFS website: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm. Additionally, reviewers of this document are encouraged to offer any new information that might not yet be available at the Regional level.

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3.1.A. Cetaceans

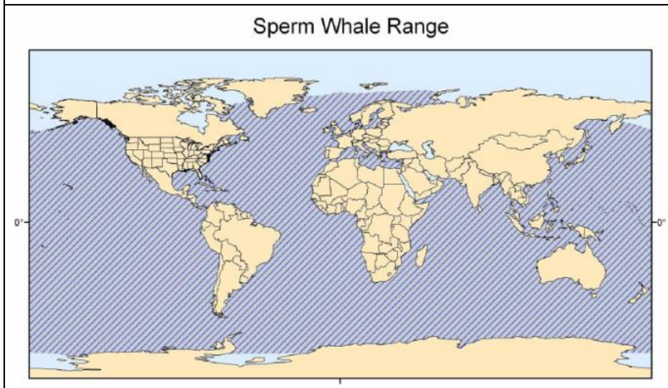
3.1.A(1) Sperm Whale	**Status**	**Endangered (1970)**	35 FR 18319
Scientific Name	*Physeter microcephalus*	**Critical Habitat**	N/A

Photo: Tim Cole, NOAA

Appearance: Mostly dark gray, though some have white patches on the belly, with an extremely large head that takes up about 1/3 of its total body length.

Diet: Sperm whales are toothed whales (*odontoceti*) and feed on large organisms, such as squid, in water depths of 1,600–3,200 ft. They can also feed on other cephalopods such as octopus, and medium- and large-sized demersal fish, such as rays, sharks, and many teleosts. Sperm whales feed throughout the year and can consume 3.0–3.5% of their body weight per day. The wide range of prey means that there are available food sources for the Sperm Whale throughout its range including the southeastern U.S. but both Sperm Whale and its primary prey are more likely to occur in deep water outside of the continental shelf.

Population: Best estimate of worldwide population is 200,000–1,500,000; though this is poorly known. The best population estimate (likely underestimated) for the western North Atlantic sperm whale is 2,288 individuals.



http://www.fisheries.noaa.gov/pr/pdfs/rangemaps/spermwhale.pdf

Current Threats:

- Ship strikes
- Entanglements in fishing gear
- Disturbance by anthropogenic noise notably in areas of oil and gas activities or where shipping activity is high
- Pollutants (e.g. PCBs, PAHs, chlorinated pesticides, heavy metals)
- Coastal pollution (potential)
- Killer whales (natural)
- Large sharks (natural)
- Whaling (historically)

Distribution/Habitat/Migration: Sperm whales inhabit all oceans of the world in areas with water depths of 2,000 ft or more but are uncommon in waters less than 1,000 ft; meaning that Sperm Whale will not likely occur within the Yellow Zone and would be more likely in the two thirds of the Green Zone outside the continental shelf. Female sperm whales are generally found in deep waters (at least 3,200 ft) of low latitudes (less than 40°, except in the North Pacific where they are found as high as 50°). They breed in tropical waters. Older, larger males are generally found near the edge of pack ice in both hemispheres. On occasion, however, these males will return to the warm-water breeding area. Sperm whale migrations are not as predictable or well understood as migrations of most baleen whales. In some mid-latitudes, there seems to be a trend to migrate north and south depending on the seasons (whales move poleward in the summer). However, in tropical and temperate areas, there appears to be no obvious seasonal migration. Along the U.S. Atlantic coast, most sightings in summer are along the continental shelf and slope, from the Outer Banks (NC) to Georges Bank (MA).

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

NMFS (2015) *Sperm Whale 5-Year Review*
NMFS (2010) *Final Recovery Plan for the Sperm Whale*
NMFS (2015) *Sperm Whale North Atlantic Stock*
NMFS (2012) *Sperm Whale: Northern Gulf of Mexico Stock* (Marine Mammal Stock Assessment Report)

3.1.A(2) North Atlantic Right Whale

Status: **Endangered (1970)** 73 FR 12024

Scientific Name *Eubalaena glacialis* **Critical Habitat** 59 FR 28805 (1994)

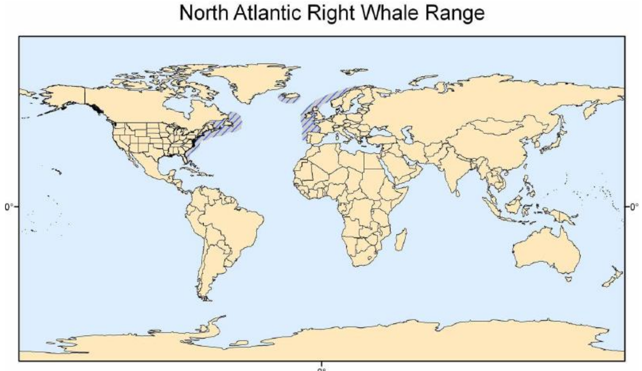
Photo: NOAA NMFS Northeast Regional Office

Appearance: Features include stocky body, black coloration (some have white patches on belly), no dorsal fin, a large head, strongly bowed lower lip, and callosities (raised patches of roughened skin) on their head.

Diet: Right whales feed primarily on copepods, with *Calanus finmarchicus* believed to be the primary prey. Other zooplankters are also taken, including Pseudocalanus, Centropages, and even cyprids. Right whales are primarily skimmers and filter small prey through their baleen. Feeding occurs from spring through fall in northern latitudes. Relatively cooler water temperatures and 300–600 ft depths adjacent to steeply bottom topography seem to be related to certain areas used for feeding. Zooplankton are abundant throughout the southeastern U.S. marine waters, mostly concentrated within the continental shelf with higher concentrations near shallower water; however, *C. finmarchicus*, does not occur in these waters and the area is not considered a foraging area for northern right whales. Female whales typically do not feed during movement to or residence within calving grounds of the southeastern U.S.

Population: It is believed the western North Atlantic population numbers about 450 individual right whales. Although precise estimates of abundance are not available for the eastern North Atlantic right whales, the population is nearly extinct, probably only numbering in the low tens of animals.

North Atlantic Right Whale Range



http://www.fisheries.noaa.gov/pr/pdfs/rangemaps/northatlanticrightwhale.pdf

Current Threats:

- Ship collisions
- Entanglements in fishing gear
- Habitat degradation
- Contaminants
- Climate and ecosystem change
- Disturbance from whale-watching
- Noise from industrial activities
- Coastal pollution (potential)
- Killer whales (natural)
- Large sharks (natural)

Distribution/Habitat/Migration: North Atlantic Right Whales primarily occur in coastal or shelf waters along the eastern U.S., and seasonally along RRT4 Atlantic States within a range generally less than 100 nmi from shore (this includes the entirety of the *Yellow Zone* and approximately one third of the *Green Zone*). Right whales migrate to higher latitudes during spring and summer. North Atlantic right whales inhabit the Atlantic Ocean, particularly between 20° and 60° latitude. For much of the year, their distribution is strongly correlated to the distribution of their prey. During winter, right whales occur in lower latitudes and coastal waters where calving takes place. However, the whereabouts of much of the population during winter remains unknown. Five "areas of high use" that are key habitat areas for right whales have been identified: Coastal Florida and Georgia, Great South Channel, Scotian Shelf, Massachusetts Bay and Cape Cod Bay, and Bay of Fundy. In the coastal waters off Georgia and northern Florida, calving occurs from December through March. All vessels 65ft or longer must travel at 10 knots or less in this area during this calving season to reduce the threat of ship collisions.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
		X	X	X	X	X	X

NMFS (2012) *North Atlantic Right Whale 5-Year Review*
NMFS (2004) *Recovery Plan for the North Atlantic Right Whale (Revised)*
NMFS (2014) *North Atlantic Right Whale: Western Atlantic Stock* (Marine Mammal Stock Assessment Report)

3.1.A(2)(a) North Atlantic Right Whale Critical Habitat

In January, 2016, NMFS revised the North American right whale critical habitat (81 FR 4837, January 27, 2016), replacing the right whale critical habitat that was designated in 1994 (59 FR 28793, June 3, 1994) with two new, expanded areas. These areas were determined to provide critical feeding, nursery, and calving habitat for the North Atlantic population of northern right whales.

In response to an October 2009 petition to revise the 1994 critical habitat designation, NMFS indicated its intention to make the revision by continuing the critical habitat rulemaking associated with the 2008 listing for North Atlantic and North Pacific right whales as two separate species under the ESA (75 FR 61690; October 6, 2010). NMFS identified in the designation two areas that contain the physical and biological features essential to the conservation ("essential features") of the North Atlantic right whale. The essential features provide requirements for successful foraging, calving, and calf survival. The specific area where the essential foraging features are located is in the Gulf of Maine and Georges Bank region (Unit 1) and covers a total area of approximately 21,334 nm^2. The specific area containing the calving essential features is off the southeast U.S. coast between North Carolina and Florida (Unit 2) and covers 8,429 nm^2, including an area of 341 nm^2 that was added to the southern boundary of the unit in response to public comments.

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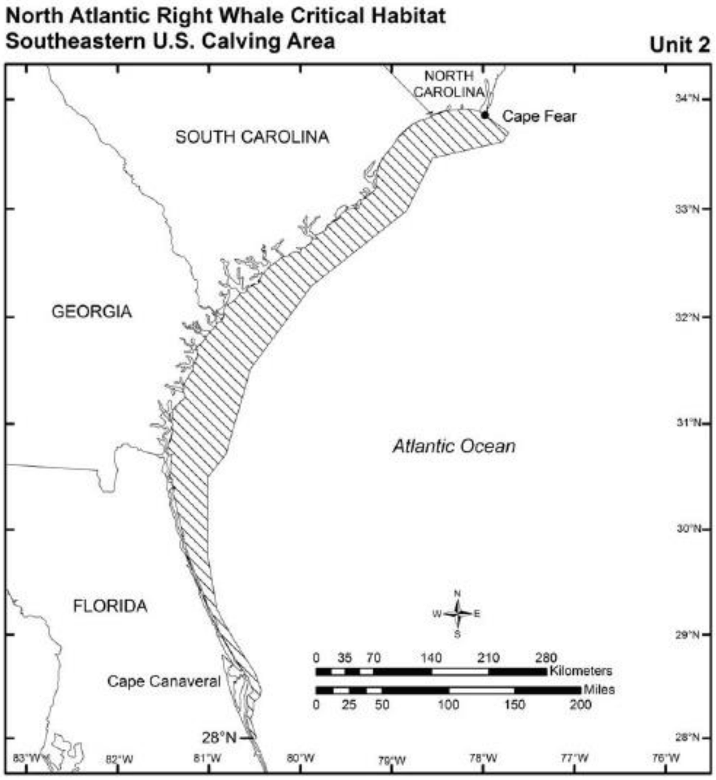
3.1.A(2)(b) North Atlantic Right Whale Critical Habitat in the *Green Zone*

3.1.A(2)(b)(i) North Atlantic Right Whale Critical Habitat	**Status**	**Final – 2016**
	Critical Habitat	81 FR 4837



http://www.nmfs.noaa.gov/pr/species/critical%20habitat%20files/se_narw_ch.pdf

Description: The 2016 southeast right whale calving area replaces the 1994 North Atlantic Right Whale Critical Habitat in the South Atlantic and consists of all marine waters from Cape Fear, North Carolina, south to 29° N latitude (approximately 43 mi north of Cape Canaveral, Florida) within the area bounded on the west by the shoreline and on the east by rhumb lines up to 50 nm offshore. If approved that portion of the critical habitat within 3 nm of shore and the ≤ 30 ft isobath would be within the *Yellow Zone*. The remaining critical habitat within the *Green Zone* would be subject to preapplication BMP for Right Whale (Appendix XX)

Important Physical and Biological Features: The specific area where the essential calving features are located is in the South Atlantic Bight (SAB) and covers a total area of approximately 8,611 nm^2 with calm sea surface conditions associated with Force 4 or less on the Beaufort Scale, sea surface temperatures of 44-63 °F, and water depths of 20-90 ft. These features simultaneously co-occur over contiguous areas of at least 231 nm^2 of ocean waters during November and April. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified. North Atlantic right whales calve in warm subtropical waters during winter, and migrate to feed in the highly productive cold temperate and subpolar waters in spring and summer. The only known calving habitat for North Atlantic right whales occurs along the Southeastern U.S. coast. Reproductive females are sighted in the calving ground off the coast of Florida and Georgia and typically arrive during late November and early December. Mothers and newborn calves reside within the southeast through winter and generally depart the calving grounds by the end of March or early April. Female whales do not typically feed during movement to, or the residence period in, the calving ground. Mother whales fast during part of or throughout lactation, and maternal reserves are heavily exploited for milk production. Mother-calf pairs are likely to select locations with the calmest sea surface conditions. If weather conditions are persistently poor then it is likely the mother may search for and locate conditions more conducive to the needs of a weak-swimming neonate. As the calving season progresses and young calves mature, calm waters become relatively less important to calf survival. Mother-calf pairs begin occupying rougher surface waters and the distribution of mother-calf pairs begins correlating more strongly with the preferred ranges of sea surface temperatures and water depths.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
			X	X	X	X	X

NMFS (2015) *Endangered Species Act Section 4(b)(2) Report: Critical Habitat for the North Atlantic Right Whale*

3.1.A(3) Humpback Whale

Status — **Endangered (1970)** — 35 FR 18319

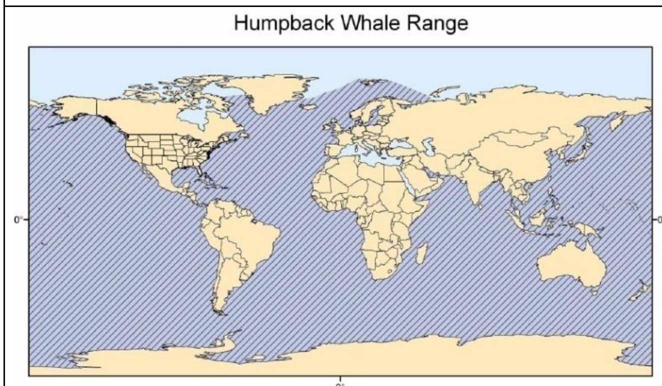
Scientific Name *Megaptera novaeangliae* **Critical Habitat** N/A

Photo: NOAA

Appearance: Humpback whales are well known for their long "pectoral" fins. Similar to all baleen whales, adult females are larger than adult males, reaching lengths of up to 60 ft. Their body coloration is primarily dark grey, but individuals have a variable amount of white on their pectoral fins and belly.

Diet: Humpback whales filter small prey through their baleen. All humpback whales feed while on the summer range, which is usually located over a continental shelf at latitudes between about 40° and 75° latitude, outside the range of Federal Region 4 *yellow or Green Zones*. Important prey to the North Atlantic population includes herring, sand lance, and capelin as well as mackerel, small Pollock, and haddock. Krill, primarily *Meganyctiphanes norvegica*, is also an important food source. These species are more likely found in the northeast U.S. and sub-arctic region.

Population: As of 1997, the overall North Atlantic humpback whale population was estimated to be 4,894 males and 2,804 females.



http://www.fisheries.noaa.gov/pr/pdfs/rangemaps/humpbackwhale.pdf

Current Threats:

- Ship strikes
- Entanglements in fishing gear (bycatch)
- Whale watch harassment
- Habitat impacts
- Harvest
- Shipping channels, fisheries, and aquaculture may occupy or destroy humpback aggregation areas.

Distribution/Habitat/Migration: Humpback whales live in all major oceans from the equator to sub-polar latitudes. During migration, humpbacks stay near the ocean surface. While feeding and calving, humpbacks prefer shallow waters. Humpback feeding grounds are in cold, productive coastal waters. Calving grounds are commonly near offshore reef systems, islands, or continental shores. In the western North Atlantic Ocean, humpback whales feed during spring, summer, and fall over a range that encompasses the eastern coast of the U.S. In winter, whales from the Gulf of Maine mate and calve primarily in the West Indies. Significant numbers of animals are found in mid- and high-latitude regions at this time. Humpback whales travel great distances during their seasonal migration, the farthest migration of any mammal, and may occur in either the *yellow or Green Zone* within the Atlantic.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

NMFS (2015) *Status Review of the Humpback Whale Under the Endangered Species Act*
NMFS (1991) *Final Recovery Plan for the Humpback Whale*
NMFS (2014) *Humpback Whale: Western North Pacific Stock* (Marine Mammal Stock Assessment Report)

3.1.A(4) Fin Whale	Status	Endangered (1970)	35 FR 18319

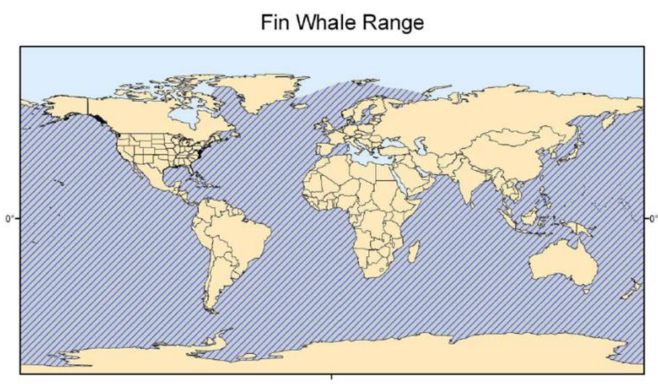
Scientific Name	*Balaenoptera physalus*	Critical Habitat	N/A

Photo: Marjorie Foster, NOAA

Appearance: Fin whales have a sleek, streamlined body with a V-shaped head. They have a tall, "falcate" dorsal fin. The species has a distinctive coloration pattern: the back and sides of the body are black or dark brownish-gray, and the ventral surface is white.

Diet: Fin whales filter small prey through their baleen. All Fin whales in the North Atlantic eat pelagic crustaceans (mainly euphausiids or krill) and schooling fish such as capelin, herring, and sand lance. Most individuals probably prey on both invertebrates and fish, depending on availability. These species are more likely found in the northeast U.S. and sub-arctic region and northern latitude, and feeding areas are outside of Federal Region 4 *yellow* and *Green Zones*.

Population: The best abundance estimate available for the western North Atlantic fin whale stock is 1,618 individuals. This is the estimate derived from the 2011 NOAA shipboard surveys and is considered best because it represents the most current data in spite of the survey not including all of the stock's range.



http://www.nmfs.noaa.gov/pr/pdfs/rangemaps/finwhale.pdf

Current Threats:
- Commercial whaling (historically)
- Collisions with vessels
- Entanglement in fishing gear
- Reduced prey abundance due to overfishing
- Habitat degradation
- Disturbance from low-frequency noise
- Illegal whaling or resumed legal whaling
- Killer whale (only non-human predator)
-

Distribution/Habitat/Migration: Fin whales are found in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes, and less commonly in the tropics. They occur year-round in a wide range of latitudes and longitudes, but the density of individuals in any one area changes seasonally. Fin whales can be found in social groups of 2-7 whales. In the North Atlantic, they are often seen feeding in large groups with humpback whales, minke whales, and Atlantic white-sided dolphins. Fin whales are large, fast swimmers. Fin whales are migratory, moving seasonally into and out of high-latitude feeding areas, but the overall migration pattern is complex, and specific routes have not been documented. A southward "flow pattern" occurs in the fall from the Labrador-Newfoundland region, past Bermuda, and into the West Indies. Fin Whales may occur in both the *Yellow Zone* and the *Green Zone* of both the Gulf of Mexico and the Atlantic, most likely during winter months.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:

NMFS (2011) *Fin Whale 5-Year Review*
NMFS (2010) *Final Recovery Plan for the Fin Whale*
NMFS (2015) *Fin Whale: Western North Atlantic Stock* (Marine Mammal Stock Assessment Report)

3.1.A(5) Sei Whale	Status	Endangered (1970)	35 FR 18319

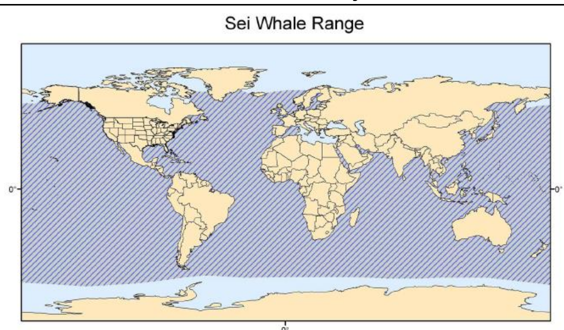
Scientific Name	*Balaenoptera borealis*	Critical Habitat	N/A

Photo: NMFS Northeast Fisheries Science Center

Appearance: Sei whales have a long, sleek body that is dark bluish-gray to black in color and pale underneath. The body is often covered in oval-shaped scars, sometimes has subtle "mottling", and has an erect "dorsal" fin. This species usually does not arch its back or raise its flukes when diving.

Diet: Sei whales filter small prey through their baleen by both skimming at the surface and gulping at depth. Populations in the North Atlantic feed primarily on calanoid copepods (zooplankton), with a secondary preference for euphausiids. Zooplankton are abundant throughout the southeastern U.S. marine waters, mostly concentrated within the continental shelf with higher concentrations near shallower water; meaning greater food source abundance within the *Yellow Zone* and one third of the *Green Zone* closest to shore. Sei whales are capable of diving 5-20 min to opportunistically feed on plankton, small schooling fish, and cephalopods by both gulping and skimming. They prefer to feed at dawn and may exhibit unpredictable behavior while foraging and feeding on prey.

Population: Sei whales inhabiting U.S. waters have been divided into four stocks: Hawaiian, Eastern North Pacific, Nova Scotia, and Western North Atlantic stocks. Scientists estimate that the current worldwide population is about 80,000 individuals. After commercial whaling exhausted all known populations of this species, sei whales in the North Atlantic & North Pacific are considered relatively abundant.



http://www.nmfs.noaa.gov/pr/pdfs/rangemaps/seiwhale.pdf

Current Threats:

- Commercial hunting and whaling
- Ship strikes
- Interactions with fishing gear

Distribution/Habitat/Migration: Sei whales occur in subtropical, temperate, and subpolar waters around the world. They prefer temperate waters in the mid-latitudes. They are usually observed in deeper waters of oceanic areas far from the coastline such as the continental slope, shelf breaks, and deep ocean basins situated between banks. During the summer, they are commonly found in the Gulf of Maine, and on Georges Bank and Stellwagen Bank in the western North Atlantic. Sei Whales undertake seasonal north/south movements, wintering at relatively low latitudes and summering at relatively higher latitudes. Generally speaking, sei whales do not tend to move to as high latitudes as do some of the other balaenopterid species, and they also tend not to enter semi-enclosed water bodies, including the Gulf of Mexico (although sightings have been recorded). The entire distribution and movement patterns of this species are not well known. This species may unpredictably and randomly occur in a specific area, sometimes in large numbers. These events may occur suddenly and then not occur again for long periods of time. Sei whales are usually observed singly or in small groups of 2-5 animals, but are occasionally found in larger (30-50 animals) loose aggregations. Sei whales in federal region 4 would most likely be found within the *Green Zone* of the Atlantic during transition months between winter and summer, but can possibly occur in both the *Green and Yellow Zones* throughout the region.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:

NMFS (2012) *Sei Whale 5-Year Review*
NMFS (2011) *Final Recovery Plan for the Sei Whale*
NMFS (1998) *Sei Whale: Western North Atlantic Stock* (Marine Mammal Stock Assessment Report)

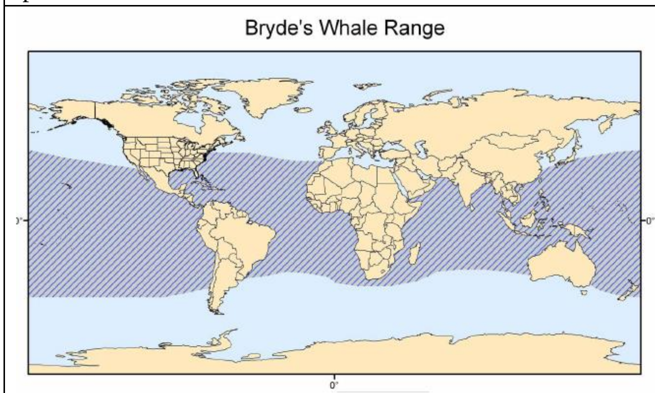
3.1.A(6) Brydes Whale	Status	Candidate (2014)	N/A*
Scientific Name	*Balaenoptera edeni*	**Critical Habitat**	N/A

Photo: Isabel Beasley, NOAA

Appearance: Bryde's whales are large animals that have a sleek body that is dark gray in color, white underneath, and an erect, "falcate" "dorsal" fin located far down the animal’s back. They look similar in appearance to sei whales, but can be distinguished by three distinct prominent longitudinal ridges located on the animal's rostrum in front of the blowhole.

Diet: Bryde’s whales filter small prey through their baleen by both skimming at the surface and gulping at depth. Prey for the Gulf of Mexico Distinct Population Segment includes plankton (krill and copepods), crustaceans (shrimp), schooling fish (anchovies and sardines). Bryde’s whales have also been observed diving synchronously with increasing depths between dusk and dawn likely following zooplankton diurnal vertical migration. Some individuals may exhibit preferences for one type of prey (e.g., fish over zooplankton), while others may be more flexible in response to changing food availability.

Population: For management purposes, Bryde's whales inhabiting U.S. waters have been divided into three stocks: the Eastern Tropical Pacific stock, Hawaiian stock, and Northern Gulf of Mexico stock. The estimated population of Bryde's whales in the northern Gulf of Mexico is 25-40 individuals. There may be up to 90,000-100,000 animals worldwide, with two-thirds occurring in the Northern Hemisphere. There are insufficient data to determine the population trends for this species.



http://www.nmfs.noaa.gov/pr/pdfs/rangemaps/brydeswhale.pdf

Current Threats:

- Ship strikes
- Underwater sounds
- Anthropogenic noise
- Whaling outside the U.S. (for research/other uses)

Note: Bryde’s whales were not significantly targeted historically by commercial whalers

Distribution/Habitat/Migration: Bryde's whales likely have a cosmopolitan distribution and occur in tropical and warm temperate oceans. They can be found globally in all oceans from 40° S to 40° N. Bryde's whales prefer highly productive tropical, subtropical and warm temperate waters worldwide (61-72° F or 16-20° C). The smaller form of this species may prefer waters near the coast and continental shelf. These large baleen whales are usually sighted individually or in pairs, but there are reports of loose aggregations of up to 20 animals associated with feeding areas. Some populations of Bryde's whales may migrate seasonally, moving towards higher latitudes during the summer and towards the equator during the winter. Other populations of Bryde's whales are residents and do not migrate. Despite their very small population size, the Bryde’s whales are the most commonly detected baleen whale species in the Gulf of Mexico, and may be the only resident baleen whale species. Accordingly, this species fills a unique ecological niche in the region. Bryde’s whales may occur throughout both the yellow and *Green Zone*s of both the Gulf of Mexico and the Atlantic with greater chances of encounter over the continental shelf.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:

NRDC (2014) *A petition to list the Gulf of Mexico Bryde’s whale as endangered under the Endangered Species Act*

NMFS (2014) *http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/brydeswhale.htm*

NMFS (2012) *Bryde’s Whale: Northern Gulf of Mexico Stock* (Marine Mammal Stock Assessment Report)

3.1.B. Sea Turtles

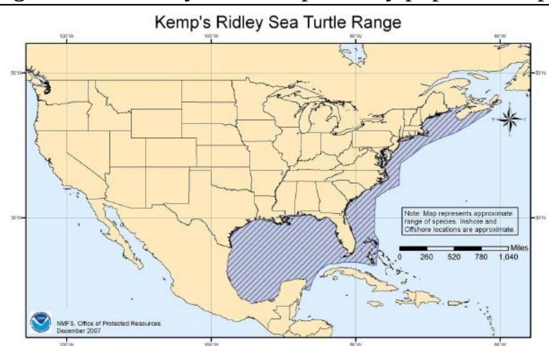
3.1.B(1) Kemp's Ridley Sea Turtle	Status	Endangered (1970)	35 FR 18319
Scientific Name	*Lepidochelys kempii*	Critical Habitat	*petitioned (2010)

Photo: Kim Bassos-Hull, Mote Marine Laboratory

Appearance: Grayish-green, nearly circular top shell with a pale yellowish bottom shell. Considered the smallest marine turtle. Their top shell (carapace) is often as wide as it is long and contains 5 pairs of costal "scutes". Each of the front flippers has one claw; back flippers may have one or two.

Diet: Use of the *Sargassum* community has been suggested for oceanic juvenile loggerhead and green turtles in the Northwest Atlantic. Neritic zone, juvenile Kemp's Ridley sea turtles feed primarily on decapod crustaceans. The distribution of foraging Kemp's ridleys is related to the distribution and availability of all the major crab species that are consumed. Studies have also shown that their diets include various items such as mollusks, natural debris, sea horses, and tunicates. However, crabs constitute the bulk of their diet. Neritic zone, adult Kemp's ridleys have a preference for portunid crabs. Adults appear to be shallow water, benthic feeders, consuming primarily crabs and occasionally clams, shrimp, vegetation, fish, and marine debris.

Population: The Kemp's ridley has experienced a, dramatic decrease in arribada size at the nesting beaches of Rancho Nuevo. A 1947 video documented 42,000 Kemp's ridleys nesting during a single day. The population experienced a decline between the late 1940s to mid-1980s, with a record low of 702 nests at Rancho Nuevo in 1985, representing fewer than 250 nesting females. Today, the Kemp's ridley population appears to be in the early stages of recovery.



http://www.nmfs.noaa.gov/pr/pdfs/rangemaps/kemps_ridley_turtle.pdf

Current Threats:
- Incidental capture in fishing gear (primarily in shrimp and other trawls, but also in gill nets, longlines, traps/pots, dredges)
- Egg collection
- General threats to marine turtles

Distribution/Habitat/Migration: Kemp's ridleys are distributed throughout the Gulf of Mexico and U.S. Atlantic seaboard. Adult Kemp's primarily occupy "neritic" habitats [muddy or sandy bottoms where prey can be found]. Kemp's ridleys rarely venture into waters deeper than 160 ft and are therefore more likely to be encountered in the *Yellow Zone* and encounters in the *Green Zone* may be most likely during migration or within *Sargassum*. Females nest from May to July, laying two to three clutches of approximately 100 eggs. Juveniles have been known to associate with floating *Sargassum*, utilizing it as an area of refuge, rest, and/or food. This developmental drifting period is hypothesized to last about two years or until the turtle reaches a carapace length of about 8 inches (in). Some males migrate annually between feeding and breeding grounds; others may not migrate at all. Female Kemp's have been tracked migrating to and from nesting beaches in Mexico including foraging zones ranging from the Yucatán Peninsula to southern Florida. Hatchlings may be found in currents within the Gulf of Mexico or may be swept into the Atlantic Ocean.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:

NMFS (2015) *Kemp's Ridley Sea Turtle 5-Year Review*
NMFS (1992) *Recovery Plan for the Kemp's Ridley Sea Turtle*
NMFS (2011) *Final Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle – Second Revision*

3.1.B(2) Green Sea Turtle	Status	Endangered (1978) Proposed Threatened (2015)	43 FR 32800 80 FR 15271

Scientific Name *Chelonia mydas* | **Critical Habitat** N/A

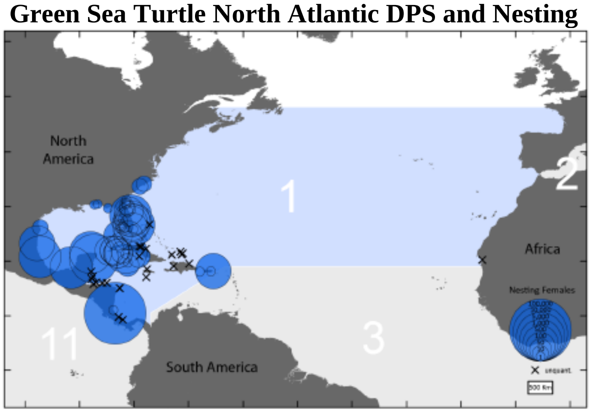
Photo: Andy Bruckner, NOAA

Appearance: Green turtles are the largest of all the hard-shelled sea turtles, but have a comparatively small head. Their top shell (carapace) is smooth with shades of black, gray, green, brown, and yellow; their bottom shell (plastron) is yellowish white.

Diet: Adult green turtles are unique among sea turtles in that they eat only plants, feeding primarily on seagrasses and algae. This diet is thought to give them greenish-colored fat, from which they take their name. It is assumed that post-hatchling, pelagic-stage green turtles are omnivorous, but there are no data on diet from this age class. It is known that once green turtles shift to benthic feeding grounds, they are herbivores.

Population: In the U.S., green turtles nest primarily along the central and southeast coast of Florida where an estimated 200-1,100 females nest annually.

Green Sea Turtle North Atlantic DPS and Nesting



http://www.nmfs.noaa.gov/pr/species/documents/green_turtle_listing_webinar_public.pdf

Current Threats:

- Harvest of eggs and adults (historically, though the practice continues in some locals)
- Incidental capture in fishing gear
- Fibropapillomatosis (disease)
- General threats to marine turtles

Distribution/Habitat/Migration: The green turtle is globally distributed and generally found in tropical and subtropical waters along continental coasts and islands between 30° N and 30° S. In U.S. Atlantic and Gulf of Mexico waters, green turtles are found in inshore and nearshore waters from Texas to Massachusetts, the U.S. Virgin Islands, and Puerto Rico. Important feeding areas include the Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River, Cedar Key, and St. Joseph Bay. While nesting season varies from location to location in the southeastern U.S., females generally nest in the summer between June and September; peak nesting occurs in June and July. During the nesting season, females nest at approximately two-week intervals. They lay an average of five nests. In Florida, green turtle nests contain an average of 135 eggs. Adult females migrate from foraging areas to mainland or island nesting beaches and may travel hundreds or thousands of kilometers each way. After emerging from the nest, hatchlings swim to offshore areas, where they are believed to live for several years, feeding close to the surface on a variety of pelagic plants and animals. Once the juveniles reach a certain age/size range, they leave the pelagic habitat and travel to nearshore foraging grounds. Once they move to these nearshore benthic habitats, adult green turtles are almost exclusively herbivores, feeding on sea grasses and algae.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:

NMFS (2007) *Green Sea Turtle 5-Year Review*
NMFS (1991) *Recovery Plan for U.S. Population of Atlantic Green Turtle*

3.1.B(3) Loggerhead Sea Turtle, Northwest Atlantic DPS	Status	Threatened (2011)	76 FR 58868
Scientific Name	*Caretta*	**Critical Habitat**	79 FR 39856 (2014)

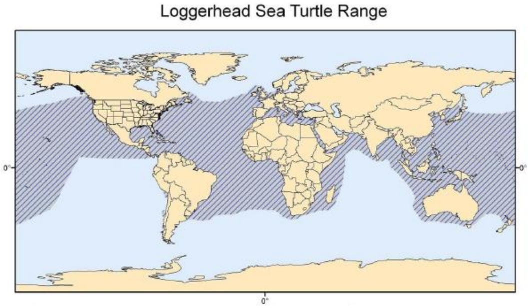
Photo: NOAA

Appearance: Loggerheads were named for their relatively large heads, which support powerful jaws and enable them to feed on hard-shelled prey. The top shell is slightly heart-shaped, reddish-brown in adults and sub-adults; the bottom shell is generally a pale yellowish color. The neck and flippers are usually dull to reddish brown on top; pale yellow on the sides and bottom.

Diet: Loggerhead sea turtle diet is different between life stages and zones. They are primarily carnivorous, although they do ingest some vegetation. Loggerheads in the oceanic-stage [juvenile] consume primarily coelenterates (e.g., sea jellies, hydroids) and salps, but also ingest a range of organisms including the pelagic snail *Janthina* spp., barnacles (*Lepas* spp.), and crabs. Juveniles in the neritic zone primarily consume benthic invertebrates, notably mollusks and benthic crabs. Discarded fish bycatch, from nearshore shrimp trawl fishing was commonly ingested by juvenile loggerheads; proportionally more bycatch was consumed by smaller turtles than by larger, older turtles.

Population: Total estimated nesting in the U.S. is approximately 68,000 to 90,000 nests per year.

Loggerhead Sea Turtle Range



http://www.nmfs.noaa.gov/pr/pdfs/rangemaps/loggerhead_turtle.pdf

Current Threats:

- Incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges
- Directed harvest
- General threats to marine turtles

Distribution/Habitat/Migration: Loggerheads are circumglobal, occurring throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. They are the most abundant species of sea turtle found in U.S. coastal waters. Adult loggerheads are known to make extensive migrations between foraging areas and nesting beaches. During non-nesting years, adult females from U.S. beaches are distributed in waters off the eastern U.S. and throughout the Gulf of Mexico, Bahamas, Greater Antilles, and Yucatán. During the summer, nesting occurs primarily in the subtropics. Although the major nesting concentrations in the U.S. are found from North Carolina through southwest Florida, minimal nesting occurs outside of this range westward to Texas and northward to Virginia. In the southeastern U.S., mating occurs in late March to early June and females lay eggs between late April and early September. Loggerheads nest on ocean beaches, generally preferring high energy, relatively narrow, steeply sloped, coarse-grained beaches. Females lay three to five nests, and sometimes more, during a single nesting season. The eggs incubate approximately two months before hatching sometime between late June and mid-November. Newly emerged hatchlings move from their nest to the surf, swim, and are swept through the surf zone. Post-hatchling loggerheads take up residence in local downwellings, common between the Gulf Stream and the Southeastern United States coast, and between the Loop Current and the Gulf Coast of Florida. Between 7-12 years old, oceanic juveniles migrate to nearshore coastal areas (neritic zone) and continue maturing until adulthood. In addition to providing critically important habitat for juveniles, the neritic zone also provides crucial foraging habitat, inter-nesting habitat, and migratory habitat for adult loggerheads in W. North Atlantic.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:

NMFS (2009) *Loggerhead Sea Turtle 2009 Status Review Under the U.S. Endangered Species Act*
NMFS (2009) *Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle – Second Revision*
NMFS (2007) *Loggerhead Sea Turtle 5-Year Review*

3.1.B(3)(a) Loggerhead Sea Turtle Critical Habitat

Thirty-six management units, encompassing up to five critical habitats, have been identified by NMFS and USFWS for the loggerhead sea turtle within the Northwest Atlantic DPS. Management units with critical habitat located within or overlapping the *Green Zone* are described in paragraph 3.1.B(3)(b).

Before introducing the applicable management units, the five types of critical habitat are introduced and described in accordance with 79 FR 39856:

1) **Migratory.** Constricted migratory habitat are high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side. The majority of neritic stage loggerhead migratory tracks are on the continental shelf and are also associated with near-land contact by the Gulf Stream.

2) **Winter.** Winter habitat is warm water habitat south of Cape Hatteras, North Carolina near the western edge of the Gulf Stream used by a high concentration of juveniles and adults during the winter months where water temperatures are above 10° C from November through April, continental shelf waters are in proximity to the western boundary of the Gulf Stream, and water depths are between 20 and 100 m.

3) **Nearshore Reproductive.** Nearshore reproductive habitat is a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season. These nearshore waters are directly off the highest density nesting beaches and their adjacent beaches, as identified in 50 CFR 17.95(c), to 1.6 km offshore. The waters are sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and waters with minimal manmade structures that could promote predators, disrupt wave patterns necessary for orientation, and/or create excessive longshore currents. These habitats are identified as high-density nesting beaches by USFWS as well as beaches adjacent to the high-density nesting beaches that can serve as expansion areas.

4) **Breeding.** Breeding habitats are sites with high densities of both male and female adult individuals during the breeding season, are close to primary Florida migratory corridor, and are close to Florida nesting grounds. These areas likely represent important locations for breeding activities and the propagation of the species. There is no distinct boundary for these concentrated breeding sites; "core" areas are designated where data indicate adult males congregate to gain access to receptive females.

5) ***Sargassum*.** Loggerhead *Sargassum* habitat is developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum*. Based upon the best available data on the distribution of *Sargassum* in the Gulf of Mexico, it is apparent that the western Gulf contains the most predictable and abundant *Sargassum* habitat, and in the eastern Gulf (western Florida shelf) *Sargassum* concentrations are lower, more dispersed and transient. In the Atlantic, the highest *Sargassum* production has been found in the Gulf Stream, the lowest on the shelf, and intermediate in the Sargasso Sea (outside of the U.S. EEZ), with *Sargassum* contributing about 0.5% of the total primary production in the area, but nearly 60% of the total in the upper 1 m (3 ft) of the water column. Turtles observed in the Atlantic have been found near the western wall of the Gulf

Stream and its associated frontal boundaries. Turtles may rarely occupy continental shelf waters and may rarely move westward of the Gulf Stream boundary. Turtles may move east of the Gulf Stream boundary in association with mesoscale eddies, and east into the Sargasso Sea. In the Atlantic, has the greatest biomass occurring off the southeastern U.S. coast after July, roughly coinciding with peak hatchling production in the southeastern United States. The physical forces that aggregate *Sargassum* also aggregate pollutants and debris, making this habitat especially vulnerable.

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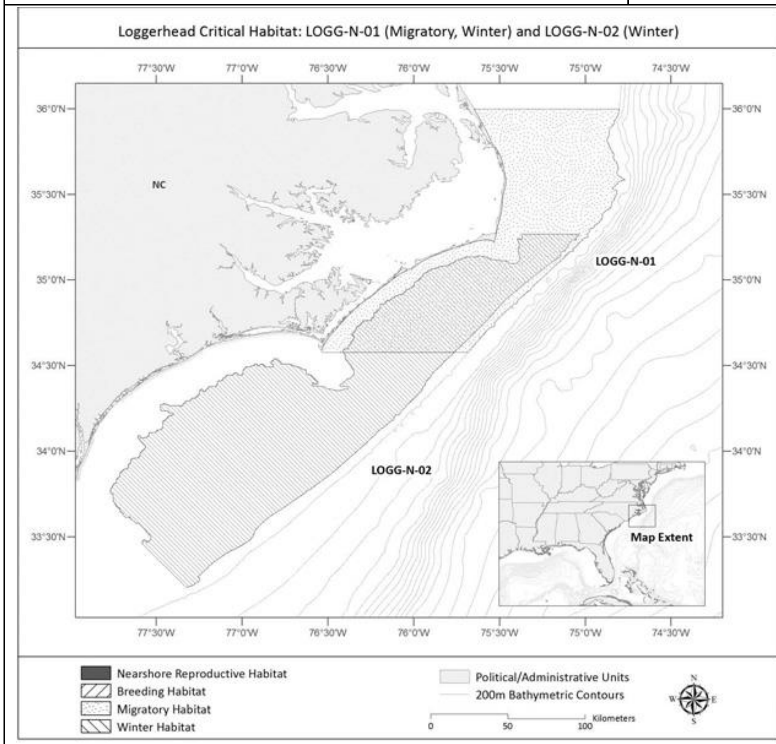
3.1.B(3)(b) Loggerhead Sea Turtle Management Units with Critical Habitat existing or overlapping within the *Green Zone*

3.1.B(3)(b)(i) N-01 (Migratory), N-02 (Winter)	**Status:**	**Final – 2014**
	Critical Habitat:	79 FR 39856



Description: The North Carolina Constricted Migratory Corridor and Northern Portion of the North Carolina Winter Concentration Area (N-01) unit contains constricted migratory and winter habitat. The unit includes the North Carolina constricted migratory corridor and the overlapping northern half of the North Carolina winter concentration area. The constricted migratory corridor consists of waters between 36° N and Cape Lookout (approximately 34.58° N) from the edge of the Outer Banks barrier islands, NC to the 200 m (656 ft) depth contour. The constricted migratory corridor overlaps with the northern portion of winter concentration area off North Carolina. The western and eastern boundaries of winter habitat are the 20 m and 100 m (65.6 and 328 ft) depth contours, respectively. The northern boundary of winter habitat includes waters between the 20 and 100 m (65.6 and 328 ft) depth contours between Cape Lookout to Cape Fear. The eastern and western boundaries of winter habitat are the 20 m and 100 m (65.6 and 328 ft) depth contours, respectively. The northern boundary is Cape Lookout (approximately 34.58° N).

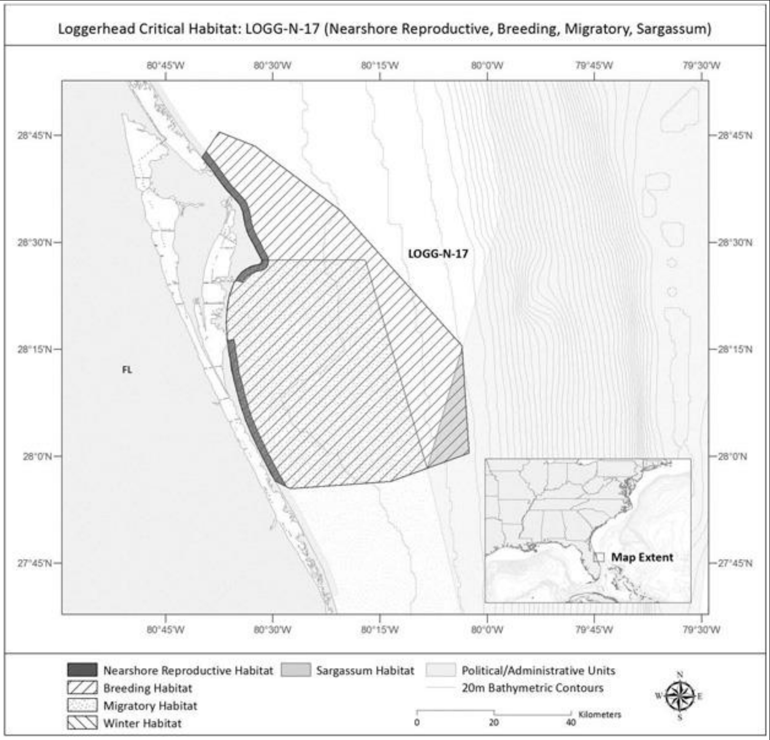
Additional Information pertaining to Important Physical and Biological Features: The constricted migratory corridor off North Carolina serves as a concentrated migratory pathway for loggerheads transiting to neritic foraging areas in the north, and back to winter, foraging, and/or nesting areas in the south. The majority of loggerheads pass through this migratory corridor in the spring (April to June) and fall (September to November), but loggerheads are also present in this area from April through November and, given variations in water temperatures and individual turtle migration patterns, these time periods are variable. Winter habitat is warm water habitat south of Cape Hatteras, North Carolina near the western edge of the Gulf Stream used by a high concentration of juveniles and adults during the winter months where water temperatures are above 10° C from November through April, continental shelf waters are in proximity to the western boundary of the Gulf Stream, and water depths are between 20 and 100 m.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
							X

NMFS (2013) *Biological Report on the Designation of Marine Critical habitat for the Loggerhead Sea Turtle*

3.1.B(3)(b)(ii) N-17 (Nearshore Productive, Breeding, Migratory, *Sargassum*)	**Status:**	**Final – 2014**
	Critical Habitat	79 FR 39856



Description: Titusville to Floridana Beach Concentrated Breeding Area, Northern Portion of the Florida Constricted Migratory Corridor, Nearshore Reproductive Habitat from 28.70° N, 80.66° W near Titusville to Cape Canaveral Air Force Station; and Nearshore Reproductive Habitat from Patrick Airforce Base and Central Brevard Beaches, Brevard County, Florida (N-17) unit includes overlapping areas of nearshore reproductive habitat, constricted migratory habitat, breeding habitat, and *Sargassum* habitat. The concentrated breeding habitat area is from the MHW line on shore at 28.70° N, 80.66° W near Titusville to depths less than 60 m and extending south to Floridana Beach. This overlaps with waters in the northern portion of the Florida constricted migratory corridor, which begins at the tip of Cape Canaveral Air Force Station (28.46°N)and ends at Floridana beach, including waters from the MHW line on shore to the 30 m depth contour. Additionally, the above two habitat areas overlap with two nearshore reproductive habitat areas. The first begins near Titusville at 28.70° N, 80.66° W to the south boundary of the Cape Canaveral Air Force Station/Canaveral Barge Canal Inlet from the MHW line seaward 1.6 km. The second begins at Patrick Air Force Base, Brevard County, through the central Brevard Beaches to Floridana Beach from the MHW line seaward 1.6 km.

Additional Information pertaining to Important Physical and Biological Features:
The constricted migratory corridor in Florida stretches from the westernmost edge of the Marquesas Keys (82.17° W. long.) to the tip of Cape Canaveral (28.46° N. lat.). The northern border stretches from shore to the 30 m depth contour. The seaward border then stretches from the northeastern-most corner to the intersection of the 200 m depth contour and 27° N. lat. parallel. The seaward border then follows the 200 m depth contour to the westernmost edge at the Marquesas Keys. Adult male and female turtles use this corridor to move from foraging sites to the nesting beach or breeding sites from March to May, and then use this corridor to move from the nesting beach or breeding sites to foraging sites from August to October, while juveniles and adults use it to move south during fall migrations to warmer waters.

Two units of breeding critical habitat have been noted as containing large densities of reproductively active male and female loggerheads in the spring, prior to the nesting season. The first is contained within the Southern Florida migration corridor from the shore out to the 200 m (656 ft) depth contour along the stretch of the corridor between the Marquesas Keys and the Martin County/Palm Beach County line. The second area identified as a concentrated breeding site is located in the nearshore waters just south of Cape Canaveral, Florida.

Potential Range by Area Committee Area of Operation

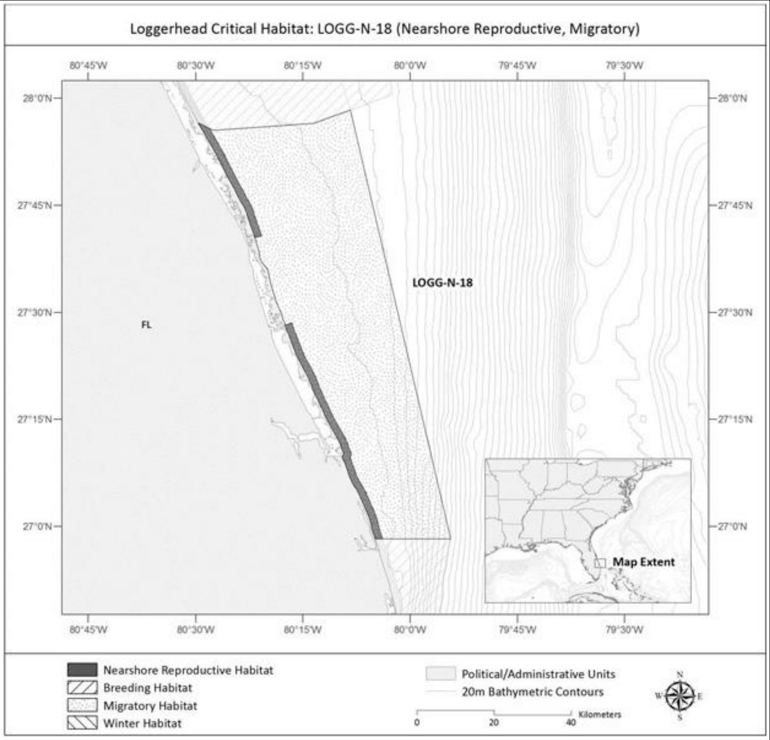
MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
			X	X			

NMFS (2013) *Biological Report on the Designation of Marine Critical habitat for the Loggerhead Sea Turtle*

3.1.B(3)(b)(iii) N-18 (Nearshore Productive, Migratory)

Status: **Final - 2014**

Critical Habitat 79 FR 39856



Description: Florida Constricted Migratory Corridor from Floridana Beach to Martin County/Palm Beach County Line; Nearshore Reproductive Habitat from Floridana Beach to the south end of Indian River Shores; Nearshore Reproductive Habitat from Fort Pierce inlet to Martin County/Palm Beach County Line, Brevard, Indian River and Martin Counties, Florida (N-18) unit contains nearshore reproductive habitat and constricted migratory habitat. The unit contains a portion of the Florida constricted migratory corridor, which is located in the nearshore waters from the MHW line to the 30 m depth contour off Floridana Beach to the Martin County/Palm Beach County line. This overlaps with two nearshore reproductive habitat areas. The first nearshore reproductive area includes nearshore areas from Floridana Beach to the south end of Indian River Shores (crossing Sebastian Inlet) from the MHW line seaward 1.6 km. The second nearshore reproductive habitat area includes nearshore areas from Fort Pierce inlet to Martin County/Palm Beach County line (crossing St. Lucie Inlet) from the MHW line seaward 1.6 km.

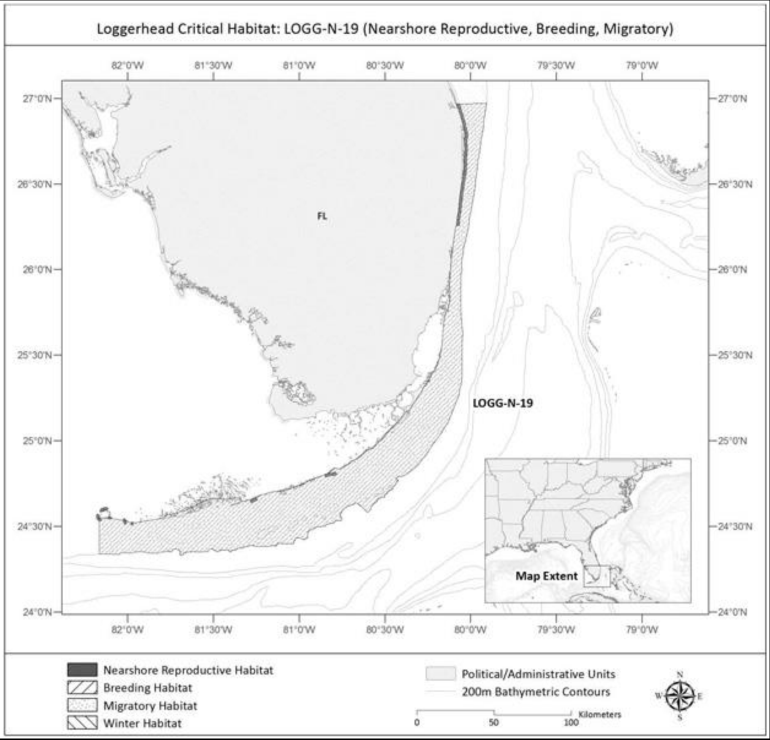
Additional Information pertaining to Important Physical and Biological Features:
The constricted migratory corridor in Florida stretches from the westernmost edge of the Marquesas Keys (82.17° W. long.) to the tip of Cape Canaveral (28.46° N. lat.). The northern border stretches from shore to the 30 m depth contour. The seaward border then stretches from the northeastern-most corner to the intersection of the 200 m depth contour and 27° N. lat. parallel. The seaward border then follows the 200 m depth contour to the westernmost edge at the Marquesas Keys. Adult male and female turtles use this corridor to move from foraging sites to the nesting beach or breeding sites from March to May, and then use this corridor to move from the nesting beach or breeding sites to foraging sites from August to October, while juveniles and adults use it to move south during fall migrations to warmer waters.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
			X	X			

NMFS (2013) *Biological Report on the Designation of Marine Critical habitat for the Loggerhead Sea Turtle*

3.1.B(3)(b)(iv) N-19 (Nearshore Productive, Breeding, Migratory)	Status:	Final – 2014
	Critical Habitat	**79 FR 39856**



Description: Southern Florida Constricted Migratory Corridor; Southern Florida Concentrated Breeding Area; and Six Nearshore Reproductive Areas, Florida (N-19) unit contains nearshore reproductive habitat, constricted migratory habitat, and breeding habitat. The unit contains the southern Florida constricted migratory corridor habitat, overlapping southern Florida breeding habitat, and overlapping nearshore reproductive habitat. The southern portion of the Florida concentrated breeding area and the southern Florida constricted migratory corridor are both located in the nearshore waters starting at the Martin County/Palm Beach County line to the westernmost edge of the Marquesas Keys (82.17° W), with the exception of the waters under the jurisdiction of Naval Air Station Key West. The seaward border then follows the 200 m depth contour to the westernmost edge at the Marquesas Keys.

Additional Information pertaining to Important Physical and Biological Features:
The constricted migratory corridor in Florida stretches from the westernmost edge of the Marquesas Keys (82.17° W. long.) to the tip of Cape Canaveral (28.46° N. lat.). The northern border stretches from shore to the 30 m depth contour. The seaward border then stretches from the northeastern-most corner to the intersection of the 200 m depth contour and 27° N. lat. parallel. The seaward border then follows the 200 m depth contour to the westernmost edge at the Marquesas Keys. Adult male and female turtles use this corridor to move from foraging sites to the nesting beach or breeding sites from March to May, and then use this corridor to move from the nesting beach or breeding sites to foraging sites from August to October, while juveniles and adults use it to move south during fall migrations to warmer waters.

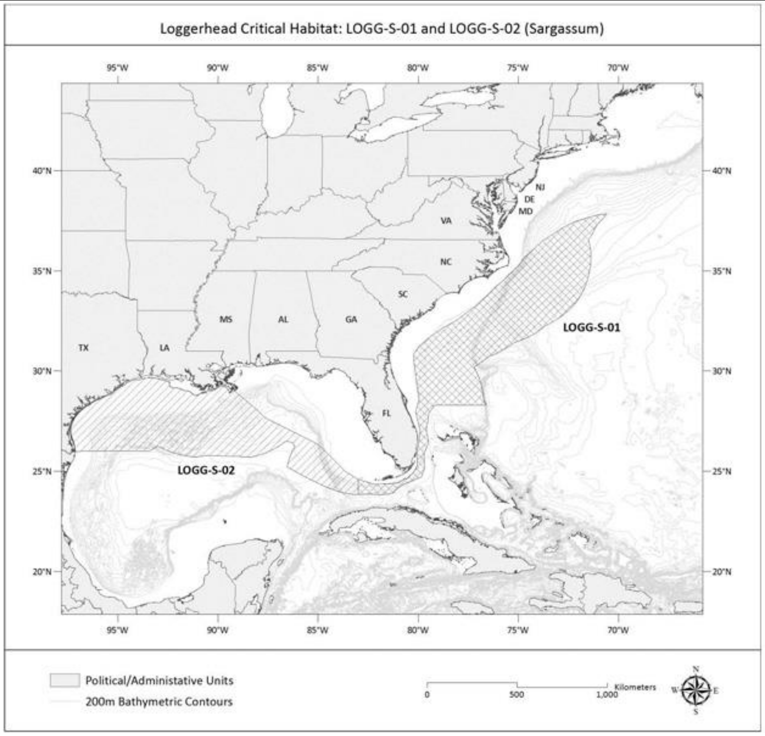
Two units of breeding critical habitat have been noted as containing large densities of reproductively active male and female loggerheads in the spring, prior to the nesting season. The first is contained within the Southern Florida migration corridor from the shore out to the 200 m (656 ft) depth contour along the stretch of the corridor between the Marquesas Keys and the Martin County/Palm Beach County line. The second area identified as a concentrated breeding site is located in the nearshore waters just south of Cape Canaveral, Florida.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
		X	X				

NMFS (2013) *Biological Report on the Designation of Marine Critical habitat for the Loggerhead Sea Turtle*

3.1.B(3)(b)(v) S-01 (*Sargassum*), S-02 (*Sargassum*)	**Status:**	**Final - 2014**
	Critical Habitat	79 FR 39856



Description: *Atlantic Ocean Sargassum (S-01)* unit contains *Sargassum* habitat and overlaps with breeding habitat (LOGG-N-17). The western edge of the unit is the Gulf of Mexico-Atlantic border (83° W). The outer boundary of the unit is the U.S. EEZ, starting at the Gulf of Mexico-Atlantic border and proceeding east and north until the EEZ coincides with the Gulf Stream at. The inner boundary of the unit starts at the Gulf of Mexico-Atlantic border to the outer edge of the breeding/migratory critical habitat (LOGG-N-19) along the outer edge of the corridor (following the 200 m depth contour) until it coincides with the breeding habitat off of Cape Canaveral (LOGG-N-17), and from there roughly following the velocity of 0.401-0.50 m/second until it coincides with the outer edge of the EEZ. *Gulf of Mexico Sargassum (S-02)* unit also contains *Sargassum* habitat only. The northern and western boundaries of the unit follow the 10 m depth contour starting at the mouth of South Pass of the Mississippi River proceeding west and south to the outer boundary of the U.S. EEZ. The southern boundary of the unit is the U.S. EEZ from the 10 m depth contour off of Texas to the Gulf of Mexico-Atlantic border (83° W). The eastern boundary follows the 10 m depth contour from the mouth of South Pass of the Mississippi River, in a straight line to the northernmost boundary of the Loop Current and along the eastern edge of the Loop Current to the Gulf of Mexico-Atlantic border.

Additional Information pertaining to Important Physical and Biological Features:
In the Gulf of Mexico, high concentrations of *Sargassum* were found in the northwest from March to June. *Sargassum* then spreads eastward into the central and eastern Gulf of Mexico, and then into the Atlantic starting in about July. *Sargassum* was found in a widespread area of the Atlantic Ocean east of Cape Hatteras in July, spreading further north and east by September. Observations from 2003 to 2007 suggest that *Sargassum* has a lifespan of approximately 1 year or less, and that the northwest Gulf of Mexico is a major nursery area. In the Atlantic, the highest *Sargassum* production has been found in the Gulf Stream, the lowest on the shelf, and intermediate in the Sargasso Sea (outside of the U.S. EEZ), with *Sargassum* contributing about 0.5 percent of the total primary production in the area, but nearly 60 percent of the total in the upper 1 m (3 ft) of the water column. The designation of *Sargassum* critical habitat will help conserve loggerhead sea turtles by protecting essential forage, cover and transport habitat for post-hatchlings and early juveniles.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

NMFS (2013) *Biological Report on the Designation of Marine Critical habitat for the Loggerhead Sea Turtle*

3.1.B(4) Leatherback Sea Turtle

Status | **Endangered (1970)** | 35 FR 8491

Scientific Name *Dermochelys coriacea* | **Critical Habitat** N/A

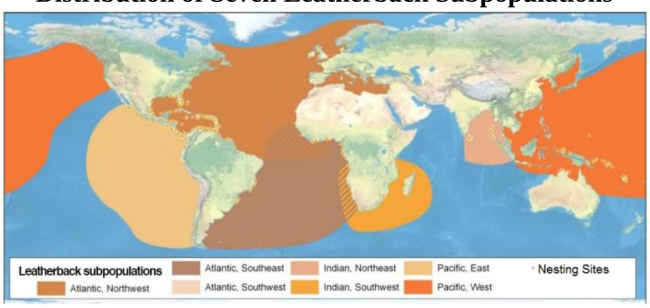
Photo: R. Tapilatu

Appearance: The leatherback is the largest turtle in the world. A leatherback's top shell is about 1.5 in thick and consists of leathery, oil-saturated connective tissue overlaying loosely interlocking dermal bones. Their carapace has seven longitudinal ridges, tapering to a blunt point. Their front flippers don't have claws or scales and are proportionally longer than in other sea turtles; back flippers are paddle-shaped.

Diet: Leatherbacks feed on soft-bodied animals, such as pelagic medusae (jellyfish), siphonophores, and salpae in temperate and boreal latitudes. Aerial surveys document leatherbacks in Virginia waters, especially May to July during peak jellyfish abundance. Further south, foraging on the cabbage head jellyfish has been observed in waters off North Carolina. Observers documented leatherbacks feeding on “jellyballs” (*Stomolophus*) in Georgia waters and notes that the turtles are seen in waters as shallow as 15 ft where jellyballs are abundant. In the Gulf of Mexico, aerial survey data often show leatherbacks associated with *Stomolophus*. Other observers have also reported a “co-incidence” of leatherbacks and maximum jellyfish abundance, especially Aurelia, in the Gulf.

Population: In the Caribbean, Atlantic and Gulf of Mexico, leatherback populations are generally increasing. The Atlantic coast of Florida is one of the main nesting areas, where nesting beach data from 1989-2014 indicate that the number of nests at core index nesting beaches ranged from 27 to 641 in 2014.

Distribution of Seven Leatherback Subpopulations



http://www.nmfs.noaa.gov/pr/species/turtles/images/leatherbacks_global_distribution_wallaceetal2013.jpg

Current Threats:
- Harvest of eggs and turtles themselves
- Incidental capture in fishing gear, such as gillnets, longlines, trawls, traps/pots, and dredges
- General threats to marine turtles

Distribution/Habitat/Migration: Leatherbacks have the widest global distribution of all reptile species, distributed worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. Leatherbacks are known as pelagic animals, but they also forage in coastal waters. Thermoregulatory adaptations such as a counter-current heat exchange system, high oil content, and large body size allow them to maintain a core body temperature higher than the surrounding water, allowing them to tolerate colder water temperatures. Leatherbacks are the most migratory and wide ranging of sea turtle species. Leatherbacks mate in waters adjacent to nesting beaches and along migratory corridors. The largest nesting population at present in the western Atlantic is in French Guiana. Within the U.S., there are minor nesting colonies in the Caribbean, Puerto Rico, U.S. Virgin Islands, and Southeast Florida. After nesting, female leatherbacks migrate from tropical waters to more temperate latitudes, which support high densities of jellyfish prey in the summer. The distribution and developmental habitats of juvenile leatherbacks are poorly understood. In an analysis of available sighting, researchers found that leatherback turtles smaller than about 3 ft carapace length were only sighted in waters about 79°F (26°C) or warmer, while adults were found in waters as cold as 32-59°F (0-15°C) off Newfoundland.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:

NMFS (2013) *Leatherback Sea Turtle 5-Year Review*
NMFS (2016) *Species in the Spotlight – Priority Actions: 2016-2020 – Pacific Leatherback Turtle*
NMFS (1991) Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico

3.1.B(5) Hawksbill Sea Turtle	Status	Endangered (1970)	35 FR 8491
Scientific Name *Eretmochelys imbricata*		**Critical Habitat** N/A	

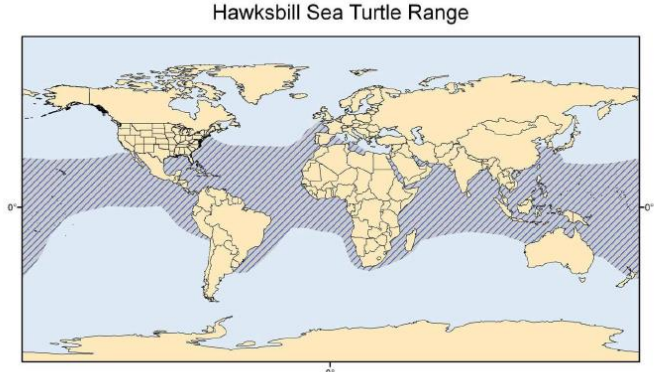
Photo: Karen Salvini

Appearance: The hawksbill turtle is small to medium-sized compared to other sea turtle species. Their head is elongated and tapers to a point, with a beak-like mouth. The top of its shell is dark to golden brown, with streaks of orange, red, and/or black with a serrated back and overlapping "scutes", while the bottom shell is clear yellow. Hawksbill turtles are unique among sea turtles in that they have two pairs of prefrontal scales on the top of the head, each flipper usually has two claws.

Diet: Sponges and other invertebrates, algae, eggs of pelagic fish, and pelagic species of fish, but also has been found to consume various floating debris. Although a wide variety of benthic organisms have been recorded from digestive tracts, sponges are the principal diet of hawksbills once they enter shallow coastal waters and begin feeding on the bottom. Quantitative studies have focused on the Caribbean, but there is evidence that spongivory is a worldwide feeding habit. A high degree of feeding selectivity is indicated by the consumption of a limited number of sponge species. The hawksbill's highly specific diet, and its dependence on filter-feeding, hard-bottom communities make it vulnerable to deteriorating conditions on coral reefs.

Population: Within the continental U.S., nesting is restricted to the southeast coast of Florida and the Florida Keys, but nesting is rare in these areas. Hawksbills are solitary nesters and, thus, determining population trends or estimates on nesting beaches is difficult. The largest populations of hawksbills are found in the Caribbean, the Republic of Seychelles, Indonesia, and Australia.

Hawksbill Sea Turtle Range



http://www.nmfs.noaa.gov/pr/pdfs/rangemaps/hawksbill_turtle.pdf

Current Threats:

- Habitat loss of coral reef communities
- Harvest of their eggs and meat
- Commercial exploitation (historically, but still permitted in some parts of the world
- Increased recreational and commercial use of nesting beaches in the Pacific
- Incidental capture in fishing gear
- General threats to marine turtles

Distribution/Habitat/Migration: Hawksbill turtles are circumtropical, usually occurring from 30°N to 30°S latitude in the Atlantic, Pacific, and Indian Oceans and associated bodies of water. In the continental U.S., hawksbills are found primarily in Florida and Texas, though they have been recorded in all the Gulf States and along the east coast as far north as Massachusetts. Post-hatchlings are believed to occupy the "pelagic" environment, taking shelter in floating algal mats and drift lines of flotsam and jetsam in the Atlantic. Small juveniles recruit to coastal foraging grounds; their size at recruitment is approximately 8-10 in in carapace length in the Atlantic. The ledges and caves of coral reefs provide shelter for resting hawksbills both during the day and at night. Hawksbills are also found around rocky outcrops and high energy shoals, which are also optimum sites for sponge growth. They are also known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent. Adult hawksbill turtles are capable of migrating long distances between nesting beaches and foraging areas. In the Atlantic, a female hawksbill tagged at Buck Island Reef National Monument in the U.S. Virgin Islands traveled 1,160 mi to the Miskito Cays in Nicaragua.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:

NMFS (2013) *Hawksbill Sea Turtle 5-Year Review*

NMFS (1993) *Recovery Plan for the Hawksbill Turtle in the U.S. Carribean, Atlantic and Gulf of Mexico*

3.1.C. Fish

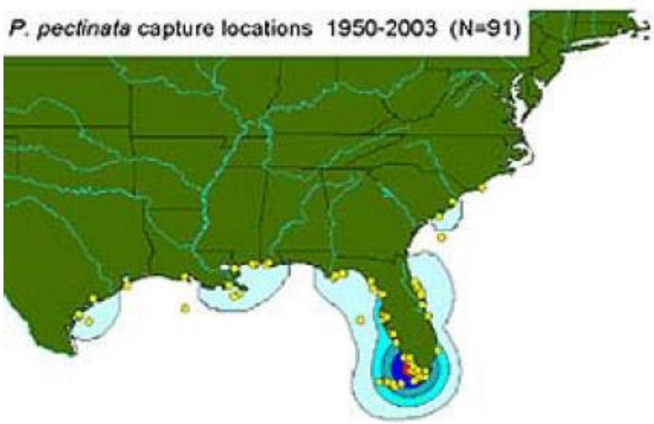
3.1.C(1) Smalltooth Sawfish U.S. DPS	Status	Endangered (2003)	68 FR 15674
Scientific Name *Pristis pectinata*		**Critical Habitat**	74 FR 45353 (2009)

Photo: Florida Fish and Wildlife Conservation Commission

Appearance: Sawfish are actually modified rays with a shark-like body and gill slits on their ventral side. Sawfish get their name from their "saws"--long, flat snouts edged with pairs of teeth which are used to locate, stun, and kill prey. They have 25-29 teeth per side. Males have broader teeth than females. The body of the smalltooth sawfish is an olive grey color dorsally, with a white ventral surface.

Diet: Sawfish subsist chiefly on small schooling fish, such as mullets and clupeids. They feed to some extent on crustaceans and other bottom dwelling inhabitants. Prey are abundant throughout yellow and *Green Zone*s of the Gulf of Mexico and Atlantic. Sawfish attack prey by slashing sideways through schools, and often impale the fish on their rostral teeth which are subsequently scraped off by rubbing them on the bottom and then ingested whole.

Population: No accurate estimates of abundance trends over time are available, but available data indicate that the population has declined by about 95%. Smalltooth sawfish were once common throughout their historic range, but they have declined in U.S. waters over the last century. No robust estimates of population size exist.



http://www.fisheries.noaa.gov/pr/pdfs/recovery/smalltoothsawfish.pdf

Current Threats:

- Bycatch in various fisheries, especially in gill nets
- Loss of juvenile habitat

Distribution/Habitat/Migration: In the U.S., smalltooth sawfish are primarily found in the peninsula of Florida, common only in the Everglades region at the southern tip of the state. Historically, however, they have ranged as far north as New Jersey in the Eastern U.S., and throughout the Gulf of Mexico. Smalltooth sawfish inhabit shallow coastal waters of tropical seas and estuaries throughout the world. They are usually found in shallow waters (less than 32 ft [10 m]), very close to shore over muddy and sandy bottoms. They are often found in sheltered bays, on shallow banks, and in estuaries or river mouths. They prefer warmer water temperature of 22-28°C (71-82°F). They are known to ascend inland in river systems and have been shown to have a salinity preference of 18-24 parts per thousand. Although smalltooth sawfish will more likely be found in shallow water of the *Yellow Zone*, occurrence beyond the 30-foot isobath into the *Green Zone* is possible. The long, toothed rostrum of the sawfish and feeding on schooling fish makes it particularly vulnerable to bycatch.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:

NMFS (2010) *Smalltooth Sawfish 5-Year Review*
NMFS (2009) *Smalltooth Sawfish Recovery Plan*

3.1.C(1)(a) Smalltooth Sawfish U.S. DPS Critical Habitat

The smalltooth sawfish U.S. DPS has two critical habitats designated by the NMFS, the Charlotte Harbor Estuary unit and the Ten Thousand Islands/Everglades unit. Both critical habitats are nearshore, and do not appear within or overlapping the *Green Zone*. The physical and biological features essential to the conservation of the U.S. DPS of smalltooth sawfish, which provide nursery area functions are: red mangroves and shallow euryhaline habitats characterized by water depths between the Mean High Water line and 3 ft (0.9 m) measured at Mean Lower Low Water.

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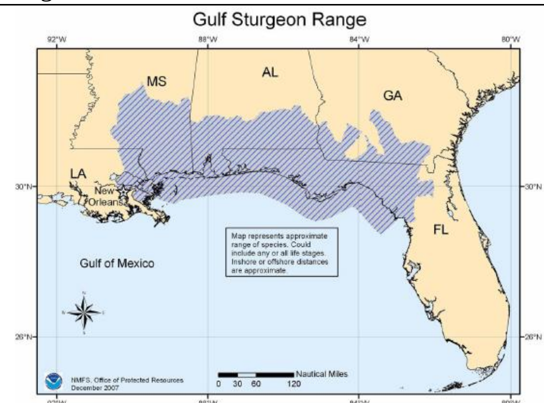
3.1.C(2) Gulf Sturgeon[48]	**Status**	Threatened (1991)	56 FR 49653
Scientific Name *Acipenser oxyrinchus desotoi*		**Critical Habitat**	68 FR 13370 (2003)

Photo: U.S. Geological Survey

Appearance: Sturgeon are primitive fish characterized by bony plates, or "scutes," and a hard, extended snout; they have a "heterocercal" caudal fin--their tail is distinctly asymmetrical with the upper lobe longer than the lower. Adults range from 4-8 ft length, females attain larger sizes than males. They can live for up to 60 years, but average about 20-25 years.

Diet: Gulf sturgeon are bottom feeders and prey primarily on macroinvertebrates, including brachiopods, mollusks, worms, and crustaceans. Gulf sturgeon may also eat aquatic plants. Available food species for Gulf sturgeon are abundant throughout the northern Gulf of Mexico continental shelf and occur well outside of the *Yellow Zone*. Subadult and adult Gulf sturgeon feed for three to four months in a marine environment and migrate to fresh water in the spring where they do not feed for eight or nine months.

Population: The total number of adult Gulf sturgeon is unknown. However, over 15,000 adults are estimated in the seven coastal rivers of the Gulf of Mexico. Of those rivers, over 9,000 are estimated in the Suwannee River (GA-FL), the most viable subpopulation; about 3,000 mature Gulf sturgeon are estimated in the Choctawhatchee River (AL-FL); and about 400 on average are estimated for each of the other rivers: Pearl, Pascaguola, Escambia, Yellow, and Apalachicola.



http://www.nmfs.noaa.gov/pr/pdfs/rangemaps/gulfsturgeon.pdf

Current Threats:

- Construction of water control structures, such as dams and "sills", mostly after 1950, exacerbated habitat loss
- Dredging
- Groundwater extraction
- Irrigation
- Flow alterations
- Poor water quality
- Contaminants, primarily from industrial sources
- Overfishing (historically)

Distribution/Habitat/Migration: Gulf sturgeon are found in river systems from Louisiana and Florida, in nearshore bays and estuaries, and in the Gulf of Mexico. Riverine habitats, where the healthiest populations of Gulf sturgeon are found, include long, spring-fed, free-flowing rivers, typically with steep banks, a hard bottom, and an average water temperature of 60-72° F. All foraging occurs in brackish or marine waters of the Gulf of Mexico and its estuaries; sturgeon do not forage in riverine habitat. Gulf sturgeon are anadromous: adults spawn in freshwater and migrate into marine waters to forage and over winter. Gulf sturgeon initiate movement up to the rivers between February and April and migrate back to the Gulf of Mexico between September and November. Juvenile Gulf sturgeon stay in the river for about the first 2-3 years. Gulf sturgeon are most likely to occur within the northern Gulf of Mexico *Yellow Zone* in fall, winter and early spring months, and may be found at 30 nm, or more, from shore.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X						

Additional References:

NMFS (2009) *Gulf Sturgeon 5-Year Review*
NMFS (1995) *Gulf Sturgeon Recovery / Management Plan*

[48] ***NMFS and USFWS share jurisdiction of this species.***

3.1.C(2)(a) Gulf Sturgeon Critical Habitat

The listed Gulf sturgeon species is jointly managed by NMFS (for species located in coastal waters) and the USFWS (for species located in the inland waters). Critical habitat of the Gulf sturgeon is also jointly managed by NMFS and the USFWS. NMFS manages the Gulf sturgeon's critical habitat in the coastal waters between the mouths of rivers and streams, and the waters in and around the Gulf coast barrier islands. The USFWS manages the Gulf sturgeon's critical habitat found within the inland river systems.

For the purposes of this assessment, only the Gulf sturgeon critical habitats managed by NMFS are listed in this section. Presently, none of the NOAA managed Gulf sturgeon critical habitats are located within the *Green Zone*. Outside of the *Green Zone*, there are seven critical habitats of the Gulf sturgeon under the management of NMFS which are located in the coastal waters of Region 4.

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3.1.C(3) Scalloped Hammerhead, Central & Southwest Atlantic DPS[49]	Status	Threatened (2014)	79 FR 38213

Scientific Name	*Sphyrna lewini*	Critical Habitat	80 FR 71774 (2015)

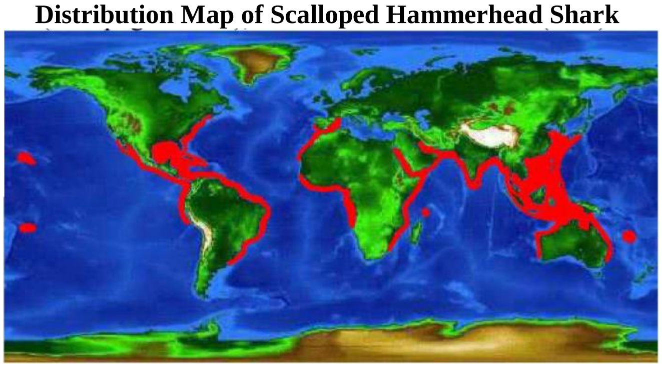
Photo: NOAA

Appearance: Scalloped hammerhead sharks are moderately large sharks characterized by the flat, extended head or "cephalofoil." The cephalofoil of a scalloped hammerhead shark is characterized by an indentation located centrally on the front head and two more indentations on either side of the central indentation.

Diet: The scalloped hammerhead shark is a high trophic level predator and opportunistic feeder with a diet that includes a wide variety of teleosts, cephalopods, crustaceans, and rays. Juveniles may increase foraging nocturnally. Available prey species are abundant in both shallow and deepwater throughout the yellow and *Green Zone*s.

Population: A 2009 stock assessment found that the northwestern Atlantic population has decreased from about 155,500 in 1981 to about 26,500 individuals in 2005.

Distribution Map of Scalloped Hammerhead Shark



http://www.fisheries.noaa.gov/pr/pdfs/statusreviews/scallopedhammerheadshark2014.pdf

Current Threats:
- Targeted fisheries, shark fin trade
- Bycatch

Distribution/Habitat/Migration: The scalloped hammerhead shark is a coastal pelagic species found worldwide in coastal warm temperate and tropical seas between 46°N and 36°S to depths of 1,000 m. This species can also be found in ocean waters and occurs over continental and insular shelves and adjacent to deeper water. It has been observed close inshore and even entering estuarine habitats, as well as offshore to depths of 1,000 m. Scalloped hammerhead may occur in the *Yellow Zone* and within approximately 1/3 of the *Green Zone* over the continental shelf. Adult aggregations are common at seamounts, but otherwise, [as it pertains to Region IV] adults can be solitary or occur in pairs.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:

NMFS (2014) *Status Review Report: Scalloped hammerhead Shark*

CITES (2013) *Consideration of Proposals for Amendment of Appendices I and II*

[49] The scalloped hammerhead shark was initially petitioned for listing in 2011, however only 4 distinct population segments have been designated as either threatened or endangered. Due to its adjacency to Region IV, the scalloped hammerhead of the Central & Southwest Atlantic DPS is considered in this assessment. For operational purposes, best practices determined in this assessment shall be applied across all Region IV in consideration of both the scalloped hammerhead species of the Central & Southwest Atlantic and Northwest Atlantic & Gulf of Mexico DPSs.

3.1.C(4) Atlantic Sturgeon, South Atlantic DPS

3.1.C(4) Atlantic Sturgeon, South Atlantic DPS	**Status**	**Endangered (2012)**	77 FR 5914

Scientific Name	*Acipenser oxyrinchus oxyrinchus*	**Critical Habitat**	N/A

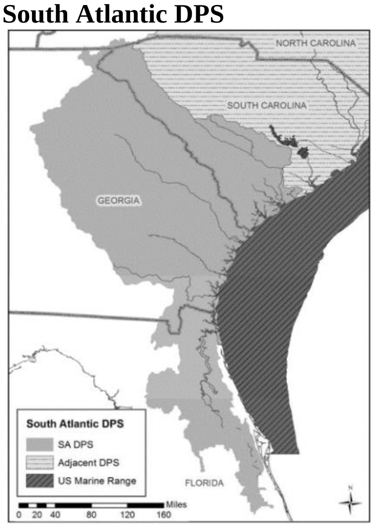
Photo: Robert Michelson

Appearance: The Atlantic sturgeon is a long-lived, estuarine dependent, anadromous fish that can grow to approximately 14 ft long and can weigh up to 800 lb. They are bluish-black or olive brown dorsally, with paler sides and a white belly. Atlantic sturgeon are similar in appearance to shortnose sturgeon, but can be distinguished by their large size, smaller mouth, different snout shape, and scutes.

Diet: Atlantic sturgeon are omnivorous benthic (bottom) feeders and filter quantities of mud along with their food. Adult sturgeon diets include mollusks, gastropods, amphipods, isopods, and fish. Juvenile sturgeon feed on aquatic insects and other invertebrates. Available food species for Atlantic sturgeon are abundant throughout the Atlantic continental shelf and occur well outside of the *Yellow Zone*.

Population: The Altamaha River, Georgia, spawning population, which is believed to be the largest in the Southeast, is at approximately 6% of its historic level (currently estimated at 343 adult spawning females annually). The remaining riverine spawning populations in the South Atlantic DPS are estimated to be at less than 1% of their historic numbers (currently estimated at less than 300 adult spawning females annually).

South Atlantic DPS



http://www.nmfs.noaa.gov/pr/pdfs/fr/fr77-5914.pdf

Current Threats:
- Ship Strikes
- Habitat degradation & impediments (damming, dredging)
- Accidental catch
- Injury or death by fishing activities
- Water quality (temperature, velocity, depth, dissolved oxygen, pollutants) from agricultural runoff, silviculture, industrialization, and transfer of water between river basins for commercial and residential uses
- Climate Change impacts to existing water quality and quantity
- Introduction of non-indigenous sturgeon pathogens

Distribution/Habitat/Migration: Atlantic sturgeon are currently present in 32 U.S rivers; spawning occurs in at least 20. Atlantic sturgeon are "anadromous"; adults spawn in freshwater in the spring and early summer and migrate into "estuarine" and marine waters where they spend most of their lives. In some southern rivers a fall spawning migration may also occur. They spawn in moderately flowing water in deep parts of large rivers. Juveniles usually reside in estuarine waters for months to years. Subadults and adults live in coastal waters and estuaries when not spawning, generally in shallow (10-50 m depth) nearshore areas dominated by gravel and sand substrates. Long distance migrations away from spawning rivers are common. Atlantic sturgeon in marine waters generally remain in shallow depths under 20 m which exceeds the *Yellow Zone* boundary and reaches midway along the continental shelf through the *Green Zone*.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
			X	X	X	X	X

Additional References:
NMFS (2007) *Status Review of Atlantic Sturgeon*

3.1.C(5) Atlantic Sturgeon, Carolina DPS	**Status**	**Endangered (2012)**	77 FR 5914

Scientific Name	*Acipenser oxyrinchus oxyrinchus*	**Critical Habitat**	N/A

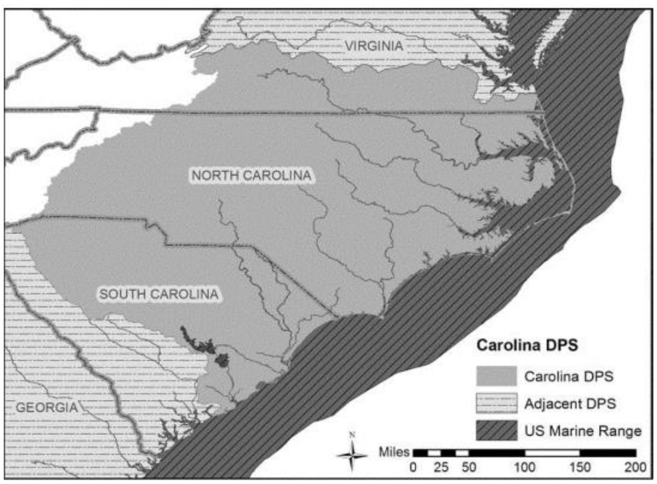
Photo: Robert Michelson

Appearance: The Atlantic sturgeon is a long-lived, estuarine dependent, anadromous fish that can grow to approximately 14 ft long and can weigh up to 800 lb. They are bluish-black or olive brown dorsally, with paler sides and a white belly. Atlantic sturgeon are similar in appearance to shortnose sturgeon, but can be distinguished by their large size, smaller mouth, different snout shape, and scutes.

Diet: Atlantic sturgeon are omnivorous benthic (bottom) feeders and filter quantities of mud along with their food. Adult sturgeon diets include mollusks, gastropods, amphipods, isopods, and fish. Juvenile sturgeon feed on aquatic insects and other invertebrates. Available food species for Atlantic sturgeon are abundant throughout the Atlantic continental shelf and occur well outside of the *Yellow Zone*.

Population: Numbers of Atlantic sturgeon in the Carolina DPS are extremely low compared to historic levels. The riverine spawning populations in the Carolina DPS are estimated at less than 3% of their historic levels (currently less than 300 spawning adult females annually).

Carolina DPS



http://www.nmfs.noaa.gov/pr/pdfs/fr/fr77-5914.pdf

Current Threats:
- Ship strikes
- Habitat degradation, dams, dredging
- Incidental catch from fisheries
- Injury or death by fishing activities
- Water quality (temperature, velocity, depth, dissolved oxygen, pollutants) from agricultural runoff, silviculture, industrialization, and transfer of water between river basins for commercial and residential uses
- Climate Change impacts to existing water quality and quantity
- Introduction of non-indigenous sturgeon pathogens

Distribution/Habitat/Migration: Atlantic sturgeon are currently present in 32 U.S rivers; spawning occurs in at least 20. Atlantic sturgeon are "anadromous"; adults spawn in freshwater in the spring and early summer and migrate into "estuarine" and marine waters where they spend most of their lives. In some southern rivers a fall spawning migration may also occur. They spawn in moderately flowing water in deep parts of large rivers. Juveniles usually reside in estuarine waters for months to years. Subadults and adults live in coastal waters and estuaries when not spawning, generally in shallow (10-50 m depth) nearshore areas dominated by gravel and sand substrates. Long distance migrations away from spawning rivers are common. Atlantic sturgeon in marine waters generally remain in shallow depths under 20 m which exceeds the *Yellow Zone* boundary and reaches midway along the continental shelf through the *Green Zone*.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
					X	X	X

Additional References:

NMFS (2007) *Status Review of Atlantic Sturgeon*

3.1.C(6) Shortnose Sturgeon

3.1.C(6) Shortnose Sturgeon	Status	Endangered (1967)	32 FR 4001
Scientific Name	*Acipenser brevirostrum*	**Critical Habitat**	N/A

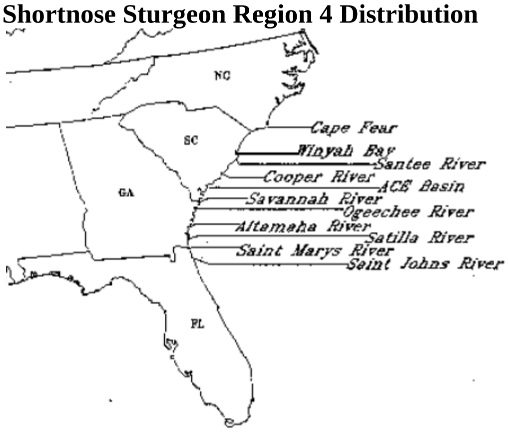
Photo: UMaine

Appearance: The shortnose sturgeon is the smallest of the three sturgeon species that occur in eastern North America; they grow up to 4.7 ft (1.4 m) and weigh up to 50.7 lb (23 kg). Their body surface contains five rows of bony plates, or "scutes."

Diet: Shortnose sturgeon are benthic omnivores but have also been observed feeding off plant surfaces. Shortnose sturgeon are continuous feeders and eat crustaceans, insect larvae, worms, and mollusks. However, they apparently undergo ontogenetic shifts in preferred foods; insect larvae and small crustaceans predominate in juvenile diet; adults feed primarily on small mollusks. Juveniles may randomly vacuum the bottom; adults are more selective feeders. Adult shortnose sturgeon may also only switch to other prey when preferred foods are unavailable. Available food species for Shortnose sturgeon are abundant throughout the Atlantic continental shelf and occur well outside of the *Yellow Zone*.

Population: No estimate of the historical population size of shortnose sturgeon is available. While the shortnose sturgeon was rarely the target of a commercial fishery, it often was taken incidentally in the commercial fishery for Atlantic sturgeon. In the 1950s, sturgeon fisheries declined on the east coast, which resulted in a lack of records of shortnose sturgeon. This led the USFWS to conclude that the fish had been eliminated from the rivers in its historic range (except the Hudson River) and was in danger of extinction because of pollution and overfishing, both directly and incidentally.

Shortnose Sturgeon Region 4 Distribution



http://www.nmfs.noaa.gov/pr/pdfs/recovery/sturgeon_shortnose.pdf

Current Threats:

- Construction of dams, mainly during the period of industrial growth (late 1800s-early 1900s) may have resulted in substantial loss of suitable habitat
- Pollution of many large northeastern river systems
- Habitat alterations from discharges
- Dredging or disposal of material into rivers
- Related development activities involving Estuarine/ riverine mudflats and marshes
- Commercial exploitation (historically)

Distribution/Habitat/Migration: Shortnose sturgeon occur in most major river systems along the U.S. eastern seaboard. In the southern portion of the range, they are found in the: St. Johns River in FL; Altamaha, Ogeechee, and Savannah Rivers in GA; and in South Carolina, the river systems that empty into Winyah Bay and the Santee/ Cooper River complex that forms Lake Marion. Data are lacking for the rivers of North Carolina. They are "anadromous" fish; they spawn in the coastal rivers along the east coast of North America from the St. John River in Canada to the St. Johns River, FL. They prefer the nearshore marine, estuarine, and riverine habitat of large river systems. Shortnose sturgeon, unlike other anadromous species in the region such as shad or salmon, do not appear to make long distance offshore migrations. Shortnose sturgeon feeding patterns vary seasonally. In southern river systems, females may fast prior to summer spawning but males may continue to feed. Shortnose sturgeon are most likely to occur within the Atlantic *Yellow Zone* in fall, winter and early spring months; these parameters are not exclusive and it remains possible that Shortnose sturgeon can be found in the *Green Zone*.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
			X	X	X	X	X

Additional References:

NMFS (1998) *Final Recovery Plan for the Shortnose Sturgeon*
NMFS (2010) *Biological Assessment of Shortnose Sturgeon*

3.1.C(7) Nassau grouper	Status	Proposed for Listing	79 FR 51929

Scientific Name	*Epinephelus striatus*	Critical Habitat	N/A

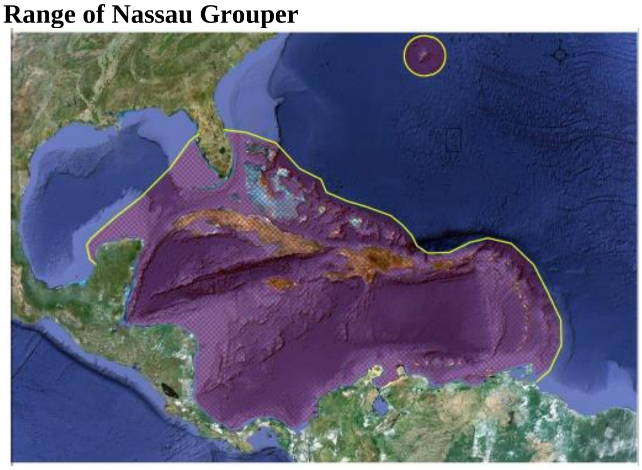
Photo: C. Dahlgren

Appearance: The Nassau grouper is a moderate sized fish with large eyes and a robust body. The range of color is wide, but ground color is generally buff, with 5 dark brown vertical bars and a large black saddle blotch on top of caudal peduncle and a row of black spots below and behind eye.

Diet: Adult Nassau grouper are unspecialized, bottom-dwelling, ambush-suction predators, its diet primarily consisting of eating small fish (piscivorous). Young Nassau grouper feed on a variety of plankton, including pteropods, amphipods, and copepods. Available prey species are abundant throughout the yellow and *Green Zone*s.

Population: The Nassau grouper was formerly one of the most common and important commercial groupers in the insular tropical western Atlantic and Caribbean. Declines in landings and catch per unit of effort have been reported throughout its range, and it is now considered to be commercially extinct in a number of areas, including Puerto Rico. Information on past and present abundance and density, at coral reefs and aggregation sites, is based on a combination of anecdotal accounts, visual census surveys, and fisheries data.

Range of Nassau Grouper



http://www.fisheries.noaa.gov/pr/species/documents/nassau_bioassessrpt_final.pdf

Current Threats:

- Spawning aggregation fishing
- Historical harvest
- Lack of law enforcement to enforce existing U.S. and foreign regulations
- Growth rate/productivity
- Spatial structure/connectivity
- Habitat alteration
- Aquaculture
- Disease, parasites, abnormalities

Distribution/Habitat/Migration: The Nassau grouper's distribution currently includes Bermuda and Florida (USA), throughout the Bahamas and Caribbean Sea. Many earlier reports of Nassau grouper up the Atlantic coast to North Carolina have not been confirmed. The Nassau grouper is primarily a shallow-water, insular fish species; and is considered a reef fish, but it transitions through a series of developmental shifts in habitat. As larvae, they are planktonic. Larvae recruit from an oceanic environment into demersal habitats. Following settlement, Nassau grouper juveniles are reported to inhabit macroalgae (primarily *Laurencia* spp.), coral clumps (*Porites* spp.), and seagrass beds. Nassau grouper are most likely to be found year round in shallow waters within the Atlantic *Yellow Zone* of South Florida including sensitive ecosystems which have been classified as *Yellow Zone* areas (even if outside state jurisdiction and the 30-foot isobath). However, Nassau grouper may be found within the *Green Zone* during transitions between these habitats.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
		X	X	X	X	X	X

Additional References:

NMFS (2013) *Nassau Grouper Biological Report*

WildEarth Guardians (2010) *Petition to List the Goliagh Grouper, Nassau Groupder, and Speckled Hind Under the U.S. Endangered Species Act*

3.1.D. Corals

3.1.D(1) Elkhorn Coral	Status	Threatened (2006)	71 FR 26852
Scientific Name	*Acropora palmata*	**Critical Habitat**	73 FR 72210 (2008)

Photo: NOAA Florida Keys National Sanctuary

Appearance: Elkhorn coral is a large, branching coral with thick and sturdy antler-like branches. Their shape resembles elk antlers ("elk horn"). Their branches can grow to over 6.5 ft (2 m).

Diet: Corals may be carnivorous, capturing small prey that become trapped on their mucus-covered surfaces or entangled by specialized stinging cells on the tentacles. They absorb dissolved organic materials from surrounding waters and also produce their own food. Tiny, single-celled algae called zooxanthellae live within the coral cells and generate energy-rich compounds through photosynthesis. This "food" is translocated to the coral host, providing the majority of its energy and carbon requirements. The key to the ecological success of reef-building corals, this symbiotic relationship requires adequate, but not excessive, sunlight for the algae to be productive through photosynthesis.

Population: In areas where loss has been quantified, estimates are in the range of 90-95% reduction in abundance since 1980. Reductions (around 75-90%) were recently observed in some areas such as the Florida Keys in 1998 due to bleaching and hurricane damage.

http://www.nmfs.noaa.gov/pr/images/rangemaps/acropora.jpg

Current Threats:
- Disease, such as white band disease
- Hurricanes
- Predation
- Bleaching
- Algae overgrowth
- Sedimentation
- Temperature and salinity variation
- Low genetic diversity

Distribution/Habitat/Migration: Elkhorn coral was formerly the dominant species in shallow water (3-16 ft deep) throughout the Caribbean and on the Florida Reef Tract, forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Elkhorn coral is found on coral reefs in southern Florida, the Bahamas, and throughout the Caribbean. Its northern limit is Biscayne National Park, Florida, and it extends south to Venezuela, though it is not found in Bermuda. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 ft, although isolated corals may occur to depths of 65 ft. The dominant mode of reproduction for elkhorn coral is asexual, with new colonies forming when branches break off of a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites) and will typically release millions of "gametes". The coral larvae (planula) live in the plankton for several days until finding a suitable area to settle, but very few larvae survive to settle and metamorphose into new colonies. The asexual reproduction in this species raises the possibility that genetic diversity may be very low in the remnant populations. Colonies are fast growing: branches increase in length by 2-4 in per year, with colonies reaching their maximum size in approximately 10-12 years. Over the last 10,000 years, elkhorn coral has been one of the three most important Caribbean corals contributing to reef growth and development and providing essential fish habitat.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
		X	X				

Additional References:
NMFS (2005) *Atlantic Acropora Status Review*
NMFS (2015) *Recovery Plan – Elkhorn Coral, and Staghorn Coral*

3.1.D(1)(a) Elkhorn Coral Species Critical Habitat

NMFS identified four "specific areas" within the geographical area occupied by the elkhorn and staghorn coral species at the time of listing that contain their essential features, one of which is located within the Region IV area of responsibility, the Florida Critical Habitat Area. The Florida Critical Habitat Area of the elkhorn and staghorn coral species exists both inside (offshore) and outside (nearshore) of the *Green Zone*, and is described in section 3.1.D(1)(b).

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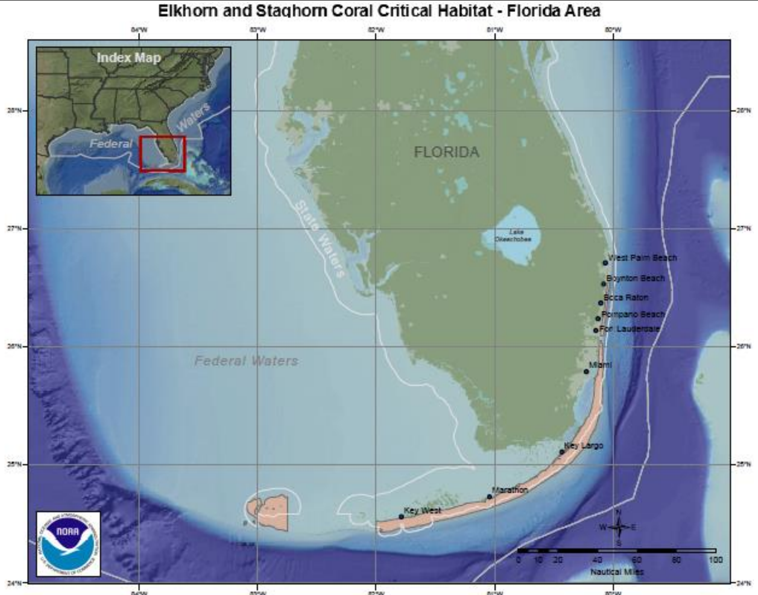
3.1.D(1)(b) Elkhorn Coral Species Critical Habitat existing within or overlapping the *Green Zone*

3.1.D(1)(b)(i) Acropora Area 1	**Status:**	**Final - 2008**
	Critical Habitat	73 FR 72210

Elkhorn and Staghorn Coral Critical Habitat - Florida Area



http://sero.nmfs.noaa.gov/maps_gis_data/protected_resources/critical_habitat/images/acropora_florida_critical_habitat.pdf

Description:
The Florida Critical Habitat Area comprises all waters in the depths of 98 ft (30 m) and shallower to: (1) the 6-ft (1.8 m) contour from Boynton Inlet, Palm Beach County, to Government Cut, Miami-Dade County; and the mean low water (MLW) line from Government Cut south to 82° W longitude in Monroe Counties; and the MLW line surrounding the Dry Tortugas, FL.

Important Physical and Biological Features: NMFS identified the following physical or biological feature of elkhorn and staghorn coral habitat essential to their conservation (essential feature): substrate of suitable quality and availability to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. "Substrate of suitable quality and availability" is defined as natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover. This feature is essential to the conservation of these two species due to the extremely limited recruitment currently being observed. Note: Natural sites covered with loose sediment, fleshy or turf macroalgal covered hard substrate, or seagrasses do not provide the essential feature for elkhorn and staghorn corals.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
		X	X				

3.1.D(2) Staghorn Coral	Status	Threatened (2006)	71 FR 26852
Scientific Name	*Acropora cervicornis*	**Critical Habitat**	73 FR72210 (2008)

Photo: NOAA Florida Keys National Marine Sanctuary

Appearance: Staghorn coral is a coral with cylindrical branches. Their shape resembles male deer antlers ("stag horn"); and their branches can grow to over 6.5 ft (2 m).

Diet: Corals may be carnivorous, capturing small prey that become trapped on their mucus-covered surfaces or entangled by specialized stinging cells on the tentacles. They absorb dissolved organic materials from surrounding waters and also produce their own food. Tiny, single-celled algae called zooxanthellae live within the coral cells and generate energy-rich compounds through photosynthesis. This “food” is translocated to the coral host, providing the majority of its energy and carbon requirements. The key to the ecological success of reef-building corals, this symbiotic relationship requires adequate, but not excessive, sunlight for the algae to be productive through photosynthesis.

Population: Since 1980, populations have collapsed throughout their range from various threats. Populations have declined by up to 98% throughout their range, and localized "extirpations" have occurred.

http://www.nmfs.noaa.gov/pr/images/rangemaps/acropora.jpg

Current Threats:

- Disease, such as white band disease, is their biggest source of mortality
- Hurricanes
- Predation
- Bleaching
- Algae overgrowth
- Sedimentation
- Temperature and salinity variation
- Asexual reproduction, allows rapid population recovery from physical disturbances such as storms, but makes recovery from disease or bleaching difficult
- Low genetic diversity

Distribution/Habitat/Migration: Staghorn coral is found throughout the Florida Keys, the Bahamas, the Caribbean islands, and Venezuela. The northern limit of staghorn coral is around Boca Raton, FL. Staghorn coral occur in back reef and fore reef environments from 0-100 ft (0 to 30 m) deep. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. The dominant mode of reproduction for staghorn coral is asexual fragmentation, with new colonies forming when branches break off a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites) and will release millions of "gametes". The coral larvae (planula) live in the plankton for several days until finding a suitable area to settle, but very few larvae survive to settle and metamorphose into new colonies. This coral exhibits the fastest growth of all known western Atlantic corals, with branches increasing in length by 4-8 in (10-20 cm) per year. Staghorn coral has been one of the three most important Caribbean corals in terms of its contribution to reef growth and fish habitat.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
		X	X				

Additional References:

NMFS (2015) *Recovery Plan, Elkhorn Coral and Staghorn Coral*
NMFS (2005) *Atlantic Acropora Status Review*

3.1.D(2)(a) Staghorn Coral Species Critical Habitat

Same as 3.1.D(1)(a).

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3.1.D(3) Rough Cactus Coral	Status	Threatened (2014)	79 FR 53852

Scientific Name	*Mycetophyllia ferox*	Critical Habitat	N/A

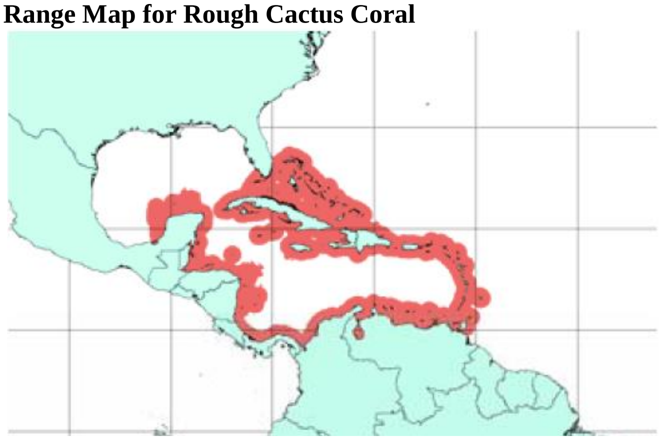
Photo: C. Sheppard

Appearance: Mycetophyllia ferox forms a thin, encrusting plate that is weakly attached. Mycetophyllia ferox is taxonomically distinct. Maximum colony size is 50 cm.

Diet: Corals may be carnivorous, capturing small prey that become trapped on their mucus-covered surfaces or entangled by specialized stinging cells on the tentacles. They absorb dissolved organic materials from surrounding waters and also produce their own food. Tiny, single-celled algae called zooxanthellae live within the coral cells and generate energy-rich compounds through photosynthesis. This "food" is translocated to the coral host, providing the majority of its energy and carbon requirements. The key to the ecological success of reef-building corals, this symbiotic relationship requires adequate, but not excessive, sunlight for the algae to be productive through photosynthesis.

Population: Mycetophyllia ferox is usually uncommon or rare, constituting less than 0.1% of all coral species at generally <1% of the benthic cover. Density of M. ferox in southeast Florida and the Florida Keys was approximately 0.8 colonies per 10 m2 between 2005 and 2007. There is indication that the species was much more abundant in the upper Florida Keys in the 1970s. In a survey of 97 stations in the Florida Keys, M. ferox declined in occurrence from 20 stations in 1996 to four stations in 2009. At 21 stations in the Dry Tortugas, M. ferox declined in occurrence from eight stations in 2004 to three stations in 2009.

Range Map for Rough Cactus Coral



http://www.nmfs.noaa.gov/pr/pdfs/species/coral_petition_cbd.pdf

Current Threats:

- Ocean warming
- Ocean acidification
- Dredging
- Coastal development
- Coastal point source pollution
- Agricultural and land use practices
- Disease
- Predation
- Reef fishing
- Aquarium trade
- Physical damage from boats and anchors
- Marine debris
- Aquatic invasive species

Distribution/Habitat/Migration: Mycetophyllia ferox occurs in the western Atlantic and throughout the wider Caribbean. It has been reported in reef environments in water depths of 5 to 90 m, including shallow and mesophotic habitats. The species has the potential to exhibit recovery, because of its reproductive strategy (e.g., brooding with moderate recruitment success). M. ferox is highly vulnerable to disease and nutrient enrichment; and is moderately vulnerable to ocean warming, acidification, trophic effects of fishing, and sedimentation. Geographic distribution in the highly disturbed Caribbean exacerbates vulnerability to extinction because M. ferox is limited to an area with high, localized human impacts and increasing threats. Its abundance, combined with spatial variability in ocean warming and acidification across the species' range, moderates vulnerability because the threats are non-uniform, and there will likely be a large number of colonies that are either not exposed or do not negatively respond to a threat at any given point in time.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
	X	X	X	X			

Additional References

NMFS (2011) *NOAA Technocal Memorandum NMFS-PIFSC-27: Status Review Report of 82 Candidate Coral Species Petitioned Under the U.S. Endangered Species Act*

WildEarth Guardians (2013) *Petition to List Eighty-One Marine Species Under the Endangered Species Act*

3.1.D(4) Mountainous Star Coral	Status	Threatened (2014)	79 FR 53852

Scientific Name	*Orbicella faveolata*	Critical Habitat	N/A

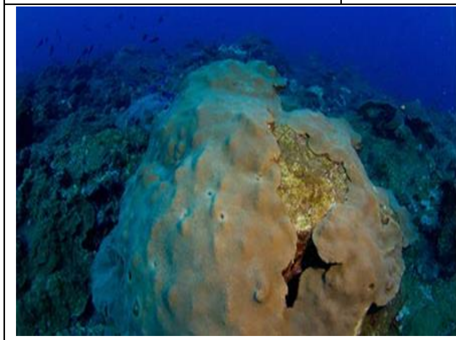


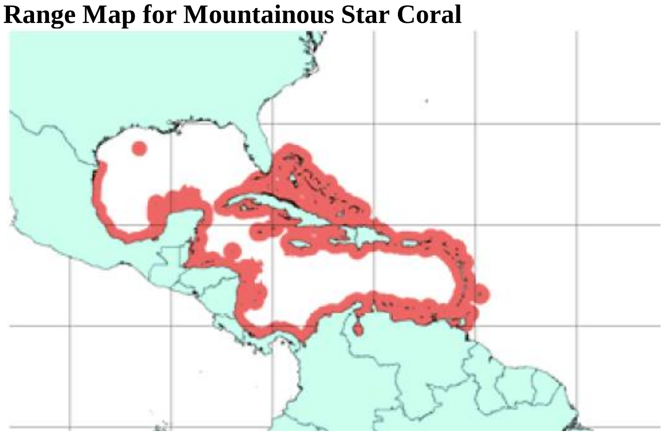
Photo: NOAA

Appearance: *Orbicella faveolata* grows in heads or sheets, the surface of which may be smooth or have keels or bumps. The skeleton is much less dense than in the other two *Orbicella* species. Colony diameter can reach up to 10 m with a height of 4 to 5 m.

Diet: Corals may be carnivorous, capturing small prey that become trapped on their mucus-covered surfaces or entangled by specialized stinging cells on the tentacles. They absorb dissolved organic materials from surrounding waters and also produce their own food. Tiny, single-celled algae called zooxanthellae live within the coral cells and generate energy-rich compounds through photosynthesis. This "food" is translocated to the coral host, providing the majority of its energy and carbon requirements. The key to the ecological success of reef-building corals, this symbiotic relationship requires adequate, but not excessive, sunlight for the algae to be productive through photosynthesis.

Population: Orbicella faveolata is a common species throughout the greater Caribbean. Based on population estimates, there are at least tens of millions of colonies present in each of several locations including the Florida Keys, Dry Tortugas, and the U.S. Virgin Islands. Population decline has occurred over the past few decades with a 65% loss in O. faveolata cover across five countries. Decline in the Florida Keys between the late 1970s and 2003 was approximately 80 to 95%.

Range Map for Mountainous Star Coral



http://www.nmfs.noaa.gov/pr/pdfs/species/coral_petition_cbd.pdf

Current Threats:

- Ocean warming
- Ocean acidification
- Dredging
- Coastal development
- Coastal point source pollution
- Agricultural and land use practices
- Disease
- Predation
- Reef fishing
- Aquarium trade
- Physical damage from boats and anchors
- Marine debris
- Aquatic invasive species

Distribution/Habitat/Migration: *Orbicella faveolata* occurs in the western Atlantic and throughout the Caribbean, including Bahamas, Flower Garden Banks, and the entire Caribbean coastline. The depth range of *O. faveolata* has been reported as 0.5 to 40 m and up to 90 m. *Orbicella* species have slow growth rates, late reproductive maturity, and low recruitment rates. Colonies can grow very large and live for centuries. *O. faveolata* is negatively impacted by increasing carbon dioxide and lower pH conditions and is highly susceptible to disease. Despite high declines, the species is still common and remains one of the most abundant species on Caribbean reefs. Geographic distribution in the highly disturbed Caribbean exacerbates vulnerability to extinction over the foreseeable future because *O. faveolata* is limited to an area with high, localized human impacts and predicted increasing threats.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
	X	X	X	X			

Additional References

NMFS (2011) *NOAA Technocal Memorandum NMFS-PIFSC-27: Status Review Report of 82 Candidate Coral Species Petitioned Under the U.S. Endangered Species Act*

WildEarth Guardians (2013) *Petition to List Eighty-One Marine Species Under the Endangered Species Act*

3.1.D(5) Pillar Coral

Status | **Threatened (2014)** | 79 FR 53852

Scientific Name *Dendrogyra cylindrus* | **Critical Habitat** N/A

Photo: Cindy Lewis

Appearance: Pillar coral grows in water 3 to 75 ft deep. It forms cylindrical columns on top of encrusting bases. The colony may appear "furry" if the tentacles are out. *Dendrogyra cylindrus* forms cylindrical columns on top of encrusting bases. Colonies are generally grey-brown in color and may reach three meters in height. Tentacles remain extended during the day, giving columns a furry appearance.

Diet: Feeding rates are low relative to most other Caribbean corals, indicating *D. cylindrus* is primarily a tentacle feeder rather than a suspension feeder. However, it has a relatively high photosynthetic rate and stable isotope values suggest it receives substantial amounts of photosynthetic products from its zooxanthellae.

Population: *Dendrogyra cylindrus* is uncommon but conspicuous with scattered, isolated colonies. It is rarely found in aggregations. Between 2005 and 2007, mean density of *D. cylindrus* was approximately 0.5 colonies per 10 m^2 in the Florida Keys and low encounter rates are reported in more than one survey study. The low coral cover of this species renders data difficult to realize trends; therefore, *D. cylindrus* may be naturally uncommon to rare but trends are unknown.

Range Map for Pillar Coral

http://www.nmfs.noaa.gov/pr/pdfs/species/coral_petition_cbd.pdf

Current Threats

- Ocean warming and acidification
- Dredging
- Coastal development
- Coastal point source pollution
- Agricultural and land use practices
- Disease
- Predation
- Reef fishing
- Aquarium trade
- Physical damage from boats and anchors
- Marine debris
- Aquatic invasive species

Distribution/Habitat/Migration: *Dendrogyra cylindrus* is present in the western Atlantic and throughout the greater Caribbean and inhabits most reef environments in depths from 1-25 m but is most common between 5-15 m. *D. cylindrus* is a gonochoric (separate sexes) broadcast spawning species with relatively low annual egg production for its size. *Dendrogyra cylindrus* can propagate by fragmentation following storms or other physical disturbance. Average growth rates of 1.8 to 2.0 cm per year in linear extension have been reported in the Florida Keys. Partial mortality rates are size-specific with larger colonies having greater rates. Spawning observations have been made several nights after the full moon of August in the Florida Keys. *D. cylindrus* also appears to be sensitive to cold temperatures.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
	X	X	X	X			

Additional References

NMFS (2011) *NOAA Technocal Memorandum NMFS-PIFSC-27: Status Review Report of 82 Candidate Coral Species Petitioned Under the U.S. Endangered Species Act*
WildEarth Guardians (2013) *Petition to List Eighty-One Marine Species Under the Endangered Species Act*

3.1.D(6) Lobed Star Coral	Status	Threatened (2014)	79 FR 53852
Scientific Name *Orbicella annularis*		**Critical Habitat** N/A	

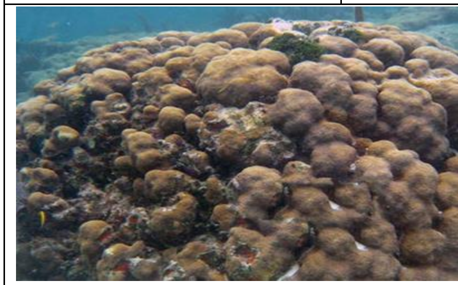


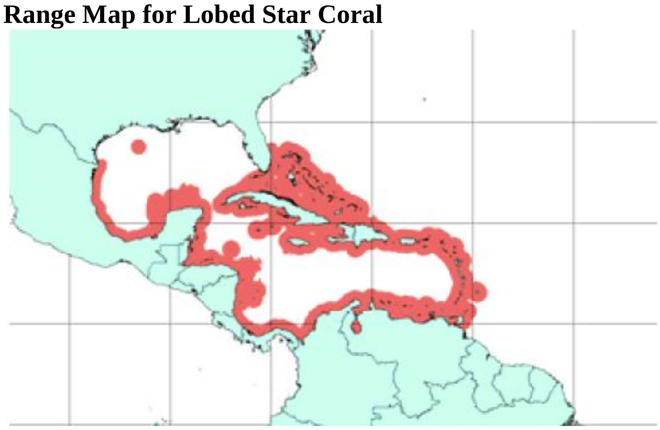
Photo: NOAA

Appearance: Lobed star coral grows in lobes, and the surface does not have ridges or bumps.

Diet: Corals may be carnivorous, capturing small prey that become trapped on their mucus-covered surfaces or entangled by specialized stinging cells on the tentacles. They absorb dissolved organic materials from surrounding waters and also produce their own food. Tiny, single-celled algae called zooxanthellae live within the coral cells and generate energy-rich compounds through photosynthesis. This "food" is translocated to the coral host, providing the majority of its energy and carbon requirements. The key to the ecological success of reef-building corals, this symbiotic relationship requires adequate, but not excessive, sunlight for the algae to be productive through photosynthesis.

Population: *Orbicella annularis* is common throughout the western Atlantic and greater Caribbean including the Flower Garden Banks. Major declines range from 50-95% in locations including Puerto Rico, Belize, the Florida Keys, Mexico, and the U.S. Virgin Islands. In the Florida Keys, abundance of *O. annularis* ranked 30 out of 47 coral species in 2005, 13 out of 43 in 2009, and 12 out of 40 in 2012. Several population projections indicate population decline in the future is likely at specific sites, and local extirpation is possible within 25 to 50 years at conditions of high mortality, low recruitment, and slow growth rates.

Range Map for Lobed Star Coral



http://www.nmfs.noaa.gov/pr/pdfs/species/coral_petition_cbd.pdf

Current Threats

- Ocean warming
- Ocean acidification
- Dredging
- Coastal development
- Coastal point source pollution
- Agricultural and land use practices
- Disease
- Predation
- Reef fishing
- Aquarium trade
- Physical damage from boats and anchors
- Marine debris
- Aquatic invasive species

Distribution/Habitat/Migration: *Orbicella annularis* is dominant on mesophotic reefs in Puerto Rico and the U.S. Virgin Islands at depths of 30 to 45 m, and it is found at depths up to 90 m. *O. annularis* is hermaphroditic broadcast spawner beginning six to eight nights following the full moon in late August through early October. *Orbicella* species have slow growth rates (approximately 1 cm per year, ranging from 0.06 to 1.2 cm per year), late reproductive maturity, and low recruitment rates. Colonies can grow very large and live for centuries. Large colonies have lower total mortality than small colonies, and partial mortality of large colonies can result in the production of ramets. The species complex has highly susceptibility to ocean warming, acidification, disease, sedimentation, and nutrients; some susceptibility to trophic effects of fishing and sea level rise.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
	X	X	X	X			

Additional References

NMFS (2011) *NOAA Technocal Memorandum NMFS-PIFSC-27: Status Review Report of 82 Candidate Coral Species Petitioned Under the U.S. Endangered Species Act*
WildEarth Guardians (2013) *Petition to List Eighty-One Marine Species Under the Endangered Species Act*

3.1.D(7) Boulder Star Coral	Status	Threatened (2014)	79 FR 53852

Scientific Name	*Orbicella franksi*	Critical Habitat	N/A

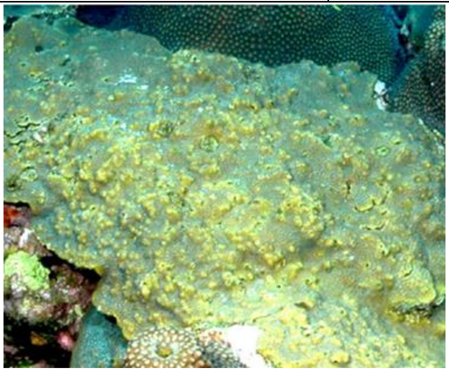


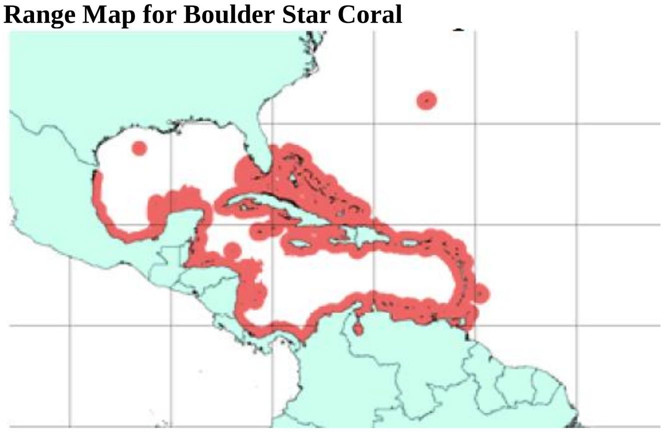
Photo: NOAA

Appearance: Boulder star coral has large, unevenly-arranged polyps that make the surface of the coral look irregular. *Orbicella franksi* is distinguished by large, unevenly arrayed polyps that give the colony its characteristic irregular surface. Colony form is variable, and the skeleton is dense with poorly developed annual bands. Colony diameter can reach up to 5 m with a height of up to 2 m.

Diet: Corals may be carnivorous, capturing small prey that become trapped on their mucus-covered surfaces or entangled by specialized stinging cells on the tentacles. They absorb dissolved organic materials from surrounding waters and also produce their own food. Tiny, single-celled algae called zooxanthellae live within the coral cells and generate energy-rich compounds through photosynthesis. This "food" is translocated to the coral host, providing the majority of its energy and carbon requirements. The key to the ecological success of reef-building corals, this symbiotic relationship requires adequate, but not excessive, sunlight for the algae to be productive through photosynthesis.

Population: There are at least tens of millions of *O. franksi* colonies present in both the Dry Tortugas and U.S. Virgin Islands. The frequency and extent of partial mortality, especially in larger colonies, appear to be high in some locations such as Florida and Cuba. A decrease in *O. franksi* percent cover by 38%, and a shift to smaller colony size across five countries, suggest that population decline has occurred in some areas.

Range Map for Boulder Star Coral



http://www.nmfs.noaa.gov/pr/pdfs/species/coral_petition_cbd.pdf

Current Threats:

- Ocean warming and acidification
- Dredging
- Coastal development
- Coastal point source pollution
- Agricultural and land use practices
- Disease
- Predation
- Reef fishing
- Aquarium trade
- Physical damage from boats and anchors
- Marine debris
- Aquatic invasive species

Distribution/Habitat/Migration: *Orbicella franksi* is distributed in the western Atlantic and throughout the Caribbean Sea including in the Bahamas, Bermuda, and the Flower Garden Banks. *Orbicella franksi* tends to have a deeper distribution (20-30 m) than the other two species in the *Orbicella* species complex. Low tissue biomass can render specific colonies of *O. franksi* susceptible to mortality from stress events, such as bleaching or disease.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
	X	X	X	X			

Additional References

NMFS (2011) *NOAA Technocal Memorandum NMFS-PIFSC-27: Status Review Report of 82 Candidate Coral Species Petitioned Under the U.S. Endangered Species Act*

WildEarth Guardians (2013) *Petition to List Eighty-One Marine Species Under the Endangered Species Act*

3.1.E. Marine Plants

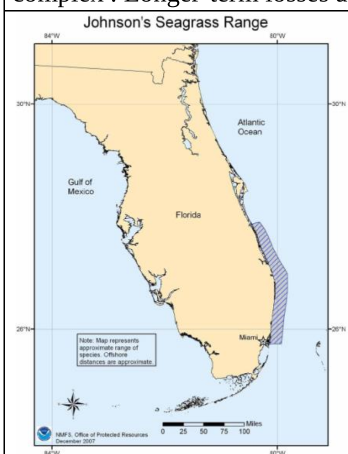
3.1.E(1) Johnson's Seagrass	Status	Threatened (1998)	63 FR 49035
Scientific Name: *Halophila johnsonii*		Critical Habitat	65 FR 17786 (2000)

Photo: Lori Morris

Appearance: Green with pairs of linearly shaped leaves. Identified by its smooth margins, spatulate leaves in pairs, a creeping rhizome a horizontal subterranean plant stem, like the runners on a strawberry plant) with petioles, sessile (attached to their bases) female flowers, and long-necked fruits.

Diet: Salinity, temperature and water quality are addressed in this section to account for the conditions vital to the reproduction and growth. Research suggests that *H. johnsonii* has a wider tolerance of salinity, temperature, and optical water quality conditions than *H. decipiens*. Documented salinity range is 15-43 parts per thousand (ppt) and the species has been observed growing perennially near the mouths of freshwater discharge canals. Observations indicate that Johnson's seagrass grows all year long at its northern range limits where temperatures have dropped below 10°C. Johnson's seagrass does not exhibit photoinhibition at high light intensities, so it is found growing from deeper turbid waters of the interior portion of the Indian River Lagoon up to the intertidal. Johnson's seagrass also grows in clear water associated with the high energy environments and flood deltas inside ocean inlets where tidal velocities approach the threshold of motion for unconsolidated sediments.

Population: Johnson's seagrass is the rarest species of its genus. It has a limited distribution, limited ability to disperse and colonize habitats because of its asexual reproduction, and dependence on substrate stability. Data on the species are rare, though one study found that abundance of all seagrass species is 16% less than in 1986 for the entire Indian River Lagoon complex . Longer-term losses are thought to be approximately 50% for all seagrasses since the 1970s.



http://www.fisheries.noaa.gov/pr/pdfs/rangemaps/johnsonsseagrass.pdf

Current Threats:
- Boating activities, such as: ◦propeller scarring of the substrate
- Anchoring
- Mooring
- Dredging
- Storm action and sedimentation
- Degraded water quality
- Siltation due to human disturbance and land-use practices
- Increase algal growth can degrade water quality and smother

Distribution/Habitat/Migration: Johnson's seagrass prefers to grow in coastal lagoons in the intertidal zone, or deeper than many other seagrasses. It does worse in the intermediate areas where other seagrasses thrive. The species has been found in coarse sand and muddy substrates and in areas of turbid waters and high tidal currents. Johnson's seagrass is more tolerant of salinity, temperature, and desiccation variation than other seagrasses in the area. Johnson's seagrass has a very limited distribution; it is the least abundant seagrass within its range. It has a disjunct and patchy distribution along the east coast of Florida from central Biscayne Bay to Sebastian Inlet. The largest patches have been documented inside Lake Worth Inlet. The southernmost distribution is reported to be in the vicinity of Virginia Key in Biscayne Bay, near Miami.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
			X				

Additional References: NMFS (2007) *Endangered Species Act 5-Year Review Johnson's Seagrass*
NMFS (2002) *Final Recovery Plan for Johnson's Seagrass*

3.1.E(1)(a) Johnson's Seagrass Critical Habitat

Based on best available information, it is not clear whether the distribution of Johnson seagrass extends into the *Green Zone*. Regarding the designation of critical habitat for the Johnson seagrass, there is no critical habitat presently designated within the "*Green Zone*."

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Section 3.2. Species and Designated Critical Habitat under the Jurisdiction of the U.S. Fish and Wildlife Service

The purpose of this section is to highlight the species listed and proposed for listing, and their critical habitat under the Endangered Species Act that have been identified within the preauthorized area (see Section 2.1.B and Section 2.2.B) where potential use of dispersants may occur during a response to an oil spill at the water surface. For each of these listed species, the name (common and scientific), photo identifying the appearance of the species, status, distribution, threats and the particular Area Committee areas of operation that the species could be found. There are no designated critical habitat under the jurisdiction of the USFWS for any of the listed species included in this Biological Assessment.

USFWS will update the Region IV Regional Response Team regarding any new listing, including proposed or candidate, of species as endangered or threatened within the *Green Zone*, and any updates to the current listing of species identified in this section. The Region IV Regional Response Team will confirm the information contained in this section at least annually with the USFWS.

Validation of the information presented for each of the species in this section, as well as additional information, may be found within the USFWS website: http://www.fws.gov/endangered. Additionally, reviewers of this document are encouraged to offer any new information that might not yet be available at the Regional level.

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3.2.A. Sirenia

3.2.A(1) West Indian Manatee	Status	Endangered (1967) Proposed Threatened (2016)	32 FR 4001
Scientific Name	*Trichechus manatus latirostris*	**Critical Habitat**	N/A

Photo: USFWS

Appearance: Most adult manatees are about 10 ft long and weigh 800 to 1,200 lb; they can be larger than 12 ft and as much as 3,500 lb. Manatees have tough, wrinkled brown-to-gray skin.

Diet: Manatees are herbivores. They consume 4-9% of their body weight each day, spending 5 to 8 hours a day eating typically non-native water hyacinths and hydrilla, along with native aquatic plants such as Vallisneria or eelgrass. Manatees may feed by two methods in coastal seagrass beds: (1) rooting, where virtually the entire plant is consumed; and (2) grazing, where exposed grass blades are eaten without disturbing the roots or sediment. Manatees may return to specific seagrass beds to graze on new growth. Shallow grass beds with ready access to deep channels are preferred feeding areas in coastal and riverine habitats. Grass species identified as preferential manatee food sources are found only within the *Yellow Zone*. However, this is based on observed feeding habits and does not preclude the possibility that manatee may occasionally feed on grasses which grow in deeper waters of the *Green Zone*.

Population: The highest count obtained during annual surveys was 3,300 manatees in January 2001 and this is presumed to be a minimum count (the estimated number of mature individuals in the population is 2,310). The fraction detected is unknown and so there are no statistically based estimates of abundance for the entire Florida manatee population. The Florida manatee subspecies is listed as Endangered on the basis of a population size of less than 2,500 mature individuals and the population is estimated to decline by at least 20% over the next two generations (estimated at ~40 years) due to changes in warm-water habitat and threats from watercraft.

Range Map for West Indian Manatee

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A007

Current Threats:

- Collisions with boats
- Loss of warm water habitat
- Habitat Intrusion from operation of flood gates and locks
- Habitat destruction
- Pollution including the ingestion of fishing line and tackle
- Natural events particular cool winter temperatures
- Harmful Algal Blooms (red tide)
- Harassment
- Hunting (historically)

Distribution/Habitat/Migration: The West Indian manatee is found along the coast of Florida and in the Caribbean. The manatee often rests suspended just below the water's surface with only the snout above water. It feeds underwater, but must surface periodically to breathe. Manatees move between freshwater, brackish, and saltwater environments. They prefer large, slow-moving rivers, river mouths, and shallow coastal areas such as coves and bays. The animals may travel great distances as they migrate between winter and summer grounds. During the winter, manatees congregate around warm springs and around industrial water discharges of warm water. Manatees reach breeding maturity between 3 and 10 years of age. Manatees are significantly more likely to be found in shallow waters of the *Yellow Zone* but may be found in the *Green Zone* during transitions between winter and summer grounds.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:
USFWS (2001) *Florida Manatee Recovery Plan, Third Revision*
USFWS (2007) *West Indian Manatee 5-Year Review*

3.2.B. Fish

3.2.B(1) Gulf Sturgeon	Status	Threatened (1991)	56 FR 49653
Scientific Name *Acipenser oxyrinchus desotoi*		**Critical Habitat**	68 FR 13370 (2003)


Photo: U.S. Geological Survey

Appearance: Sturgeon are primitive fish characterized by bony plates, or "scutes," and a hard, extended snout; they have a "heterocercal" caudal fin--their tail is distinctly asymmetrical with the upper lobe longer than the lower. Adults range from 4-8 ft (1-2.5 m) in length, females attain larger sizes than males. They can live for up to 60 years, but average about 20-25 years.

Diet: Gulf sturgeon are bottom feeders and prey primarily on macroinvertebrates, including brachiopods, mollusks, worms, and crustaceans. Gulf sturgeon may also eat aquatic plants. Available food species for Gulf sturgeon are abundant throughout the northern Gulf of Mexico continental shelf and occur well outside of the *Yellow Zone*. Most subadult and adult Gulf sturgeon feed for three to four months in a marine environment and migrate to fresh water in the spring where they do not feed for the following eight or nine months.

Population: The total number of adult Gulf sturgeon is unknown. However, over 15,000 adults are estimated in the seven coastal rivers of the Gulf of Mexico. Of those rivers, over 9,000 are estimated in the Suwannee River (GA-FL), the most viable subpopulation; about 3,000 mature Gulf sturgeon are estimated in the Choctawhatchee River (AL-FL); and about 400 on average are estimated for each of the other rivers: Pearl, Pascaguola, Escambia, Yellow, and Apalachicola.

Range Map for Gulf Sturgeon

http://www.fws.gov/southeast/drought/pdf/SturgeonFactS08.pdf

Current Threats:
- Construction of water control structures, such as dams and "sills", mostly after 1950, exacerbated habitat loss
- Dredging
- Groundwater extraction
- Irrigation
- Flow alterations
- Poor water quality
- Contaminants, primarily from industrial sources
- Overfishing (historically)

Distribution/Habitat/Migration: Gulf sturgeon are found in river systems from Louisiana and Florida, in nearshore bays and estuaries, and in the Gulf of Mexico. Riverine habitats, where the healthiest populations of Gulf sturgeon are found, include long, spring-fed, free-flowing rivers, typically with steep banks, a hard bottom, and an average water temperature of 60-72° F. All foraging occurs in brackish or marine waters of the Gulf of Mexico and its estuaries; sturgeon do not forage in riverine habitat. Gulf sturgeon initiate movement up to the rivers between February and April and migrate back to the Gulf of Mexico between September and November. Gulf sturgeon are anadromous: adults spawn in freshwater and migrate into marine waters in the fall to forage and overwinter. Juvenile Gulf sturgeon stay in the river for about the first 2-3 years. Gulf sturgeon are most likely to occur within the northern Gulf of Mexico *Yellow Zone* in fall, winter and early spring months, but these parameters are not exclusive and the species may be found at 30 nm, or more, from shore.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X						

Additional References: USFWS (1995) *Gulf Sturgeon Recovery / Management Plan*
USFWS (2009) *Gulf Sturgeon 5-Year Review*

3.2.C. Birds

3.2.C(1) Red Knot	Status	Threatened (2014)	79 FR 73705
Scientific Name	*Calidris canutus rufa*	**Critical Habitat**	N/A

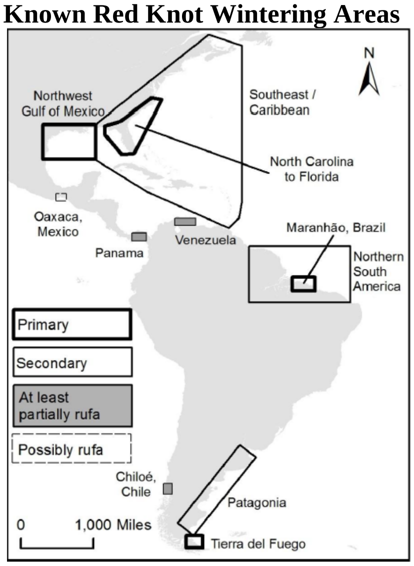
Photo: USFWS

Appearance: The rufa red knot (*Calidris canutus rufa*) is a medium-sized shorebird about 9-11 in (23-28 cm) in length. It is recognized during the breeding season by rufous (red) plumage in the face, stripe above the eye, breast, and upper belly. Females are similar in color to males, though the colors are less intense. Red knots have a proportionately short neck; its black bill that tapers to a fine tip and is not much longer than head. Nonbreeding plumage is gray above and whitish below.

Diet: Small clams, mussels, snails and other invertebrates, swallowing their prey whole. In spring, migrating knots follow spawning seasons of intertidal invertebrates like juvenile clams, mussels and horseshoe crab eggs. Red not do not float or dive and will likely not be found feeding within the *Green Zone*.

Population: There is insufficient data for a precise range wide population estimate for the rufa red knot. Long-term survey data from two key red knot areas, Tierra del Fuego (wintering) and Delaware Bay (spring), showing declines of 70 to 75% since about 2000. A sustained decline may have stabilized at a relatively low level in the last few years.

Known Red Knot Wintering Areas



http://www.fws.gov/northeast/redknot/pdf/20141125_REKN_FL_supplemental_doc_FINAL.pdf

Current Threats:
- Climate Change
- Shoreline stabilization
- Coastal development
- Beach cleaning
- Invasive vegetation
- Agriculture
- Aquaculture
- Predation
- Parasites (migration)
- Hunting (migration)
- Reduced food availability

Distribution/Habitat/Migration: Red knots migrate from North America to Central and South America each fall and back each spring, traveling in large flocks. Wintering areas for the rufa red knot include the Atlantic coasts in South America, the Northwest Gulf of Mexico, and the Southeastern United States. Smaller numbers of knots winter in the Caribbean, and along the central Gulf coast, the mid-Atlantic, and the Northeast United States. The core of the Southeast wintering area is thought to shift from year to year among Florida (particularly the central Gulf coast), Georgia, and South Carolina. Migrating knots can complete nonstop flights of more than 1,500 mi, converging on critical stopover areas to rest and refuel. Red knots arrive at stopovers areas very thin; they eat constantly to gain weight, adding up to 10% of their body weight each day for several days. Red knots migrate over the *Green Zone* in fall and spring but do not dive or float on water for feeding or rest.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
X	X	X	X	X	X	X	X

Additional References:
USFWS (2014) *Rufa Red Knot Background Information and Threats Assessment*

3.2.C(2) Roseate Tern

3.2.C(2) Roseate Tern	Status	Endangered (1987) Threatened (1987)	52 FR 42064

Scientific Name	*Sterna dougalli*	Critical Habitat	N/A

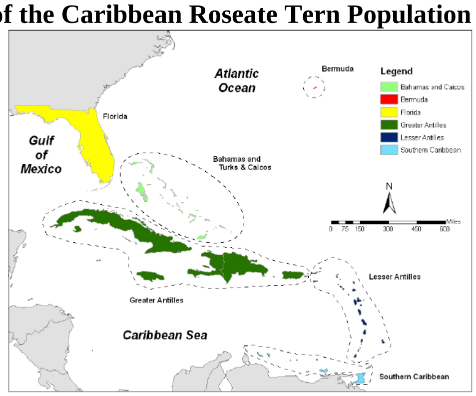
Photo: Jorge E. Saliva

Appearance: The roseate tern (*Sterna dougalli*) is about 40 cm in length, with light-gray wings and back. The rest of the body is white. During the breeding season three-fourths of the black bill and legs turn orange-red.

Diet: Specializes on small schooling marine fish such as dwarf herring, thread herring, halfbeak, young mackerel, and small squid. Flies into the wind or hovers over the school of fish at heights of 5-10 m, plunging downward to seize the fish in the bill, sometimes submerging completely. Roseate terns in the northeast may fly up to 13 mi from the colony to fish but on average they forage much closer, 2 mi, at water depths less than 16 ft. Tends to concentrate in places where prey fish are brought close to the surface by the vertical movement of water; usually forage over shallow bays, tidal inlets and channels, tide-rips and sandbars over which tidal currents run rapidly. The wide diet variety occurs throughout the yellow and *Green Zone* but feeding will likely occur over shallower water within the *Yellow Zone*.

Population: At the time of listing, worldwide population of the Roseate Tern was estimated between 20,000 and 30,000 pairs, possibly up to 44,000 pairs, with the largest numbers in the Indian Ocean. The 2010 USFWS 5-year review estimated less than 3,100 nesting pairs in the endangered northeast U.S. population, down from a high of approximately 4,000 in 1999. Estimates of the threatened Caribbean population at 2,500 to 7,000 nesting pairs with less than 300 pairs in Florida.

Range of the Caribbean Roseate Tern Population



http://www.fws.gov/northeast/EcologicalServices/pdf/endangered/ROST%205-year%20final.pdf

Current Threats:

- Human Disturbance
- Competition
- Kleptoparasitism
- Climate Change
- Predation
- Parasites
- Trapping (migration)

Distribution/Habitat/Migration: The Northeast and Caribbean populations are separated by a gap of about 1,000 mi between the Bahamas and New York. Nesting sites in Florida include small sand and coral rubble islands, and tar and gravel-covered rooftops on two-story high buildings. A high percentage of the Florida Keys roseate tern population typically occupies a single nesting location in any given year. In general, roseate terns in the Caribbean begin egg laying in May and have downy chicks in June. Northeastern roseate terns are thought to migrate through the eastern Caribbean in fall and spring and winter mainly on the east coast of Brazil. Along the way, migrating terns may feed at sea during the daytime, roost after dark, and continue the next day. Endangered Northeastern Roseate Terns may migrate through the yellow and *Green Zone* of the Atlantic in fall and again in spring. Caribbean Terns may be found around South Florida and the Florida Keys from spring to fall and will mostly reside within the *Yellow Zone* during that time.

Potential Range by Area Committee Area of Operation

MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
		X	X				

Additional References:

USFWS (2010) *Roseate Tern 5-Year Review*
USFWS (1993) *Recovery Plan Caribbean Roseate Tern*

Section 3.3. Essential Fish Habitat

3.3.A. Essential Fish Habitats and Habitats of Particular Concern South Atlantic Fishery Management Council

The following information comes directly from:

- Fishery Ecosystem Plan of the South Atlantic Region, Volume II, South Atlantic Habitats and Species. (April 2009. South Atlantic Fishery Management Council. National Oceanic and Atmospheric Administration Award No. FNA05NMF4410004); and,
- The Final Essential Habitat Plan (1998) of the South Atlantic Fishery Management Council (SAFMC)[50]; and is serves as the foundation from which this Biological Assessment will address Essential Fish Habitat.

The information presented here and throughout the above documents serves as the foundation from which this Biological Assessment will address essential fish habitat.

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[50] http://safmc.net/ecosystem/EcosystemManagement/HabitatProtection/SAFMCHabitatPlan

3.3.A(1) Marine Water Column — SAFMC

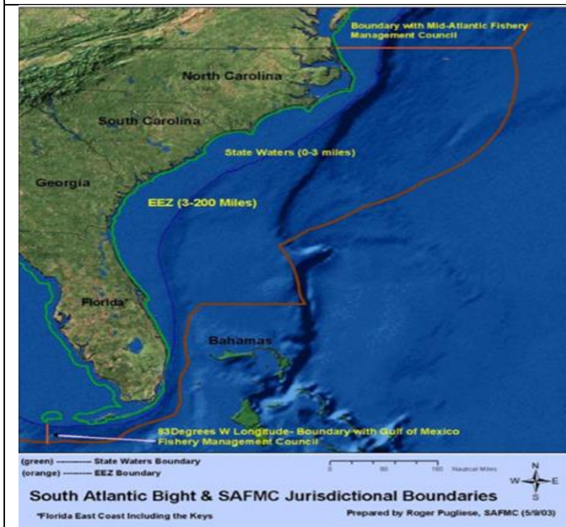

Figure 3-2. Jurisdictional boundaries of the South Atlantic Fishery Management Council (SAFMC).

Boundary & Water (Current) Types.

The marine water column managed by the SAFMC encompasses all marine waters between North Carolina's northern state boundary to Florida's Dry Tortugas islands, extending offshore to the U.S. EEZ boundary. From Dry Tortugas to Cape Canaveral, the three water types are: Florida Current Water (FCW), waters originating in Florida Bay, & shelf water. Shelf waters off the Florida Keys are a mixture of FCW and waters from Florida Bay. From Cape Canaveral to Cape Hatteras, four water masses are found: Gulf Stream Water (GSW), Carolina Capes Water (CCW), Georgia Water (GW) & Virginia Coastal Water (VCW). Virginia Coastal Water enters the region from north of Cape Hatteras. Carolina Capes Water and GW are a mixtures of freshwater runoff & GSW. Lastly, a third region can be articulated surrounding the western boundary current, where spatial/temporal variation in its position has dramatic effects on water column habitats.

Key Features & Characteristics

Overview. Specific habitats in the water column can best be defined in terms of gradients and discontinuities physical and biological characteristics, such as temperature, salinity, density, nutrients, light, and depth. These "structural" components of the water column environment are not static but change both in time and space. Therefore, there are numerous potentially distinct water column habitats for a broad array of species and life stages within species.

Temperature. Temperature varies least in the marine system and marine species tend to be less tolerant of temperature extremes and rapid changes in temperature. Water temperature is one of the most important factors in determining use of coastal ocean habitat by warm temperate and tropical. Tropical species occur off the North Carolina coast where offshore bottom water temperatures range from approximately 52-81°F. Estuarine dependent species in the nearshore ocean, such as black sea bass and southern flounder, have a broader temperature tolerance. Research in North Carolina marine waters has found that fish species composition over hardbottom shifted during a 15-year period, with an increase in tropical species and decrease in temperate species. The change in species composition was associated with warming trends.

Stratification influenced by light and nutrient. In nearshore ocean waters, the depth that light penetrates to allow photosynthesis (euphotic zone) may be quite shallow because of high turbidity and wind mixing. Proceeding offshore there is generally a sharp decrease in chlorophyll a where the water column becomes more stratified. Primary production rates decreased significantly from the inner shelf to the outer shelf of the South Atlantic Bight. Production levels may increase by a factor of three to ten with warm core intrusions from the Gulf Stream. Because these intrusions occur irregularly on the inner shelf zone, this nearshore area depends more on nutrients recycled or resuspended by wind or tidal forces. Zooplankton distribution is directly related to location of phytoplankton blooms. On the inner shelf in Onslow Bay, NC, 80% of the chlorophyll a was associated with the sediment. Benthic microalgal biomass always exceeded phytoplankton biomass. Because of circulation patterns, inorganic nutrients could be resuspended and retained in sufficient amounts to allow localized phytoplankton blooms within the surf zone. Primary production within the water column can also come from macroalgae detached from hard substrate or floating on the surface.

Gyres. The SAFMC describes two specific gyres: the Tortugas Gyre, formed as a result of variation in the path of the Florida Current with dimensions on the order of 100 km and may persist in the vicinity of the Florida Keys for several months; and the Pourtales Gyre, formed as a result of the eastward movement of the Tortugas Gyre along the shelf. Upwelling occurs in the center of these gyres, thereby adding nutrients to the near surface (<100 m) water column. One additional gyre formation that produces similar upwelling is described at the Gulf Stream and Charleston Bump intersect, where the current is deflected offshore, resulting in the formation of a cold, quasi-permanent cyclonic gyre.

Eddies & Meanders. Along the entire length of the Florida Current and Gulf Stream, cold cyclonic eddies are imbedded in meanders along the western front. Three areas of eddy amplification are known: Downstream of Dry Tortugas, downstream of Jupiter Inlet (27°N to 30°N latitude) ("The Point" or "Amberjack Hole"), and downstream of the Charleston Bump (32°N to 34°N latitude) ("The Charleston Gyre"). Meanders propagate northward (i.e., downstream) as waves. The crests and troughs represent the onshore and offshore positions of the Gulf Stream front. Cross-shelf amplitudes of these waves are on the order 10 to 100 km. Upwelling within meander troughs is the dominant source of "new" nutrients to the southeastern U.S. shelf and supports primary, secondary, and ultimately fisheries production (Yoder 1985; Menzel 1993). Off Cape Hatteras the Gulf Stream turns offshore to the northeast. Here, the confluence of the Gulf Stream, the Western Boundary Under-Current (WBUC), Mid-Atlantic Shelf Water (MASW), Slope Sea Water (SSW), CCW, and VCW create a dynamic and highly productive environment, known as the "Hatteras Corner" or "The Point".

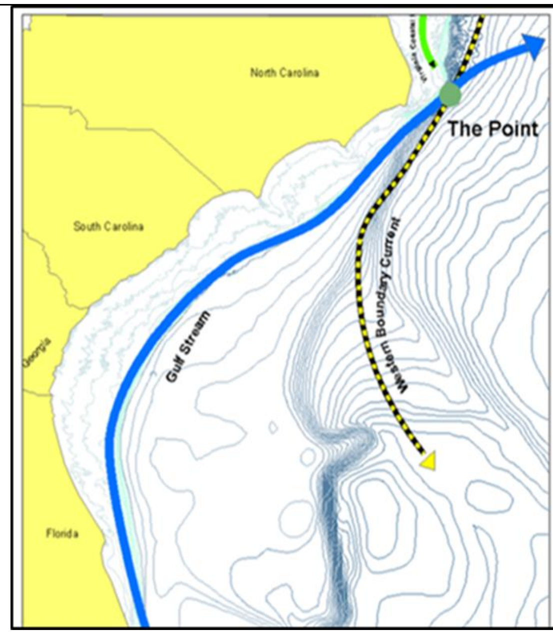

Figure 3-3. Water Masses off North Carolina

Ecosystem Functions

The water column from Dry Tortugas to Cape Hatteras serves as habitat for a variety of marine fish and shellfish. Most marine fish and shellfish broadcast spawn pelagic eggs and thus, most fishery-targeted species utilize the water column during some portion of their early life history (e.g., egg, larvae, and juvenile stages). Larvae of shrimp, lobsters, crabs, and larvae of reef, demersal and pelagic fishes are found in the water column. The exact accounting of the number of fishes whose larvae inhabit the water column is not generally known, but the number of families represented in ichthyoplankton collections ranges from 40 to 91 depending on location, season, and sampling method.

Species- and life-stage-specific patterns of water column habitat utilization are not well known for most fishes. Some utilize nearshore fronts as feeding or nursery habitats; others utilize offshore fronts. Important spawning locations with accumulation of fish larvae include estuarine fronts, the mid-shelf front, and the Gulf Stream front. Movement of the Gulf Stream front also affects the distribution of adult fishes. [The] quasi-permanent gyres which impinge upon the shelf near the Florida Keys and downstream from the Charleston Bump probably serve as important spawning/larval retention habitat for a variety of fishes including. "The Point" off Cape Hatteras supports an unusually high biomass of dolphin and wahoo and other upper trophic level predators, including many important pelagic fishes. It has been suggested that the area is the most productive sport fishery on the east coast targeting dolphin, wahoo, and other pelagic species including billfish.

3.3.A(2) *Sargassum* — SAFMC

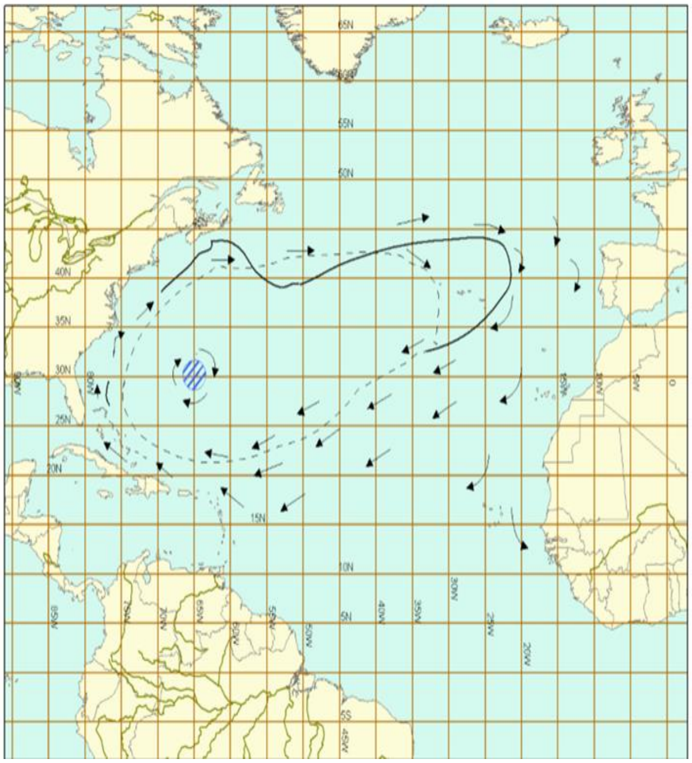

Figure 3-4. Distribution of Pelagic *Sargassum* in the NW Atlantic

General Description

Within warm waters of the western North Atlantic, pelagic brown algae *Sargassum* natans and S. fluitans (Phaeophyta: Phaeophyceae: Fucales: Sargassaceae) form a dynamic structural habitat. The pelagic species are golden to brownish in color and typically 20 to 80 cm in diameter. Both species are sterile and propagation is by vegetative fragmentation. The plants exhibit complex branching of the thallus, lush foliage of lancolate to linear serrate phylloids and numerous berrylike pneumatocysts.

Range and Abundance

Most pelagic *Sargassum* circulates between 20°N and 40°N latitudes and 30°W longitude and the western edge of the Florida Current/Gulf Stream. The greatest concentrations are found within the North Atlantic Central Gyre in the Sargasso Sea. Total biomass is unknown, but, estimates obtained from net tows range from 800 to 2000 kg wet weight/km2.

Key Features & Characteristics

Behavioral Characteristics. Large quantities of *Sargassum* frequently occur on the continental shelf off the southeastern U.S.. Depending on prevailing surface currents, this material may remain on the shelf for extended periods, be entrained into the Gulf Stream, or be cast ashore. During calm conditions *Sargassum* may form large irregular mats or simply be scattered in small clumps. Langmuir circulations, internal waves, and convergence zones along fronts aggregate the algae along with other flotsam into long linear or meandering rows collectively termed “windrows”. The algae sink in these convergence zones but buoyancy is not lost unless the algae sink below about 100 m or are held under at shallower lesser depths for extended periods. If buoyancy is lost, plants slowly sink to the sea floor contributing to the flux of carbon and other nutrients from the surface to the benthos. However, the flux of *Sargassum* to the sea floor has not been quantified. Current understanding of the seasonal distribution and areal abundance (i.e., biomass per unit area) of pelagic *Sargassum* within the EEZ is poor.

Pneumatocysts. Perhaps the most conspicuous features are the pneumatocysts. These small vesicles function as floats and keep the plants positively buoyant. The volume of oxygen within the pneumatocysts fluctuates diurnally in response, not to diurnal cycles of photosynthesis, but to changes in the partial pressure of oxygen in the surrounding medium. There are generally a large number of pneumatocysts on a healthy plant: up to 80% of the bladders can be removed and the plants will remain positively buoyant. Under calm sea states the algae are at the surface with less than 0.3% of their total mass exposed above the air-water interface. Experiments indicate that an exposure to dry air of 7 to 10 minutes will kill phylloids, whereas pneumatocysts and thallomes can tolerate exposures of 20 to 30 minutes and 40 minutes, respectively. Wetting of exposed parts with seawater at 1 minute intervals, however, is enough to prevent tissue damage. In nature, such stress is likely encountered only during the calmest seas or when the alga is cast ashore.

Productivity. Pelagic *Sargassum* contributes a small fraction to total primary production in the North Atlantic. However, within the oligotrophic waters of the Sargasso Sea it may constitute as much as 60% of total production in the upper meter of the water column. Estimates of production are typically around 1 mg C/m2/d with slightly higher values reported from more nutrient rich shelf waters. [A study showed] *Sargassum* to have low nitrogen and phosphorus requirements, and optimal growth at water temperatures of 24 to 30°C and salinity of 36 ppt. Nitrogen fixation by epiphytic cyanobacteria of the genera Dichothrix, Trichodesmium, and Synechococcus may enhance production.

Pelagic brown algae in the genus *Sargassum*

Ecosystem Functions

Pelagic *Sargassum* supports a diverse assemblage of marine organisms including fungi, micro-and macro-epiphytes, at least 145 species of invertebrates, over 100 species of fishes, four species of sea turtles, and numerous marine birds. The following points further emphasizes the complexity of the *Sargassum* community and the importance of pelagic *Sargassum* habitat to pelagic fishes, especially dolphin (Coryphaena hippurus).

“Traditionally, fishermen seek weed-lines to land dolphin and other pelagic fishes. Seasonal angling success has been associated with the distribution of *Sargassum* along the southeastern United States. For instance, Rose and Hassler (1974) suggested that diminished landings of dolphin off North Carolina were probably caused by lack of tide-lines (usually caused by floating rows of *Sargassum*) rather than overfishing in previous years as some believed.”

“Dolphin frequently feed at the surface and ingest fishes, crustaceans, insects, plants, and inorganic items that are associated with floating *Sargassum*. *Sargassum* which occurred in 48.6% of the stomachs was considered to be consumed incidental to normal foods.”

“The relative contribution of the *Sargassum* community to the diet may be indicative of physiological constraints on the foraging behavior of these pelagic predators. The pursuit and capture of free-swimming prey in the open ocean is energetically expensive, while grazing on relatively sessile animals associated with *Sargassum* can be accomplished without great energy expenditure. The tunas consume a greater proportion of pelagic, adult fishes and take less prey from the *Sargassum* community than do dolphin. Although both tunas and dolphin are capable of high speed pursuit, tunas have highly vascularized locomotion muscles enabling sustained aerobic metabolism. Dolphin, with a much smaller portion of red muscle, must rely primarily on anaerobic metabolic pathways (mainly glycolosis), and therefore are limited to short bursts of acceleration. Thus, the energetic strategy for dolphin seems to be forage primarily on smaller prey from the *Sargassum* community, but also to capture larger prey with short bursts of high speed pursuit if the opportunity arises.”

3.3.A(3) Coral Reefs and Coral Communities

SAFMC

General Description

Several definitive characteristics of reefs that apply to shallow coral reefs in the southeast U.S. include rigid frameworks, calcareous skeletons or other calcareous micro-structures are abundant, structures have positive topographic relief, framework organisms have rapid growth rates; and taxonomic diversity is high, with several ecological functional groups.

Distribution

Shallow water coral reefs and coral communities are defined as occurring in depths generally less than 40 m. As a vital first step in understanding and managing coral reef resources, it is necessary to recognize that corals are not spread evenly over the management area. Rather, dense clusters of certain species concentrate at specific geographic locations to form coral reefs or coral communities, etc.

Key Features & Characteristics

Outer Bank Reefs. They are located in the Florida reef tract primarily shoreward of the 18 m (60 ft) isobath. The linearity of these reefs approximately parallel to the Keys is due to underlying bedrock topography, rather than biological or water quality causes. The Florida reef tract includes approximately 96 km (52 nm) of outer bank reefs located between Fowey Rocks and the Dry Tortugas, a distance of about 270 km (146 nm) along the 20 m (66 ft.) isobath. A large portion of the reef tract is in the EEZ just beyond Florida's three-mile territorial sea.

Florida Key Communities. In the Florida Keys, nearshore coral communities' characteristics differ substantially between the mainland coast of east Florida and the Florida Keys. These differences include higher wave energies, fewer corals and grasses, and coarser sediments in nearshore coral communities of mainland areas. Additional factors complicate Keys and mainland comparisons of coral communities. Nearshore coral communities in the Keys are distributed across more physiographically variable cross-shelf gradients with a greater potential for structural heterogeneity than on the mainland. The presence of over 6000 patch reefs in Hawk Channel, many near shallow coral communities, introduces additional inter-habitat relationships rarely found in nearshore coral communities of mainland areas.

Southeast Florida Communities. In southeast Florida (north of the Keys), coral communities have developed on relict reef tracts parallel to the shoreline in different depths separated by large expanses of sand. The deepest community, the Outer Reef, still has many evident features of the relict reef zonation. For example, spur and groove formations dominate the eastern sides of these reefs, yet they reside in >25 m depth. Even though they appear as spur and groove, they no longer function as such and do not contain an abundant population of fast-growing, frame building corals. This is in contrast to some nearshore coral communities in the same area. Some nearshore coral communities (especially in Broward County) have a significant number of fast-growing, large, frame-building corals, yet they lack distinct zonation. There is no emergent reef crest, spur and groove fore reef, or lagoon. This community may be considered the beginnings of a new reef, however without the advantage of the Caribbean's fastest growing, frame-building coral, Acropora palmata, and its proximity to significant coastal development, it is unlikely to continue.

<table>
<tr><td colspan="2"><u>Florida to North Carolina Communities</u>. Communities containing corals from Florida north (Martin County) to North Carolina, have distinctly different assemblages than those further south. There are deep water communities dominated by a single species (Oculina), and shallow-water sponge or macroalgae dominated hardbottom communities where very few species of stony corals exist at low densities. These communities are covered in other sections of this document.</td></tr>
<tr><td rowspan="2"><u>PATCH REEFS</u>
Patch reefs are irregularly distributed clusters of corals and associated biota located generally along the seaward (southeast) coast of the Florida Keys. Most patch reefs occur 3 to 7 km (1.6 to 3.8 nm) offshore between Miami and the Dry Tortugas on the inner shelf (less than 15 m depth). Vertical relief ranges from less than 1 m to over 10 m. Patch reefs occur as either dome-type patches on the leeward side of outer bank coral reefs or as linear-type patches that parallel bank reefs in arcuate patterns. More than 6,000 patch reefs occur in the Florida reef tract between Miami and the Marquesas Keys, mostly between Hawk Channel and the outer bank reefs.</td>
<td><u>Linear-type patch reefs</u>. Linear-type patch reefs support flora and fauna, including elkhorn coral (Acropora palmata), which more nearly resemble the bank reefs. Most dome patch reefs have less than 5 m of topographic relief, but some as high as 9 m do occur. Linear-type reefs are usually situated seaward of dome-type patch reefs parallel to the outer bank reefs. In top view, linear patch reefs appear arcuate to linear, much like the outer bank coral reefs of the Florida reef tract. Hence, instead of forming clusters, these patch reefs often occur end-to-end. These linear offshore reefs are also referred to as inner line reefs and probably represent an ecologic transition from between dome patch reefs and outer bank reefs. Linear-type patch reefs support corals and other marine life much like dome-types with the possible addition of A. palmata.</td></tr>
<tr><td><u>Dome patch reefs</u>. From above, dome patch reefs tend to be clustered. Dome-type assemblages support a diverse array of stony corals and octocorals, plus numerous benthic invertebrates, algae, and fish. Except for the noticeable absence of elkhorn coral, the biota of dome patches resembles that of consolidated outer bank reefs, but with less coral zonation. Octocorals dominate the top interior zones whereas M. annularis, Diploria spp., and Colpophyllia natans dominate western margins. The dominant coral in this type of patch reef is the small star coral, Montastraea annularis, which is often present in single enormous colonies.</td></tr>
<tr><td colspan="2" align="center">Ecosystem Functions</td></tr>
<tr><td colspan="2"><u>Ecological Role & Function.</u> Coral reefs and communities serve a number of functional roles in subtropical and tropical environments of the western Atlantic, including, but not limited to: primary production, recycling of nutrients in relatively oligotrophic waters, calcium carbonate deposition yielding reef construction, refuge and foraging base for other organisms, and modification of near-field or local water circulation patterns. Coral reefs also protect shorelines, serving to buffer inshore subtidal (e.g., seagrass) and intertidal (e.g., mangroves) communities from otherwise high wave energy conditions in certain localities.</td></tr>
<tr><td colspan="2"><u>Habitat for Associated Organisms</u>. Coral reefs’ most valuable contribution to the marine environment is as habitat and refuge for numerous associated organisms including reef dwelling animals and plants. A coral assemblage may support rich populations of invertebrates (corals, sponges, tunicates, echinoderms, crabs, lobsters, gastropods, etc.), vertebrates (primarily fish, turtles, birds, and marine mammals), and plants (coralline algae, fleshy algae, eelgrass, turtle grass, etc.).</td></tr>
<tr><td colspan="2"><u>Specific to Fishes</u>. In western Atlantic reef environments, the number of fish species directly or indirectly associated with the reef system can easily exceed 400 species. The high taxonomic diversity of reef fishes indicates that many species are highly evolved, with several families generally restricted to the reef environment, among them: Chaetodontidae (butterflyfishes), Scaridae (parrotfishes), Acanthuridae (surgeonfishes), Labridae (wrasses), Holocentridae (squirrelfishes), and Pomacentridae (damselfishes). Many reef fishes are highly sedentary, with some species (e.g., damselfishes) actively defending territories. Even the spatial distribution of larger predatory species tends to be very reef-specific, with individuals rarely traveling more than 5 km from a home site after post-settlement, except for spawning purposes.</td></tr>
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3.3.A(4) Deepwater Coral Habitat — SAFMC

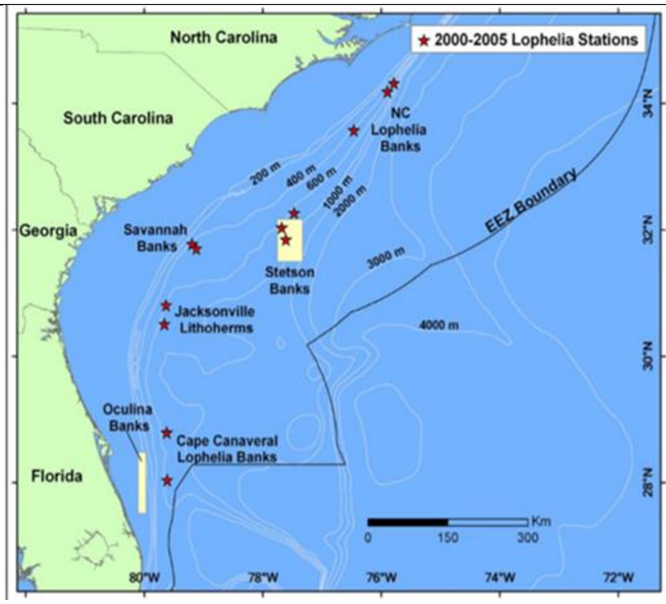

Figure 3-5. Southeastern United States regional report area, indicating general areas of Oculina varicosa reefs and the deeper coral (Lophelia mostly) habitats. Note that these areas do not represent all sites where deep (>200 m) corals occur, nor all sites visited by other researchers.

General Description

See Key Features & Characteristics.

Range and Abundance

The southeast U.S. slope area, including the slope off the Florida Keys, has a unique assemblage of deepwater Scleractinia containing a warm temperate assemblage of about 62 species, four endemic to the region. This group was characterized by many free living species, few species living deeper than 1000 m, and many species with amphi-Atlantic distributions. For the southeastern U.S., in areas deeper than 200 m, assemblages consist of 57 species of scleractinians (including 47 solitary and ten colonial structure-forming corals), four antipatharians, one zoanthid, 44 octocorals, one pannatulid, and seven stylasterids. Thus the region contains at least 114 species of deep corals (classes Hydrozoa and Anthozoa). However, this list is likely conservative

Key Features & Characteristics

Stony Corals - The dominant structure-forming coral on the southeastern U.S. outer shelf (<200 m) is Oculina varicosa (ivory tree coral). This coral only forms large reefs off east-central Florida. The shallow water form of Oculina may have symbiotic zooxanthellae, but the deeper form does not.

Black Corals - Black corals (Families Leiopathidae and Schizopathidae, ca. four species) are important structure-forming corals on the southeastern U.S. slope. These corals occur locally in moderate abundances, but their distributions seem to be limited to the region south of Cape Fear, NC.

Gold Corals - Gold corals are found most often singly away from other coral structure, but these corals are also found associated with colonies of other structure-forming corals. Little is known about this group of organisms.

Gorgonians - The gorgonians are by far the most diverse taxon on the southeastern U.S. slope represented by seven families, 17 genera, & 32 species. The diversity of gorgonians increases dramatically south of Cape Fear, NC.

Bamboo Corals - Bamboo corals are important structure-forming corals off the southeast region. They occur locally in moderate abundances; their distributions also seem to be limited to the region south of Cape Fear, NC.

True Soft Corals - The most abundant species observed in the region is Anthomastus agassizi, which is relatively abundant at sites off Florida. The majority of the alcyonacean species are smaller in size, both in vertical extent and diameter, than the gorgonians. Thus, these corals add to the overall structural complexity of the habitat by attaching to hard substrata such as dead scleractinian skeletons and coral rubble.

Stoloniferans – A total of six species, one species, the Clavularia modesta, is widespread throughout the western Atlantic; the other five species are known from North Carolina southward to the Caribbean.

Sea Pens - Little is known about pennatulids (sea pens) off the southeastern U.S. No sea pens have been observed during recent surveys and, based on museum records, only one species) is known in the region.

Stylasterids - Although not found in great abundances, stylasterids (lace corals) commonly occur off the southeastern U.S. Individuals observed in situ are often attached to dead scleractinian corals or coral rubble. Abundance and diversity of stylasterids increase southward from the Carolinas.

Ecosystem Functions

Deep coral communities are hot-spots of biodiversity in the deeper ocean, making them of particular conservation interest. Stony coral “reefs” as well as thickets of gorgonian corals, black corals, and hydrocorals are often associated with a large number of other species. Through quantitative surveys of the macroinvertebrate fauna, [it was] found over 20,000 individual invertebrates from more than 300 species living among the branches of ivory tree coral (Oculina varicosa) off the coast of Florida. Over 1,300 species of invertebrates have been recorded in an ongoing census of numerous Lophelia reefs in the northeast Atlantic. Gorgonian corals in the northwest Atlantic have been shown to host more than 100 species of invertebrates. The three dimensional structure of deep corals may function in very similar ways to their tropical counterparts, providing enhanced feeding opportunities for aggregating species, a hiding place from predators, a nursery area for juveniles, fish spawning aggregation sites, and attachment substrate for sedentary invertebrates.

Deep coral communities have also been identified as habitat for certain commercially-important fishes. At several sites in the Northeast Atlantic, [a] report [documented] that 92% of fish species, and 80% of individual fish were associated with Lophelia reef habitats rather than on the surrounding seabed. A relationship [was found] between the abundance of economically valuable fish (e.g., grouper, snapper, sea bass, and amberjack) and the condition (dead, sparse and intact) of Oculina colonies. Oculina reefs off Florida have been identified as essential fish habitat for federally-managed species. In other cases, however, the linkages between commercial fisheries species and deep corals remain unclear and may be indirect.

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3.3.A(5) Live/Hardbottom Habitat — SAFMC

General Description

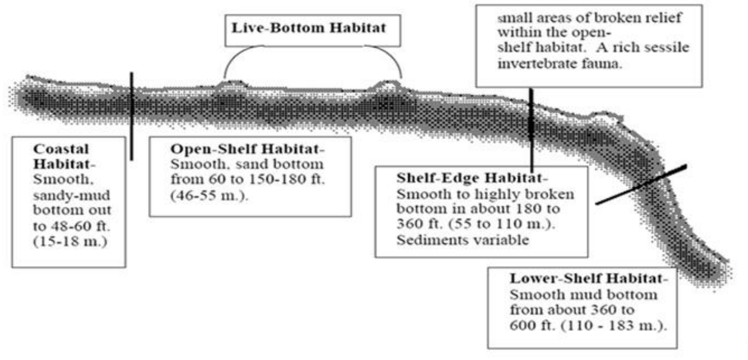

Figure 3-6. Profile of continental shelf bottom habitat segments

Range and Abundance

Within the South Atlantic, the description for the live/hardbottom habitat has been geographically segregated into two sections: Cape Hatteras to Cape Canaveral, and Cape Canaveral to the Dry Tortugas. Broadly, these regions represent temperate, wide-shelf systems and tropical, narrow-shelf systems, respectively, with concomitant distinctions in fish fauna. The zoogeographic break between these regions typically occurs between Cape Canaveral and Jupiter Inlet. The depth ranges covered extend from intertidal to almost 1000 m, depending on information for the varying shelf attributes of the South Atlantic Bight.

Key Features & Characteristics – Cape Hatteras to Cape Canaveral

Major fisheries habitats on the continental shelf along the southeastern U.S. from Cape Hatteras to Cape Canaveral (SAB) can be stratified into at least five general categories: coastal, open shelf, live/hardbottom, shelf edge, and upper slope and Blake Plateau based on type of bottom and water temperature. Surveys have documented extensive hardbottom habitat in this zone. The temperature regimes of the offshore shelf habitats mentioned above are strongly influenced by the Gulf Stream.

In general, the shelf has a ridge-and-swale (hill-and-valley) topography on the inner shelf and part of the outer shelf, with ridges having coarser surficial sediments than swales. At the shelf break, the topography is a discontinuous series of terraces before sloping or dropping off into steep slopes with submarine canyons, the relatively flat Blake Plateau, or deep Straits of Florida. On the shelf, the live-bottom habitats are often small, isolated areas of broken relief consisting of rock outcroppings that are heavily encrusted with sessile invertebrates such as ascidians, hydroids, bryozoans, sponges, octocorals, and hard corals. A study of live bottom areas from North Carolina to northern Florida revealed three hardbottom habitat types: emergent hardbottom dominated by sponges and gorgonian corals; sand bottom underlain by hard substrate dominated by anthozoans, sponges and polychaetes, with hydroids, bryozoans, and ascidians frequently observed; and softer bottom areas not underlain with hardbottom.

Along the southeastern U.S., most hard/live bottom habitats occur at depths greater than 27 m (90 ft), but many also are found at depths of from 16 to 27 m (54 to 90 ft), especially off the coasts of North Carolina and South Carolina, and within Gray's Reef National Marine Sanctuary off Georgia. The shelf edge habitat extends more or less continuously along the edge of the continental shelf at depths of 55 to 110 m (180 to 360 ft). The lower shelf habitat has a predominately smooth mud bottom, but is interspersed with rocky and very coarse gravel substrates where snowy and yellow edge groupers and tile fishes are found. The continental slope off North Carolina, Georgia and Northern Florida is interrupted by the relatively flat Blake Plateau, which divides the slope into the Florida-Hatteras Slope and the Blake Escarpment. On the northern Blake Plateau are important fish habitats, including coral mounds and the Charleston Bump.

Between the 360-500 m depth contour on the Blake Plateau, and starting to the north off central North Carolina, discontinuous large mounds of deep sea coral reefs occur. The Charleston Bump is a deepwater rocky bottom feature on the Blake Plateau southeast of Charleston, South Carolina. It includes a shoaling ramp and ridge/trough

features on which the seafloor rises from 700 m to shallower than 400 m within a relatively short distance and at a transverse angle to both the general isobath pattern of the upper slope, and to Gulf Stream currents.

Key Features & Characteristics – Cape Canaveral to Dry Tortugas
The term hardbottom is applied in two relatively different areas of southeast Florida: the mainland and associated sedimentary barrier islands, and the coral islands and reef tract of the Florida Keys. The benthic habitat characteristics of the shelf bordering the mainland are not as complex as in the Florida Reef Tract. Within both subregions, non-coralline, hardbottom habitats are present in both nearshore (<4 m) and mid- and outer-shelf areas (>4 m).
Mainland Southeast Florida - Nearshore hardbottom habitats are the primary natural reef structures at depths of 0-4 m. Several lines of offshore hardbottom reefs, derived from Pleistocene and Holocene reefs, begin in depths usually exceeding 8 m, and in bands that roughly parallel the shore. The geologic origins and biotic characteristics of these deeper reef systems are different from the nearshore hardbottom reefs, although reefs of both depth strata are lower in relief than reefs of the Florida Reef tract.
Florida Keys - Florida Keys nearshore hardbottom is semi-continuously distributed among areas with high organic sediments, increased seagrasses, more corals, and reduced wave conditions. In the midshelf and offshore hardbottom areas, due to the warmer water and immediate downstream positioning to the Florida Keys, these areas support a higher diversity and abundance of hard coral species.
Ecosystem Functions
The vertical relief and irregularity of hardbottom structure provides protective cover for numerous fish species and increases the surface area available for colonization by invertebrates and plants. Because of this, natural reefs can sustain greater fish stocks (270 to 5,279 kg/ha) compared to non-reef open shelf bottom (6.3 to 46.3 kg/ha). The abundance of fish on hardbottom and artificial reefs is related to the amount and type of structural complexity of the reef. Rocky structures with high complexity consistently support a more abundant and diverse resident fish community than less complex structures. In addition, areas with small patches of hardbottom surrounded by sand bottom support greater fish abundance and diversity than one large area of equal material, suggesting the importance of habitat edge and diversity to ecosystem productivity. Nearshore and inner shelf hardbottom areas serve as important settlement and nursery habitat for immigrating larvae of many important fisheries species. Nearshore hardbottom also serves as intermediate nursery habitat for late juveniles emigrating out of the estuaries. In North Carolina, this group of fishes includes black sea bass, gag, red grouper, sheepshead, Atlantic spadefish, bank sea bass, and gray snapper, which are estuarine-dependent as early juveniles, moving offshore to hardbottom habitat as older juveniles. In addition to providing essential functions for numerous fishery species, bio-erosion of hardbottom provides a source of new sand on the continental shelf.

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3.3.A(6) Marine Soft Bottom	**SAFMC**

General Description

Soft bottom habitat is unconsolidated, unvegetated sediment that occurs in freshwater, estuarine, and marine systems.

Key Features & Characteristics

Soft bottom has only one habitat requirement – sediment supply. Environmental characteristics, such as sediment grain size and distribution, salinity, dissolved oxygen, and flow conditions, will affect the condition of the soft bottom habitat and the type of organisms that utilize it. Benthic microalgae are a key part of the food chain in estuarine soft bottom habitat. Benthic microalgae are microscopic photosynthetic algae that live in the top few millimeters of the surface of soft bottom.

Ecosystem Functions

Soft bottom plays a very important role in the ecology of estuarine ecosystems as a storage reservoir of chemicals and microbes. Intense biogeochemical processing and recycling establish a filter to trap and reprocess watershed-derived natural and human-induced nutrients and toxic substances. These materials may pass through an estuary, become trapped in the organic rich oligohaline (low salinity) zone, or migrate within the estuary over seasonal cycles. The fate of the materials depends upon salinity gradients, which are driven by freshwater discharges, density stratification, and formation of salt wedges. Density gradients (stratification) hamper mixing and oxygen exchange of sediments and water in bottom waters with overlying oxygenated waters, leading to depletion of dissolved oxygen in bottom water. Although soft bottom habitat is composed of unconsolidated shifting sediments, colonization by benthic microalgae reduces the extent to which sediment is resuspended at low velocities, stabilizing bottom sediments and reducing turbidity in the water column. Structure from tube dwelling invertebrates also helps to bind the sediment, while filtering activity of dense aggregations of suspension feeders (hard clams) clears significant amounts of plankton and sediment from the water column and improves water clarity. Yet, because of the absence of large, extensive structure, soft bottom provides relatively less stabilization benefits than other estuarine habitats. One of the most important functions of soft bottom habitat is as a foraging area. Many demersal fish spawn over various areas of soft bottom habitat. Shallow soft bottom habitat, usually adjacent to wetlands, is utilized as a nursery for many species of juvenile fish. Soft bottom habitat can provide refuge to some organisms in some locations through predator exclusion. The soft bottom associated with inlets has a great influence on overall barrier island dynamics.

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3.3.A(7) Seagrasses	SAFMC

SEAGRASSES IN THE SOUTH ATLANTIC REGION

KEY
SOUTH ATLANTIC REGION
SEAGRASS DISTRIBUTION
ESTUARINE DRAINAGE AREAS

SEAGRASS SPECIES	I	II	III	IV	V	VI
ZOSTERA MARINA (eelgrass)	X					
RUPPIA MARITIMA (Widgeon grass)	X		X	X	X	X
HALODULE WRIGHTII (shoalgrass)	X		X	X	X	X
HALOPHILA ENGELMANNII (star grass)			X	X	X	X
SYRINGODIUM FILIFORME (manatee grass)			X	X	X	X
HALOPHILA JOHNSONII (Johnson's seagrass)					X	
THALASSIA TESTUDINUM (turtle grass)					X	X
HALOPHILA DECIPIENS (paddle grass)					X	X

Figure 3-7. Illustration & table of the distribution of seagrasses in the South Atlantic Region (1998)

General Description

Seagrasses are clonal plants which reproduce and disperse by means of sexual and asexual reproduction. Seagrasses anchor themselves in unconsolidated sediments with an extensive root and rhizome system, thus have a very significant influence on sedimentary processes and nutrient cycling. In the south Atlantic region, there are 8 seagrass species.

Range and Abundance

In the South Atlantic, seagrass habitat occurs in North Carolina and Florida, with Florida having the greatest amount of seagrass habitat. Along the Atlantic Peninsula and South Florida regions of Florida, there are an estimated 29,769 hectares (ha) and 574,875 ha of seagrass beds, respectively. The South Florida total includes seagrass in Florida Bay and the continental shelf off of the Keys (Florida Straits). Seagrass estimates in the Florida Straits include areas with continuous submerged aquatic vegetation (SAV) as well as areas where SAV is patchy and intermixed with hardbottom. Along the Atlantic Peninsula, seagrasses are most concentrated in the Indian River Lagoon system. This area, while only supporting approximately 3% of the total seagrass coverage along all of Florida, has the highest seagrass diversity, with seven species present (Zostera mariana does not occur in Florida), including the federally threatened species, Halophila johnsonii (Johnson's seagrass). Over half of all seagrass habitat in Florida occurs in South Florida and Florida Bay supports the largest contiguous seagrass beds in the world with Thalassia testudinum (turtle grass) being the most dominant species. On the Atlantic side of the Florida Keys, seagrass habitat is closely associated with hardbottom, patch reefs, and mangroves. North Carolina has the second largest seagrass distribution in the continental United States with an estimated 54,230 ha. Z. marina, H. wrightii and R. maritima, are all found within coastal lagoons, protected inland waterways and river mouths all protected by barrier islands. A unique feature of NC seagrasses is the overlap in distribution of a temperate species (Z. marina) and a tropical species (H. wrightii). Where these species co-occur there is a bimodal seasonal abundance, which extends the total annual abundance of seagrasses for a longer period of time.

Key Features & Characteristics

In the South Atlantic region all seagrasses occur on unconsolidated sediments in a wide range of physical settings and different stages of meadow development leading to a variety of cover patterns, ranging from patchy to continuous. The maximum depth limits are determined by optical water quality and transparency and sometimes limited by water velocities associated with inlets, tidal channels and unstable sediments. In North Carolina maximum depths average between 1.5 and 2.5 m and are similar to the maximum depths of seagrasses in the lagoons and Intracoastal Waterway (ICW) along the east coast of Florida. In locations near inlets with clear water and stable sediments seagrasses grow to 3-5 m, while in nearshore and offshore areas of southeastern Florida and the Keys seagrasses grow to depths of 30 m.

Salinity is an important parameter in estuaries because of its potential to control physicochemical attributes of the system that affect nutrient cycling, water transparency, floral and faunal composition, and productivity. Salinity also undergoes frequent fluctuations and may act as an important stressor. Given the fact that the south Atlantic region has extensive natural and manmade fresh water sources flowing into coastal systems, salinity is a critical parameter controlling seagrass distribution and abundance.

Seagrass meadows are usually defined by a visible boundary delineating unvegetated and vegetated substrate and vary in size from small, isolated patches of plants less than a meter in diameter to a continuous distribution of grass tens of square kilometers in area. This natural variation in grass bed morphology is related to seagrass dynamics and affects the function of seagrasses as habitat. Seagrass meadows are dynamic spatial and temporal features of the coastal landscape which actually move and can disappear and reappear periodically. The presence of a seagrasses canopy does not necessarily signify whether or not a location is capable of supporting seagrass habitat. Some species are ephemeral, for example, in North Carolina, shallow Z. marina meadows may completely exfoliate in late summer in response to warm temperatures, but in many instances, the meadows recovers in winter or spring. Because of this, identification of seagrass habitat at certain times of the year can be difficult

Ecosystem Functions

Seagrasses are rooted plants that can become nearly permanent, long-term features of coastal marine and estuarine ecosystems either as perennial or annual meadows. Because they are rooted, seagrasses directly link the sediments to the water column. No other marine plants are capable of providing this ecological service. Ecological functions provided by seagrass habitat that enhance conditions for fish species include:

1) primary productivity,
2) structural complexity,
3) modified energy regimes and stabilization of sediment and shorelines, and
4) nutrient cycling.

Seagrasses are among the most productive ecosystems in the world. High rates of primary production lead to the formation of complex, three dimensional physical structures consisting of a canopy of leaves and a dense matt of roots and rhizomes buried in the sediments. The presence of this physical structure provides substrate for attachment of organisms, shelter from predators, frictional surface area for modification of water flow and wave turbulence, sediment and organic matter deposition, and the physical binding of sediments underneath the canopy. Linked together by nutrient absorbing surfaces on the leaves and roots, and a functional vascular system, seagrass organic matter cycles and stores nutrients, and provides both direct and indirect nutritional benefits to hundreds of species of micro-organisms, meiofauna, carnivores, herbivores and detritivores.

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3.3.A(8) Oyster Reefs	SAFMC

General Description

In the western Atlantic, oysters, mussels, and one genus of gastropod build three-dimensional structures that are commonly called reefs. Other terms such as bars and beds also refer to reef structures that are created by the organisms themselves. The structure of the reef may be composed almost entirely of the reef building organism and its tubes or shells, or it may to some degree be composed of sediments, stones and shells bound together by the organisms.

Key Features & Characteristics

Reef Forming Species – Although many species typically occur on shellfish reefs, the main structural component is formed by the attachment of many individual shellfish to each other. At least three species of oysters occur along the Atlantic coast, in addition to several mussel species and other molluscs (e.g., vermetid gastropods). Of these, only the Eastern (or American) oyster (Crassostrea virginica), blue mussel (Mytilus edulis), and horse mussel (Modiolus modiolus) typically form reefs along the Atlantic coast.

Gastropods of the family Vermetidae - The only habitat-forming snails on the Atlantic coast are species in the family Vermetidae. Vermetid snails cement themselves together to form dense reefs in intertidal and shallow subtidal waters from southern New England (rarely) to the tropics. These uniquely cemented gastropods feed using a mucous net.

Aggregations of Living Shellfish - The term aggregation is used to refer to shellfish species that are not attached to one another yet occur at densities sufficient to provide structural habitat for other organisms. Three groups of bivalves, scallops, pen shells, and Rangia, form habitat in this way. Although not molluscan, brachiopods also form dense aggregations that function like other molluscan species. The major habitat-forming scallops that occur along the Atlantic and Gulf coasts are the bay scallop (Argopecten irradians with several recognized subspecies), calico scallop (Argopecten gibbus), and sea scallop (Placopecten magellanicus).

Pen shells (family Pinnidae) are large bivalves that bury partly into the substrate and are anchored by a substantial byssus (long, fine, silky filament). The upper portion of the shell protrudes above the substrate that provides habitat for other organisms when they occur in sufficient densities. Three species of pen shell occur along the Atlantic coast of the Americas: the saw-toothed pen shell (Atrina serrata), the amber pen shell (Pinna carnea), and the stiff pen shell (Atrina rigida).

The saw-toothed pen shell is typically found in sandy mud at depths of up to 6 m. It ranges from North Carolina to Texas and northern South America, and is relatively common in many areas in North Carolina. Several recent studies have shown that pen shells are adept at repairing damage in a short time, pointing to potentially interesting resource allocation issues (e.g., cost of shell repair) with regard to this relatively large infaunal organism. Many small shrimp and crab species spend their adult lives in the mantle cavity of this species and other pen shells, where they find refuge and feed on particles brought into the mantle cavity. Although the amber pen shell is generally found in sandy areas with depths up to 4 m, it rarely is found in the intertidal zone. It ranges from southeastern Florida to northern South America. The stiff pen shell is common in sandy muds from low intertidal to 27 m in depth. It ranges from North Carolina to southern Florida and the West Indies.

Shell Accumulations - The shells of dead molluscs sometimes accumulate in sufficient quantities to provide important habitat. Shell accumulations can occur from estuaries out to the continental slope, with several species present in each zone. For accumulations of smaller molluscs, we know little or nothing about their importance. Accumulations of eastern oyster shells are a common feature in the intertidal zone of many southern estuaries, particularly along waterways impacted by wind and boat wakes. Subtidal shell accumulations, however, provide habitat for many species of commercially and recreationally important fish.

Ecosystem Functions

Refuge - The term refuge is used to describe the protective function that shellfish habitat provides for the shellfish themselves, as well as for other organisms that occur in shellfish habitat. This ecosystem service largely results from the increase in structural complexity in shellfish habitat compared to surrounding areas (particularly soft sediments), serving as nursery areas for juvenile invertebrates and fish.

Benthic-pelagic couplin - This term refers to the transfer of materials and energy between the bottom community and the water column. It is probably most often used to refer to the overall effect of suspension feeders as they remove suspended particulates from the water column transferring materials and energy from the water column to the benthos. These feeding activities also typically cause a reduction in turbidity of the water column which has a positive impact on SAV, allowing more light penetration and higher rates of photosynthesis. The shellfish release ammonia and other metabolites that are nutrients for the SAV. Therefore, SAV and oyster reefs potentially play mutually beneficial roles. Oyster reefs are likely to reduce eutrophication by mediating water column phytoplankton dynamics and denitrification.

Erosion Reduction - By reducing erosion, oyster reefs reduce vegetation loss and preserve other habitat types. They also stabilize creek banks and help to reduce erosion of marshes, but may be easily impacted by boat wake or storm damage.

Habitat utilization - Shell bottom provides critical fish habitat not only for oysters, but also for recreationally and commercially important finfish, other mollusks, and crustaceans. Several studies have found higher abundance and diversity of fish on shell bottom than adjacent soft bottom, particularly pinfish, blue crabs, and grass shrimp. Shell bottom protects oyster spat and other juvenile bivalves, finfish and crustaceans from predators. Juvenile clams, in particular, settle in shell substrate for the protection it provides. While oyster reefs are the most recognized shell bottom habitat, shell hash concentrations on tidal creek bottoms provide important nursery habitat for young fish. A group of important species that are largely understudied throughout their range, but includes important members of intertidal and subtidal oyster reef communities, are the grass (Caridean) shrimp species within the genus Palaemonetes. Grass shrimp are found in large numbers in estuarine waters along the Atlantic and Gulf coasts, where they occur from Massachusetts to Texas.

Foraging Area - Shell bottom provides important foraging area for a variety of aquatic organisms. Fish, shrimp and crabs forage on the worms, algae, crustaceans, mollusks, and other invertebrates present on and in shell bottom habitat. Concentrations of prey organisms among the shell attract both specialized and opportunistic predators. Eggs from oysters and other organisms, and larvae from species belonging to the oyster shell bottom community, are eaten by protozoans, jellyfishes, ctenophores, hydroids, worms, mollusks, adult and larval crustaceans, and fishes. Blue crabs forage heavily on oyster reefs. Oyster reefs are also a foraging ground for many juvenile and adult turtle species. Another important species that utilizes intertidal and subtidal oyster reefs as foraging grounds is the blue crab, Callinectes sapidus. Blue crabs forage heavily on oyster reefs, including consuming oyster spat as juveniles.

Corridor and Connectivity - Shell bottom serves as a nearshore corridor to other fish habitats, such as salt marsh and SAV for finfish and crustaceans; therefore, it plays a significant ecological role in landscape-level processes. Vicinity (isolation) and connectivity of intertidal oyster reefs to other fish habitats, especially SAV, are two factors that affect fish utilization of shell bottom.

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3.3.A(9) Artificial Reefs — SAFMC

General Description

Artificial reefs or manmade reefs, are broadly defined as any structure placed on the seabed, either deliberately or accidentally (i.e. shipwrecks), that acts similar to natural hardbottom or reefs. Artificial reefs may be composed of a wide variety of materials ranging from natural rock or discarded materials, such as concrete rubble, to entirely manufactured materials. Natural reefs artificially enhanced or rehabilitated by transporting and attaching living corals are usually not considered artificial reefs.

Range and Abundance

Artificial reef programs in the southeastern U.S. are overseen by individual states (Florida, Georgia, South Carolina, and North Carolina) and require construction permits by the Army Corp of Engineers with review and approval by the USCG and EPA. While manmade reefs have been in use along the U.S. South Atlantic since the 1800s, their development in this region was somewhat limited through the mid-1960s. From the late 1960s to the present, reef development off the South Atlantic states (as measured by the number of permitted construction sites) has increased nearly five-fold, with approximately 250 sites now permitted in the coastal and offshore waters of these four states. Roughly half of these sites are in waters off the east coast of Florida alone. Artificial reef locations are considered live/hardbottom habitat.

Key Features & Characteristics

North Carolina – The North Carolina Division of Marine Fisheries maintains 47 artificial reef sites. These sites are located from one to 38 miles from shore and are strategically located near every maintained inlet and one unmaintained inlet along the coast. In recent years, most of the oceanic and some of the estuarine reefs have received new construction. Materials deployed since 1986 include 39 vessels, 10,000 pieces of large diameter concrete pipe, 210 train cars and over 40,000 tons of concrete pipe, bridge spans, railings and rubble.

South Carolina – As of June 2006, the system of marine artificial reefs managed by the South Carolina Department of Natural Resources consisted of 48 permitted sites (13 inside state waters) along approximately 160 miles of coastline. These sites range in location from estuarine creeks to as far as 50 mi offshore. Each manmade reef site consists of a permitted area ranging from several thousand square yards to as much as 24 mi^2. Approximately 37.5 mi^2 of coastal and open ocean bottom has been permitted, of which only about one percent has actually been developed through the addition of manmade reef substrate.

Georgia – The Georgia Department of Natural Resources has initiated reef construction at 22 sites 2½ to 70 nm offshore and at 15 estuarine locations along Georgia's 90-mile coast. Georgia's inshore artificial reef sites are typically small and largely inter-tidal in order to promote oyster reef development. Offshore, with the exception of three 400-yard diameter experimental "beach reefs",, the majority of the artificial reefs are located in adjacent EEZ waters 6 to 23 nm in 30 to70 ft of water and east of coastal trawling grounds. Development of two experimental "deepwater" reefs in 120 to 160 ft of water 50 to 70 nm offshore has also been initiated to address a growing recreational component targeting tunas, wahoo, and other "bluewater" gamefish. While the permitted estuarine and coastal "beach reef" sites are limited in size, the offshore EEZ sites typically average 4 nm2. These larger areas allow for the development of multiple "patch reefs," a design that improves material performance and helps disperse fishing pressure. Perhaps the best known and most popular materials of opportunity used for artificial reef development are metal vessels, which have been employed as materials off Georgia for over fifty years or more. As vessels age and collapse, they often become more complex, improving the overall growth and development of associated reef communities. Emulating the rock outcroppings underlying temperate natural reef communities, marine grade concrete is another preferred material of opportunity used for reef development in Georgia's estuarine and adjacent offshore waters. To date, almost 200,000 tons of concrete pipe, pilings, and bridge/wharf rubble generated through coastal construction projects have been deployed on Georgia's artificial reefs. Other materials utilized for offshore artificial reefs include 55 U.S. Army battle tanks and 50 New York City Transit System subway cars.

Florida - Concrete materials, chiefly culverts and other prefabricated steel reinforced concrete, were the primary reef material in nearly 67% of the 2,349 public reef deployments in waters off Florida as of September 2006. Secondary use materials such as obsolete oil platforms and steel vessels have also been used off Florida in the development of manmade reefs. Twenty-eight percent of Florida's manmade reef structures are metal structures, including 460 sunken vessels and barges. The majority of vessels sunk as manmade reefs are concentrated off Miami Dade, Palm Beach, and Broward Counties. On May 18, 2006, in partnership with the U.S. Navy, Florida's artificial reef program and Escambia County successfully deployed the Oriskany, an 888 ft-long aircraft carrier, 23 miles southeast of Pensacola, FL.

Ecosystem Functions

Ecosystem Engineering - Manmade reefs have the effect of changing habitats from a soft substrate to a hard substrate system or to add vertical profile to low profile (< 1 m) hard substrate systems. When manmade reefs are constructed, they provide hard substrate similar in function to hardbottom, providing habitat to fisheries resources. Coastal engineering structures such as bridges, jetties, breakwaters and shipwrecks provide significant hard substrate for epibenthic colonization and development of an associated finfish assemblage. Some of these structures also provide habitat in the water column and intertidal zone which differs significantly from typical benthic reefs.

Fisheries Enhancement - The proper placement of manmade materials in the marine environment can provide for the development of a healthy reef ecosystem, including intensive invertebrate communities and fish assemblages of value to both recreational and commercial fishermen.

Special Management Zones - The basic premise of this concept is to reduce user conflicts through gear and landings regulations at locations that feature limited resources, managed for specific user groups. The ability to regulate gear types utilized over the relatively limited area of a manmade reef enables fisheries managers to prevent rapid depletion of these sites and promote a more even allocation of reef resources and opportunities.

Eco-Tourism Activity Enhancement - Properly planned, manmade reefs can be designed to encourage diving and to reduce spatial conflicts with other user groups, including fishermen. Materials selected could be designed and deployed to create specific fisheries habitat for tropical, cryptic, and other species valued by tourists, conservationists, naturalists, photographers and other non-extractive users. The establishment of additional hardbottom reef communities in areas with thriving dive-related industries could be used to reduce diving-related pressures on existing natural reefs, especially in the case of sensitive coral reefs in the Florida Keys.

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3.3.A(10) Habitat Areas of Particular Concern (EFH-HAPC) - South Atlantic Fishery Management Council

The Habitat Areas of Particular Concern managed by the South Atlantic Fishery Management Council is identified and defined in the Essential Fish Habitat - Habitat Areas of Particular Concern (EFH-HAPC) and Coral Habitat Areas of Particular Concern (C-HAPC) worksheet provided by the SAFMC, which can be found at: http://www.safmc.net/ecosystem-management/essential-fish-habitat**.** To outline the South Atlantic Fishery Management Council's EFH-HAPC in this biological assessment, this biological assessment divides each into two categories: features and geographic areas.

3.3.A(10)(a) SAFMC EFH-HAPC Features.

The **SAFMC EFH-HAPC features** (both specific and general) located in the RRT4 coastal area of operation comprise one or more, or include components of, the EFH types previously described in Sections 3.3.A(1)-(9). Those features that have been identified as occurring within the "green zone" are presented in Table VI-26. For the purposes of this biological assessment, the determination of the impacts of preauthorized use of dispersants and in-situ burn operations on each EFH-HAPC feature is assumed the same as the determination of impacts to each of the corresponding EFH(s), described in Sections 3.3.A(1)-(9) and analyzed in Chapters 5 & 6 of this assessment, based on the shared characteristics between the EFH-HAPC feature and the EFH type(s) of which they are comprised.

Table 3-1. South Atlantic Fishery Management Council Essential Fish Habitat – Habitat Areas of Particular Concern in the Green Zone

SAFMC EFH-HAPC in the Green Zone	Corresponding EFH
All areas within the EEZ that contain *Sargassum* population	*Sargassum*
Documented sites of spawning aggregations in NC, SC, GA and FL described in the Habitat Plan; other spawning areas identified in the future; and habitats identified for submerged aquatic vegetation (SAV).	All
Medium to high profile offshore hard bottoms where spawning normally occurs; localities of known or likely periodic spawning aggregations;	Live/Hardbottom
The Point	Water Column
The Ten Fathom Ledge	Water Column
Big Rock (North Carolina)	Water Column
Charleston Bump (South Carolina)	Water Column

SAFMC EFH-HAPC in the Green Zone	Corresponding EFH
Seagrass habitat; oyster/shell habitat; pelagic and benthic *Sargassum*;	Seagrass *Sargassum* Oyster Reef Water Column
Hoyt Hills	Water Column
Hermatypic coral habitats and reefs	Coral Reef & Communities
Manganese outcroppings on the Blake Plateau	Life/Hardbottom
Council designated Artificial Reef Special Management Zones (SMZs).	Artificial Reefs
Sandy shoals of Capes Lookout, Cape Fear, and Cape Hatteras from shore to the ends of the respective shoals, but shoreward of the Gulf stream;	Soft Bottom
Hurl Rocks (South Carolina);	Water Column
The Point off Jupiter Inlet (Florida);	Water Column
The Hump off Islamorada, Florida;	Water Column
The Marathon Hump off Marathon, Florida;	Water Column
The "Wall" off of the Florida Keys;	Water Column
Pelagic *Sargassum*;	*Sargassum*
Big Rock: The Big Rock area encompasses 36 square miles of deep drowned reef around the 50-100 meter isobath on the outer shelf and upper slope approximately 36 miles south of Cape Lookout.	Deepwater
Gray's Reef National Marine Sanctuary: an inner-shelf (18-20 m) live bottom reef off Georgia	Live/Hardbottom
Offshore (530 meter; 15-90 feet) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks	Live/Hardbottom
Georgetown Hole (South Carolina);	Water Column

3.3.A(10)(b) SAFMC EFH-HAPC Geographic Areas.

The **SAFMC EFH-HAPC geographic areas** located in the RRT4 coastal area of operation comprise one or more, or include components of, the EFH previously described in Sections 3.3.A(1)-(9). Those geographic areas that have been identified as occurring within the "green zone" are presented in Table VI-27. For the purposes of this biological assessment, the determination of the impacts of preauthorized use of dispersants and in-situ burn operations on each EFH-HAPC geographic area is assumed the same as the determination of impacts to each of the corresponding EFH(s) described in Sections 3.3.A(1)-(9) and analyzed in Chapters 5 & 6 of this assessment, based on the shared characteristics between EFH-HAPC geographic areas/locations and the EFH type(s) of which they are comprised.

Table 3-2. South Atlantic Fishery Management Council Essential Fish Habitat – Habitat Areas of Particular Concern in the Green Zone

SAFMC Specific HAPC	Geographic Boundary
Oculina Bank HAPC	North boundary: 28^{O} 30’ N. Lat. South boundary: 27^{O} 30’ N. Lat. East boundary: 100 fathom contour; West boundary: 80^{O} 00’ W. Long.
Satellite Oculina Bank HAPC #1	North boundary: 28^{O} 30’ N. Lat. South boundary: 28^{O} 29’ N. Lat. East boundary: 80^{O} 00’ W. Long. West boundary: 80^{O} 03’ W. Long.
Satellite Oculina Bank HAPC #2	North boundary: 28^{O} 17’ N. Lat. South boundary: 28^{O}16’ N. Lat. East boundary: 80^{O} 00’ W. Long. West boundary: 80^{O} 03’ W. Long.

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3.3.B. Essential Fish Habitats and Habitats of Particular Concern Gulf of Mexico Fishery Management Council

The following information on Essential Fish Habitats and Habitats of Particular Concern managed by the Gulf of Mexico Fishery Management Council (GMFMC) comes directly from the Essential Fish Habitat – Gulf of Mexico Overview provided by the NMFS Southeast Region (Version: 08-2015), and the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (Volume 1: Text, March 2004, Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration Award No. NA17FC1052). Where further amplification was necessary to fully evaluate specific features of Gulf of Mexico EFH, the Generic Amendment for Addressing Essential Fish Habitat Requirements (October 1998, Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration, Award No. NA87FC0003) was used. The information presented here serves as the foundation from which this Biological Assessment will address essential fish habitat.

<table>
<tr><td>3.3.B(1) Pelagic (water column)</td><td>GMFMC</td></tr>
<tr><td>

Figure 3-8. Gulf of Mexico Fishery Management Council Region Boundary</td><td>General Description
The Gulf of Mexico is a semi-enclosed, oceanic basin connected to the Atlantic Ocean by the Straits of Florida and to the Caribbean Sea by the Yucatan Channel. Although its surface area is more than 160 million ha (395 million ac), it is a small basin by oceanic standards. Most of the oceanic water entering the Gulf flows through the Yucatan Channel, a narrow (160 km wide) and deep (1,650-1,900 m) channel. Water leaves the Gulf through the Straits of Florida, which is about as wide as the Yucatan Channel, but not nearly as deep (about 800 m). This pattern of water movement produces the most pronounced circulation feature in the Gulf of Mexico basin, known as the Loop Current with its associated meanders and intrusions. After passing through the Straits of Florida, the Loop Current, also known as the Florida Current at this stage, merges with the Antilles Current to form the Gulf Stream.</td></tr>
<tr><td colspan="2">Key Features & Characteristics</td></tr>
<tr><td colspan="2">Temperature - In the northwestern Gulf of Mexico (the Rio Grande River to the Mississippi River), bottom temperatures showed a seasonal range of 15° C (27° F) or more, but on the outer shelf the seasonal range was only 2° C (3.6° F) or less. The temperature increased with depth, with a broad band of warmer water, between 17° C (63° F) and 19° C (66° F), across the middle to deeper shelf. However, on the outer shelf off central Louisiana and south Texas, temperatures dropped below 17° C (63° F), presumably due to the intrusion of cold deeper waters. For the eastern Gulf of Mexico (Mississippi River to the Florida Keys), during the months of January, the coldest shelf water (14° C [57° F]) appeared just off the Mississippi barrier islands. Water colder than 16° C (61° F) occupied the nearshore shelf out to the 25-m isobath from the Chandeleur Islands to Cape San Blas, Florida, and below that point it extended to the 20-m isobath to northern Tampa Bay. West of DeSoto Canyon all bottom shelf waters were below 18° C (64° F). However, east of DeSoto Canyon, all outer shelf waters exceeded 18° C (64° F), and the 18° C (64° F) and 20° C (68° F) isotherms passed diagonally shoreward across the isobaths so that all shelf waters from just above Charlotte Harbor to the Florida Keys were 18° C (64° F) or above. During August, the temperature of the nearshore bottom water ranged from 26° C (79° F) near Panama City, Florida, to 30° C (86° F) around Cedar Keys, Florida. Throughout the eastern Gulf shelf, bottom water temperatures decreased with depth. Near the Mississippi River Delta the outer shelf water was 22° C (72° F), but temperatures down to 16° C (61° F) were observed along both the eastern and western rims of DeSoto</td></tr>
</table>

Canyon and at several localized areas along the outer shelf of Florida. For most of the shelf of the Florida peninsula, bottom isotherms paralleled the isobaths.

Salinity - Surface salinities in the Gulf of Mexico vary seasonally. During months of low freshwater input, surface salinities near the coastline range between 29 and 32 ppt. High freshwater input conditions during the spring and summer months result in strong horizontal salinity gradients with salinities less than 20 ppt on the inner shelf. The waters in the open Gulf are characterized by salinities between 36.0 and 36.5 ppt.

The salinity patterns reflect heavier river outflows in the Louisiana, Mississippi, and Alabama area especially during the spring, and lower freshwater outflow from the streams of Florida. The patterns also reflect the movement of open Gulf water over the lower half of the Florida shelf and intrusion of slope water around DeSoto Canyon and along the outer shelf of Florida. Freshwater springs occur at several locations on the Florida shelf.

Dissolved Oxygen - Dissolved oxygen values in the Gulf of Mexico average about 6.5 ppm, with values averaging about 5 ppm during the summer months. Areas of anoxic bottom water have not been reported from the eastern Gulf continental shelf. However, summer hypoxia of bottom water has been noted for Mobile Bay and Tampa Bay. Areas of excessively low bottom oxygen values (less than 2.0 ppm) have long been known to occur off central Louisiana and Texas during periods of stratification in the warmer months. Oxygen deficient conditions occur primarily from April through October and may cover up to 1.82 million ha (4,495,400 ac) during the midsummer with the location and extent varying annually.

A large zone of oxygen-depleted water extends across the Louisiana continental shelf and on to the Texas coast most summers. Many hypoxic zones elsewhere in the world have been caused by excess nutrients exported from rivers, resulting in reduced commercial and recreational fisheries, the disruption of benthic and demersal communities, and lead to mass mortalities of aquatic life.

Turbidity - Surface turbidity in the marine environment in the Gulf of Mexico is limited to the areas affected by the major river systems (e.g., the Mississippi/Atchafalaya River). Close inshore the high turbidity from the Mississippi River commonly extends through the entire water column with turbidity maxima occurring at the surface and toward the bottom. Farther offshore where color and intensity of turbidity indicate the amount and average grain size of material in the surface layer have decreased, the subsurface waters are also somewhat turbid, but the difference between the waters above and below may be more visible than inshore. Still farther offshore, the interface below the surface stratum becomes more diffuse as vertical mixing progresses, until a distinction ceases to exist. Another type of turbidity is the layer of turbid water commonly found near the bottom. Called nepheloid layers, these turbid waters occur in the north-central and northwestern Gulf of Mexico when the turbulence of the water is high enough to offset the settling of the sedimentary particles under the influence of gravity.

Currents - In the Loop Current, current speeds may exceed 2 m/s and transports are of the order of 0.03 km3 /s. Large unstable rings of water are shed off of the Loop Current, bringing massive amounts of heat, salt and water across the Gulf. The Loop Current plays an important role in shelf nutrient balance, at least in the eastern Gulf.

Freshwater Discharge - Runoff from precipitation on almost two-thirds of the land area of the U.S. eventually drains into the Gulf of Mexico via the Mississippi River. The combined discharge of the Mississippi and Atchafalaya Rivers alone accounts for more than half the freshwater flow into the Gulf and is a major influence on salinity levels in coastal waters on the Louisiana/Texas continental shelf. The annual freshwater discharge of the Mississippi/Atchafalaya River system represents approximately 10% of the water volume of the entire Louisiana/Texas shelf to a depth of 90 m. The Loop Current and Mississippi/Atchafalaya River system, as well as the semi-permanent, anticyclonic gyre in the western Gulf, significantly affect oceanographic conditions throughout the Gulf of Mexico.

3.3.B(2) Drift Algae (*Sargassum*, pelagic *Sargassum* community) | GMFMC

Note: The following information comes directly from the Essential Fish Habitat – Gulf of Mexico Overview provided by the NMFS Southeast Region (Version: 08-2015), and the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (Volume 1: Text, March 2004, Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration Award No. NA17FC1052). Where further amplification was necessary to fully evaluate specific features of Gulf of Mexico EFH, the Generic Amendment for Addressing Essential Fish Habitat Requirements (October 1998, Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration, Award No. NA87FC0003) was used. The information presented here serves as the foundation from which this Biological Assessment will address essential fish habitat.

General Description

The pelagic *Sargassum* community is found worldwide in circumtropical locations, and can be found in both nearshore and offshore waters. The pelagic brown algae *Sargassum* spp. provides a dynamic structural habitat in the surface waters of the Gulf of Mexico. The pelagic species propagate by vegetative fragmentation. The plants exhibit a complex branching that forms lush foliage. While most *Sargassum* occurs in the Atlantic Ocean, it also occurs in the Gulf of Mexico. Pelagic *Sargassum* supports a diverse assemblage of marine organisms. Juvenile and adult fish often associated with *Sargassum* also frequent other drifting objects. Possible reasons for the association with *Sargassum* include protection, feeding, cleaning, shade, structural affinity, visual reference, tactile stimulation, historical accident, passive drift, and use as a spawning habitat.

Key Features & Characteristics

Three species of the brown algae, *Sargassum natans* (80%) *S. fluitans* (10%) and detached sessile *S. filapendula* (10%), comprise the pelagic complex in the Gulf of Mexico. This complex consists of the floating algae and a diverse community of epibiota including algae, fungi, at least 100 species of attached, sessile or motile invertebrates, more than 100 species of fishes and 4 species of sea turtle. Major groups of invertebrates include hydroids, anthozoans, flatworms, bryozoans, polychaetes, gastropods, nudibranchs, bivalves, cephalopods, pycnogonids, isopods, amphipods, copepods, decapod crustaceans, insects, and tunicates. Shrimp and crabs constitute the majority of the invertebrate biomass associated with the *Sargassum* complex and comprise the major source of food for *Sargassum*-associated fish. Nearly 10% of *Sargassum*-associated invertebrates and two species of fish are endemics. *Sargassum* also acts as a vehicle for dispersal of some of its inhabitants and may be important in the life histories of many species of pelagic, littoral, and benthic fish, providing them with a substratum, protection against predation, and concentration of food in the open Gulf. The jacks (carangids) were one of the most numerous and diverse groups associated with *Sargassum*. Very young jacks (< 20 mm) were found within the protection of the weed, while the larger jacks were found progressively further below and away from the weed. Large amberjacks, Seriola dumerili, dolphin, Coryphaena hippurus, and almaco jacks, S. rivoliana, are major predators of the *Sargassum* complex. The gray triggerfish, Balistes capriscus, is also associated with *Sargassum*.

The *Sargassum* found in the Gulf of Mexico is carried there from the North Atlantic via the North Atlantic Gyre then through the Straits of Florida on the Florida Current. Once inside the Gulf of Mexico, it either remains drifting in the Gulf Stream, sinks, or is blown ashore by onshore winds. The *Sargassum* complex constitutes a concentration of productivity in the otherwise nutrient-poor epipelagic. If it sinks, it adds organic carbon to deep bottom sediments and constitutes a major nutrient source for deep-sea benthos. If it drifts, it provides habitat and food resources that would not otherwise be present to a variety of organisms. If it is blown ashore, it provides a source of organic material to beaches and other coastal habitats.

Ecosystem Functions

[A study] presents a list of fishes associated with the *Sargassum* complex in the area of southern Florida where it is picked up by the Florida Current and carried into the Gulf of Mexico. From April 1966-May1967, 3.9 metric tons of floating *Sargassum* [was collected] from the Florida Current that contained about 8,400 fishes from 8 orders, 23 families, 36 genera and 54 species. Carangidae (jackfish; 14 species), Monacanthidae (filefish; 10 species), Balistidae (triggerfish; 4 species) and Antennariidae (frogfish; 1 species) comprised 90% of all species collected. Of the species managed by the Gulf Council, lesser amberjack (Seriola fasciata) and banded rudderfish (S. zonata) were listed as moderately-associated with *Sargassum* and gray triggerfish (Balistes capriscus), greater amberjack (S. dumerili), and almaco jack (S. rivioliana) as closely-associated with *Sargassum*.

A recent study of the fish communities associated with *Sargassum* in the northern Gulf of Mexico collected fishes representing 57 families, and 135 species during 2001-2002 (Franks et al. 2002). The most numerically abundant fishes were Exocoetidae (28%), Carangidae (27%), and Balistidae (12%). Managed species using *Sargassum* habitat included greater and lesser amberjacks, almaco jack, banded rudderfish, cobia, Spanish mackerel, king mackerel, and gray triggerfish. Potential prey fishes such as the round scad also use *Sargassum*. Pelagic *Sargassum* habitats were found to function as a refuge from predators, a source of prey (such as small shrimp and crabs) for juvenile fishes, spawning substrate for some fishes, and a habitat providing shade and a visual reference.

Many species of jacks are thought to be pelagic spawners and the young use *Sargassum* as a nursery. Very young jacks (>20 mm) were found within the *Sargassum* complex and moved farther below and away from the floating mats as they grew. Young amberjacks appeared to use *Sargassum* as refuge whereas large amberjacks were major predators within the complex. Its resident planktonic population of copepods and larval decapods provided food for the juvenile jacks, filefishes and triggerfishes that hid within the protective mat. Larger jacks that swim around and below the mat capture smaller fish and shrimp. The filefishes fed mainly on hydroids and bryozoans, and triggerfishes ate a number of other *Sargassum* invertebrates. The stomach contents of the small gray triggerfish associated with the *Sargassum* complex indicated its heavy reliance on the complex for food. Both filefishes and triggerfishes are important forage fish used by pelagic predators, particularly dolphins and tunas.

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3.3.B(3) Shelf Edge/Sope (continental shelf) — GMFMC

Note: The following information comes directly from the Essential fish Habitat – Gulf of Mexico Overview provided by the NMFS Southeast Region (Version: 08-2015), and the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (Volume 1: Text, March 2004, Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration Award No. NA17FC1052). Where further amplification was necessary to fully evaluate specific features of Gulf of Mexico EFH, the Generic Amendment for Addressing Essential Fish Habitat Requirements (October 1998, Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration, Award No. NA87FC0003) was used. The information presented here serves as the foundation from which this Biological Assessment will address essential fish habitat.

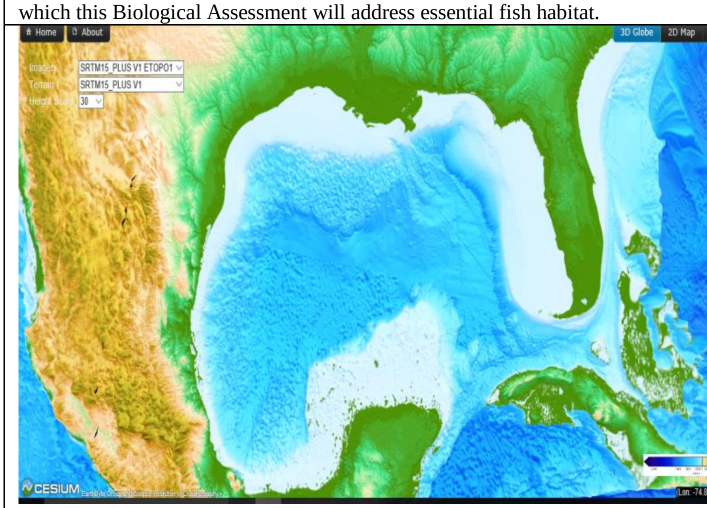

Figure 3-9. Gulf of Mexico general shaded relief map

General Description

The continental slope is a transitional environment influenced by processes of both the shelf and the abyssal (deep sea) Gulf (>975 m). This transitional character applies to both the pelagic and the benthic realms.The continental slope of the Gulf basin is a region of gently sloping sea floor that extends from the shelf edge, or roughly the 200-m isobath, to the upper limit of the continental rise, at a depth of about 2,800 m. The slope occupies more than 500,000 km2 of prominent escarpments, knolls, basins, ridge and valley topography and submarine channels.

Key Features & Characteristics

Primary Production - The highest values of surface primary production are found in the upwelling area north of the Yucatan Channel and in the DeSoto Canyon region. In general, the Western Gulf is more productive in the oceanic region than is the Eastern Gulf. It is generally assumed that all the phytoplankton is consumed by the zooplankton, except for brief periods during major plankton blooms. The zooplankton then egests a high percentage of their food intake as feces that sink toward the bottom. Most of the herbivorous zooplankton are copepods, calanoids being the dominant group. Compared to the shelf, there is less plankton on the slope and in the deep Gulf. In addition, some of the planktonic species are specifically associated with either the slope or the deep sea. The biomass of plankton does not appear to be affected by seasonal changes. Some east-west variations noted among diatom species have been attributed to the effects of different water masses, i.e., normal Gulf waters versus those influenced by the Mississippi River.

Sediment - Sediment characteristics of the Gulf of Mexico continental slope exhibit regional differences. The most common sediment type on the slope was silty clay, occurring in all geographic regions. However, in the eastern Gulf this general sediment type had higher percentages of sand than in the western or central areas of the Gulf. Clay sediments were found in the western and central Gulf but not in the eastern Gulf samples. In contrast, sand-silt-clay sediments were represented at some eastern Gulf stations but absent from the western Gulf stations. Sandy clay was found at shallow and deep stations in the western Gulf and at deep stations in the eastern Gulf. Gulf of Mexico slope sediments contain a mixture of terrigenous, petroleum, and planktonic hydrocarbons. Petroleum hydrocarbons were detected at all locations and have a dual source in natural seepage and river-associated transport. Hydrocarbons were preferentially associated with clay-like, organic-rich sediments suggesting a linkage with river-derived material. Aromatic hydrocarbon concentrations were very low at all locations but their presence was confirmed by fluorescence analysis.

Ecosystem Functions

The macro fauna (those organisms collected with box corers and retained on a 0.300 mm sieve) of the continental slope of the Gulf of Mexico are abundant (average transect densities ranged from 1,500 to 3,000 individuals/m2) and highly diverse. Except in the region of the shelf break, there is little or no tendency towards dominance by any species. A total of 324 individual benthic samples taken in the program contained nearly 50,000 macrofaunal organisms, largely of "rare species." However, the Gulf of Mexico slope macrofauna are neither as abundant nor as diverse as the macrofauna of the U.S. Atlantic slope. Given that both diversity and density levels are reduced [it was] suggested that food limitation is a more likely explanation for the observed differences than a low standing stock due to higher turnover rates in the Gulf.

Most species exhibited highly restricted depth distributions, with variation across isobaths being much greater than variation along isobaths. Sampling depths ranged from approximately 350 to approximately 3,000 m identified three macrofaunal zones on the continental slope of the Gulf of Mexico:

Shelf/Slope Transition Zone (150-450 m) is a very productive part of the benthic environment.
- Demersal fish are dominant, many reaching their maximum populations in this zone. Asteroids, gastropods, and polychaetes are common.

Upper Archibenthal Zone: The Archibenthal Zone has two subzones.
- The Horizon A Assemblage is located between 475 and 750 m. Although less abundant, the demersal fish are a major constituent of the fauna, as are gastropods and polychaetes. Sea cucumbers are more numerous.
- The Horizon B Assemblage, located at 775-950 m, represents a major change in the number of species of demersal fish, asteroids, and echinoids, which reach maximum populations here. Gastropods and polychaetes are still numerous.

The Upper Abyssal Zone is located between 975 and 2,250 m.
- Although the number of species of demersal fish drops, the number that reach maximum populations dramatically increases. This indicates a group uniquely adapted to the environment. Sea cucumbers exhibit a major increase, and gastropods and sponges reach their highest species numbers here.

The Mesoabyssal Zone, Horizon C (2,275-2,700 m) exhibits a sharp faunal break.
- The number of species reaching maximum populations in the zone drops dramatically for all taxonomic groups.

The Mesoabyssal Zone, Horizon D Assemblage (2,725-3,200 m) coincides with the lower part of the steep continental slope in the Western Gulf.
- Since the Central Gulf is dominated at these depths by the Mississippi Trough and Mississippi Fan, the separation of Horizon C and D assemblages is not as distinct in the Central Gulf. The assemblages differ in species constitution.

The Lower Abyssal Zone (3,225-3,850 m) is the deepest of the assemblages.
Megafauna is depauperate. The zone contains an assemblage of benthic species not found elsewhere. The megafauna (caught with trawl) contained over 5,400 vertebrates (fish) and more than 40,600 invertebrates. Some 126 species of fish and 432 species of invertebrates were collected.

The topographic and physical oceanographic conditions at East Breaks in the Western Gulf support nutrient-rich upwelling, which may significantly contribute to recreational billfishing in the area and the year-round presence of large pelagic filter feeders such as whale sharks and manta rays

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3.3.B(3)(a) The West Florida Shelf	GMFMC

The west Florida shelf is composed mainly of carbonate sediments in the form of quartz-shell sand (> 50 percent quartz), shell-quartz sand (< 50 percent quartz), shell sand, and algal sand. The bottom consists of a flat limestone table with localized relief due to relict reef or erosional structures. The benthic habitat types include low relief hard bottom, thick sand bottom, coralline algal nodules, coralline algal pavement, and shell rubble. The west Florida slope forms the edge of a sequence of carbonates intercalated with evaporites more than 5 km thick.

The west Florida shelf provides a large area of scattered hard substrates, some emergent, but most covered by a thin veneer of sand, that allow the establishment of a tropical reef biota in a marginally suitable environment. The only high relief features are a series of shelf edge prominences that are themselves the remnants of extensive calcareous algal reef development prior to sea level rise and are now too deep to support active coral communities. In water depths of 70 to 90 m along the southwest Florida shelf, a series of carbonate structures forms a series of steps along the shelf. This area corresponds to the partially buried, 5 km wide reef complex known as Pulley Ridge, which does support some living coral biota (including scleractinian corals) and associated organisms in its shallowest portions. The partially buried ridge runs from an area west of the Dry Tortugas, northward for approximately 100+ km. The shelf edge is marked by a double reef trend in water depths of 130 and 300 m known as Howell Hook. Howell Hook is an arcuate ridge running northward for approximately 105 km. The lower reef crests at about 210 m in the south and 235 m in the north and forms a 40-m high scarp.

Florida Middle Ground is a 153,600 ha (379,392 ac) hard bottom area 160 km westnorthwest of Tampa, Florida. This region is characterized by steep profile limestone escarpments and knolls rising 10 to 13 m above the surrounding sand and sand-shell substrate, with overall depths varying from 26 to 48 m. However, its location is apparently too far northward to allow the establishment of massive hermatypic coral assemblages.

Madison-Swanson is a 298 square km (115 square mile) area, south of Panama City, Florida, containing high-relief hard bottom habitat, and is a known spawning ground for gag and some other reef fish species. Depths run between 60 and 100 meters, with habitats ranging from low-relief drowned patch reefs (0.5-2.5 m vertical relief) to high-relief ridges and pinnacles (9-16 m vertical relief). Substrate fauna includes encrusting sponges, sea fans, corkscrew sea whips, Oculina coral, and coralline algae. Among the invertebrates found there are galatheid and goneplacid crabs, arrow crabs, crinoids, hermit crabs, basket stars, and squid. Fish species inhabiting Madison-Swanson include gag, scamp, tilefish, amberjack, snowy grouper, red snapper, short bigeyes, roughtongued bass, batfish, red barbier, reef butterflyfish, and bank butterfish. Another known spawning ground for gag and other reef fish species is Steamboat Lumps, which is a low-relief area of 269 km^2 (104 mi^2), located west of Tarpon Springs.

Dry Tortugas refers to a roughly 480 nm^2 area of carbonate banks situated in open ocean, approximately 70 mi west of Key West, and 140 mi from mainland Florida. One of the banks is emergent with seven small, sandy islands. The banks define a roughly circular pattern and were describe as an atoll. The shallow rim of the atoll is discontinuous and consists of Holocene (<10,000 years old) coral and the sandy islands. The Holocene reefs are approximately 14 m thick, and are situated upon an antecedent high of the Key Largo Limestone, formed approximately 125,000 years ago. Two significant carbonate banks are situated in close proximity to the Dry Tortugas, known as Tortugas Bank and Riley's Hump.

3.3.B(3)(b) The Mississippi-Alabama Shelf	GMFMC

The Mississippi-Alabama Shelf is a small area extending from the Mississippi River Delta to DeSoto Canyon. The sediments found here are terrigenous to the west, integrating to carbonate sediments near DeSoto Canyon. The outer shelf is dominated by topographic features, which represent the remains of ancient reef or shoreline structures. The bottom irregularities found on the shelf and shelf break off the coasts of Alabama and Mississippi were investigated and termed the low-relief hard bottom features "pinnacles." These pinnacles are made of hard, rigidly-cemented, irregularly-shaped aggregates of calcareous organic structures.

These calcareous shelf edge and upper slope prominences are present in a wide band (approximately 1.6 km) along the shelf edge from 85° to 88° W longitude. They found the average pinnacle height to be 9 m with some pinnacles exceeding 15 m in relief and the average water depth to the top of the pinnacles to be 99 m. The average water temperature corresponding with this depth was 17.3° C (63 ° F) and the average salinity was 37 ppt. Pinnacles ranged in water depths from 102 to 179 m and water depths to the top of the pinnacles were found in two zones. In the shallower zone, the depth to the top of the pinnacles ranged from 68 to 84 m and in the deeper zone the depth to the top of the pinnacles ranged from 97 to 101 m. The greatest number of pinnacles was in water depths of 102 to 113 m.

The most common organic constituents of their sediment samples within the pinnacle area [was found] to be calcareous algae, gastropods, stony corals and bryozoans. All of the calcareous algae collected were red algae (Rhodophyta), which constitute up to 75% of the sediments within the pinnacle area. The presence of the algae suggests formation in water depths considerably shallower than those near the pinnacles today.

Hard bottoms are located in several locations on the inner continental shelf adjacent to Florida and Alabama, in depths of 18 to 40 m. These hard bottom areas lie south of the mouth of Mobile Bay and south of the Alabama/Florida state line. They have a vertical relief of 0.5 to 5 m. [These areas were] identified as either:

1) massive to nodular sideritic sandstones and mudstones,
2) slabby aragonite-cemented coquina and sandstone,
3) dolomitic sandstone occurring in small irregular outcrops and
4) calcite-cemented algal calcirudite occurring in reef-like knobs.

The **Southeast Banks** area lies south-southeast of the mouth of Mobile Bay, approximately 28 km offshore in water depths of 21 to 26.5 m. Southeast Banks consists of a rock rubble field with 4 m of relief on a moderately sloping bottom of shell hash and silty sand.

The **Southwest Rock** area is located southwest of the mouth of Mobile Bay, approximately 17 km south of Dauphin Island in water depths of 20 to 22 m. Southwest Rock consists of a rock outcrop, 7 to 9 m across, that rises 1 to 1.5 m above a smooth bottom of muddy sand. A smaller outcrop, approximately 1.5 to 3.5 m across, is located 10 m to the southwest. Epifauna included mostly barnacles, serpulids, and bryozoans. Near Southwest Rock is a site that encompasses a gently sloping ridge that trends north-northwest to south-southeast and has 1 to 1.5 m of relief.

The **17 Fathom Hole** is a depression consisting of small rock rubble, shell, and coarse sand with relief of 5 m located approximately 37 km south of Mobile Bay in water depths of 30 to 32 m.

The **Big Rock/Trysler Grounds** area is located approximately 46 km offshore of the Alabama-Florida state line in water depths of 30 to 35 m. Big Rock consists of a large mound feature with 5 m of relief. The Trysler Grounds consists of small rocks with relief of 2 to 3 m on an irregular bottom.

The **40 Fathom Isobath** area is located 24 km northeast of the pinnacles area, in water depths of approximately 75 m. This area consists of topographic features with up to 9 m of relief that are either mound-like, pinnacle-like, or ridge-like in form.

3.3.B(4) Coral Reefs (reef halos, patch reefs, deep reefs) — GMFMC

Figure 3-10. Deep reefs, referred to as mesophotic coral ecosystems, can be found from 100-330 feet in the eastern Gulf of Mexico. Pictured is a scamp grouper at 320 feet off the Dry Tortugas. Image courtesy of the Cooperative Institute for Exploration, Research & Technology.

General Description

Although not common, several coral reef communities exist in the Gulf of Mexico. Far more common are solitary coral colonies, which exist throughout the Gulf of Mexico. Within the Gulf of Mexico, corals and coral reef communities exist in oceanic habitats of corresponding variability, from nearshore environments to continental slopes and canyons, including the intermediate shelf zones. Corals may dominate a habitat (coral reefs), be a significant component (hard bottom), or be individuals within a community characterized by other fauna (solitary corals).

Key Features & Characteristics

Solitary corals are a minor component of the bottom communities and comprise a minor percentage of the total coral stocks in the Gulf of Mexico.

Coral reefs exist in areas surrounding the Dry Tortugas, an island group about 117 km west of Key West, Florida. The Dry Tortugas reefs form an elliptical atoll-like structure about 27 km long by 12 km wide. Living coral reefs occupied less than 4% (4,831 ha [11,933 ac]) of the bottom above the 18-m line at the Dry Tortugas in 1976. Bird Key Reef in the Dry Tortugas [was studied], recording 45 species of stony corals. The most extensive reef type coral was staghorn coral, Acropora cervicornis. It covered a total of 478 ha (1,181 ac), and accounted for 55%of the scleractinian coral cover. Nearly half the staghorn reef type was concentrated in a single 220 ha (543 ac) reef. This reef was at depths of 6 to 14 m in an area of strong tidal currents. Coral head buttresses occupied a total 251 ha (620 ac). These buttresses occupied only 1.1 percent of the bottom, but they provided shelter for large concentrations of fishes, spiny lobster, Panulirus argus, and echinoderms near seagrass and octocoral foraging areas, making them critical elements of the Dry Tortugas system. The bank reef area accounted for 137 ha (338 ac) of the coral reef hard bottom.

On the shallow flats between the outer reefs and the lagoonal grass beds, a hard bottom community of exposed limestone dominated by octocorals occupied 3,965 ha (9,794 ac). On the shallowest portions of the southeastern sides of the major banks, small algal communities occupied a total of 114 ha (282 ac). From 100 to 250 m seaward, the sea floor is a mosaic of low relief, limestone outcroppings interspersed with carbonate sediments. The limestone outcroppings support a diverse assemblage of sessile reef organisms.

A newly studied deep reef named Pulley Ridge consists of a series of north-south oriented, drowned barrier islands on the southwest Florida shelf about 250 km west of Cape Sable. The ridge is 100+ km long and approximately 5 km across feature with less than 10 m of vertical relief and an abundance of mounds and pits. At the structures shallowest end in the southern portion (60 m deep) a variety of living coral reef organisms are found: scleractinian corals; octocorals; green, red, and brown algae; sponges; coralline algae; and tropical reef fishes. The corals found most commonly on Pulley Ridge were Agaricia spp. and Leptoceris cucullata, and other corals include Montastrea cavernosa, M. formosa, M. decactis, Porites divaricata, and Oculina tellena. Beyond 80 m, coralline algae increases in abundance, while coral abundance diminishes. Reef fishes associated with the living reef area include FMP species like red grouper, scamp, and sand tilefish; as well as typical reef residents like butterfly fishes and angelfishes. About 25% of the reef fish community consists of herbivores.

The unusual benthic productivity on Pulley Ridge, between 60 and 70 m, is probably due to the underlying drowned barrier islands which provide an elevated lithified substrate for the attachment of benthic organisms; the clear warm water that the area receives from the western edge of the Florida Loop Current, and its location within the thermocline which provides extra nutrients. Hermatypic corals and photosynthetic organisms on the ridge survive on only 1-2% of the available surface light, while most shallow reef communities require at least 5%.

Pulley Ridge [was proposed as being] the deepest coral reef in the U.S., although it does not adhere to the strict geological definition of a coral reef. The USGS and university scientists are currently studying the area. This study is expected to last at least until mid 2005. Due to its location, this reef /hard bottom area is not affected by temperature changes, increased turbidity, and nutrient overload like the shallower reefs found to the east.

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3.3.B(5) Submerged Aquatic Vegetation (SAV, seagrasses, benthic algae)	GMFMC

Note: The following information comes directly from the Essential Fish Habitat – Gulf of Mexico Overview provided by the NMFS Southeast Region (Version: 08-2015), and the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (Volume 1: Text, March 2004, Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration Award No. NA17FC1052). Where further amplification was necessary to fully evaluate specific features of Gulf of Mexico EFH, the Generic Amendment for Addressing Essential Fish Habitat Requirements (October 1998, Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration, Award No. NA87FC0003) was used. The information presented here serves as the foundation from which this Biological Assessment will address essential fish habitat.

General Description

Entire fisheries may depend on production by seagrass habitats particularly subtropical and tropical areas and to a lesser extent in temperate waters. Seagrasses are marine vascular plants found in shallow estuaries and some nearshore habitats worldwide. Vast expanses of shallow bottom are often covered with plants (meadows) due to their clonal habit. Seven species of seagrasses can be found in Gulf of Mexico estuaries and nearshore areas: shoalgrass (Halodule wrightii, also known as Halodule beaudettei), clover grass (Halophila decipiens, H. johnsonii, H. engelmanni), manatee-grass (Syringodium filiforme, also known as Cymodocea filiformis), widgeon grass (Ruppia maritima) and turtle grass (Thalassia testudinum). Most seagrass meadows include many species of algae.

Range and Abundance

There are about 1,927,500 ha of seagrasses in estuarine and nearshore areas of the Gulf of Mexico including Mexico and Cuba. An estimated 1 million ha of seagrasses are found in the estuaries and nearshore areas of the Gulf states with approximately 95% found in Texas and Florida.

Key Features & Characteristics

Both seagrasses and macroalgae have been found to be important nursery habitats for numerous fish species. The relationship between seagrasses and macroalgae depends on the source and concentrations of nutrients. Macroalgae take up most of their nutrients from the overlying water while seagrasses rely primarily on sediment nutrients and endosymbionts. As a result, macroalgae can bloom in estuaries with high nutrient concentrations in the water column. Macroalgal blooms can smother seagrasses and create decomposing mats that displace or kill animals. Some rhizophytic species of algae, such as those in the genus Caulerpa mimic seagrasses, growing in dense patches on the bottom of estuaries, but the relative habitat value of these species, compared to the seagrass species they displace, is not known.

Seagrass meadows are highly productive submerged habitats and are extremely valuable because of the multiple roles they play in the mosaic of estuarine and nearshore habitats. Thier complex structure of leaves, roots and rhizomes baffles waves, reduces erosion, and promotes water clarity while increasing bottom area and providing a surface upon which epiphytes and epibenthic organisms can live. Invertebrate abundance is much higher in seagrass beds than in adjacent unvegetated habitats. The seagrasses, with their epiflora and epifauna, provide a rich nursery with safe refuge and abundant food resources for juvenile invertebrates and fish as well as prime foraging habitat for adults of many fish species. The role of seagrasses as shelter for juvenile fish is most pronounced in subtropical and tropical waters. Many fish that are found on reefs during the day forage in adjacent seagrass meadows at night.

Seagrasses are linked to other marine and estuarine communities through export of detritus and migration of animals. Large quantities of detritus are exported out of meadows to adjacent communities and even far offshore to deep-sea habitats. In estuaries, mats of seagrass detritus result in localized high levels of secondary productivity. In addition, movement of fish between foraging habitats in seagrass meadows back to the protection of reefs or mangroves also results in transfer of nutrients out of the meadows. Not only do seagrasses make substantial contributions to overall estuarine productivity, they play a major role in productivity in nearshore and offshore habitats as well.

Ecosystem Functions

The primary determinant of seagrass presence and productivity is light availability, which is determined by the interaction of water depth and water clarity. Apart from dredging, the primary anthropogenic cause of seagrass loss is reductions in light availability caused by blooms of microscopic algae in the water column that result from discharge of nutrients into estuaries.

Seagrass presence and plant community composition is the result of the interplay between sediment characteristics, wave energy, and water depth; which determines exposure and is a factor in light penetration, salinity tolerance and successional stage. Muddy substrates are generally preferred by seagrasses, but both shoalgrass and turtle-grass will grow in sandy substrates. Clover grass will grow in highly polluted areas and nearly liquid mud. Low energy, shallow water areas with restricted circulation are prime areas for seagrass meadow development. Salinity tolerances vary. Shoalgrass tolerates the widest range of salinities, and has the highest optimal range (45 ppt). Clover grass has the narrowest range. In general, optimal salinities for the species found in the Gulf range from 20-40 ppt, although widgeongrass is considered a freshwater species that exhibits marked salinity tolerance.

Seagrasses are not tolerant of prolonged exposure to air, although shoalgrass can be found in the intertidal zone. The seagrass species present in the Gulf have varying depth limits, with widgeongrass restricted to shallow water and the rest found to considerable depths depending on light penetration. Clover grass is tolerant of low light penetration, but the rest are restricted to depths that allow at least 11-25% surface irradiance (SI), with optimal conditions between 41-46% SI. In most Gulf of Mexico estuaries, turbidity restricts seagrasses to water depths of < 3 m, although in very clear water areas of the Florida Keys seagrasses can be found in depths of up to 30 m.

Seagrasses provide trophic support to higher consumers through a grazing food web based on their epiphytic algae and epibenthic grazers like shrimp and gastropods and the secondary productivity of their epibenthic and benthic infaunal invertebrate communities. Fishes and squids live in or above the plant canopy. Fish in seagrass beds can be categorized as permanent or seasonal residents, temporal migrants, and transients. The permanent residents include relatively sessile species such as gobies whereas seasonal residents encompass those fish and invertebrates that use the meadows as nursery or spawning grounds. Drums, snappers, and grunts are common seasonal residents. Throughout the Gulf, red drum and penaeid shrimp use seagrass meadows as nursery and foraging habitat. In South Florida, gray and mutton snapper, and gag also make extensive use of seagrass meadows as nursery habitat and these species, along with other coral reef fish, may migrate from reefs into meadows at night to forage. Large offshore or oceanic fish such as mackerels and jacks are present in seagrass habitats from time to time. The large Halophila meadows off the west coast of Florida are in close association with productive live bottom habitats, and may provide important foraging grounds for commercially and recreationally important fishes such as grunts, snappers, grouper, and flatfish.

3.3.B(6) Hard Bottom (live bottom, low-relief bottoms, high-relief bottoms)	GMFMC

Note: The following information comes directly from the Essential Fish Habitat – Gulf of Mexico Overview provided by the NMFS Southeast Region (Version: 08-2015), and the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (Volume 1: Text, March 2004, Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration Award No. NA17FC1052). Where further amplification was necessary to fully evaluate specific features of Gulf of Mexico EFH, the Generic Amendment for Addressing Essential Fish Habitat Requirements (October 1998, Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration, Award No. NA87FC0003) was used. The information presented here serves as the foundation from which this Biological Assessment will address essential fish habitat.

General Description

Subtidal hard bottom communities, usually submerged rocky outcroppings or coral reefs, occur in coastal nearshore and estuarine regions of the Gulf of Mexico, primarily in Florida (the exception is 7 ½ Fathom Reef off the southern Texas coast). They range from Hernando Beach on the west central Florida coast to the Florida Keys. Coral reefs dominate hard bottom in the Keys whereas limestone outcroppings are prevalent in the west central region.

Key Features & Characteristics

Native limestone outcroppings are found along the shorelines and in the bays of the west central Florida coast. Sessile epibenthic organisms that attach to the substrate dominate the biota, which consists of algae, sponges, hard and soft corals, hydroids, anemones, and bryozoans, along with motile invertebrates such as decapod crustaceans and gastropods. Species reported from hard bottoms in Tampa Bay include starlet coral (Siderastrea radians), loggerhead sponge (Spheciospongia vesperia), boring sponge (Cliona celata), sea whip (Leptogorgia virgulata) and the alga *Sargassum* filipendulum. Like the oyster reefs with which they may occur, hard bottoms increase habitat complexity and provide structure, protection and trophic support to juveniles and adults of many marine fish species.

Sufficient light must reach the bottom for communities associated with nearshore and estuarine hard bottoms to thrive. The symbiotic algae (zooxanthellae) contained in some coral and sponge species supplies its coral host with nutrients, but algae can only flourish in areas with sufficient light. The epibiotic community on nearshore hard bottom areas can probably withstand periodic short-term turbidity and sedimentation, but prolonged episodes of turbidity due to dredging or other causes would likely result in damage or death of the community. The loss of this habitat would result in lower productivity in both estuarine and nearshore zones and potentially declines in productivity of offshore fisheries.

Hard bottoms constitute a group of biological communities characterized by a thin veneer of live corals and other biota overlying assorted sediment types. They are generally dominated by epifaunal organisms such as sponges, hard and soft corals, hydroids, anemones, barnacles, bryozoans, decapod crustaceans and gastropods. Many species of reef fish aggregate or associate with various hard bottom communities at some stage of their adult life. On the continental shelf, hard bottoms are usually of low relief and many are associated with relict reefs where the coral veneer is supported by dead corals.

3.3.B(6)(a) Live/hard bottom of the West Florida Shelf	GMFMC

The west Florida shelf has long been recognized as an area that supports commercially important fish and shellfish populations, an importance attributed at least in part to the abundance of scattered rock outcrops and sponge bottoms that provide fish habitat. One hundred seventy species of fish from 56 families have been observed or collected on the Florida Middle Ground. Of these, 97 species are considered primary reef fish and 45 species as secondary reef fish. Commercially important species include striped mullet, spotted sea trout, Spanish mackerel, king mackerel, Florida pompano, snappers, and groupers, several of which are primarily nearshore/estuarine inhabitants. The most species families of demersal fishes on the shelf are the left eye flounders, sea basses, drums, and searobins.

The extensive emergent substrate that makes up the west Florida shelf supports the growth of coralline algae at mid-shelf depths (60 to 80 m), which creates algal nodules and a crustose algal pavement, allowing the development of deepwater hermatypic corals. The coralline algal nodule and algal pavement/Agaricia assemblages represent the closest development of an active reef habitat on the shelf.

Inner Shelf Live Bottom Assemblage I - this live bottom biological assemblage consisted of patches of various algae, ascidians, hard corals, large gorgonians, hydrozoans, and sponges. Individual organisms were generally larger, and the fauna appeared to exhibit a higher biomass per unit area, than in the Inner and Middle Shelf Live Bottom Assemblage II. This assemblage [was identified] in water depths of 20 to 27 m.

Inner and Middle Shelf Live Bottom Assemblage II - this live bottom biological assemblage consisted of algae, ascidians, bryozoans, hard corals, small gorgonians, hydrozoans, and several sponges. This assemblage has a higher number of sponges and a lower biomass per unit area than the Inner Shelf Live Bottom Assemblage I. This assemblage [was identified] in water depths of 25 to 75 m

Middle Shelf Algal Nodule Assemblage - this assemblage consisted of coralline algal nodules formed by Lithophyllum spp. and Lithothamnium spp., combined with sand, silt, and clay particles. Algae, hard corals and small sponges were also present. This assemblage [was identified] in water depths of 62 to 108 m.

Agaricia Coral Plate Assemblage - this biotal assemblage consisted of a dead, hard coral coralline algae substrate covered with living algae, live hard corals, gorgonians, and sponges. This assemblage [was identified] in water depths of 64 to 81 m.

Outer Shelf Crinoid Assemblage - this assemblage consisted of large numbers of crinoids living on a coarse sand or rock rubble substrate. Small hexactinellid sponges may also be associated with this assemblage. This assemblage [was identified] in water depths of 118 to 168 m.

Outer Shelf Low Relief Live Bottom Assemblage - this live bottom assemblage consisted of various octocorals, the antipatharian corals, occasional hard corals, crinoids, the hydrozoan Stylaster sp., and small sponges in the Order Dictyonina. It was found in conjunction with low relief rock surfaces with a thin sand veneer. This assemblage [was identified] in water depths of 108 to 198 m.

Outer Shelf Prominences Live Bottom Assemblage - this biological assemblage consisted of the gorgonian, the antipatharian corals, the hard coral, crinoids, the hydrozoan, and medium to large hexactinellid sponges. All of these organisms were found on rock prominences. These prominences generally emerged from a sand-covered bottom and had a vertical relief of up to 2 m. These prominences are most likely dead coral pinnacles. This assemblage [was identified] in water depths of 136 to 169 m.

The Florida Middle Ground - The Florida Middle Ground is the best-known and most important area on the west coast of Florida, in terms of coral communities. However, at present, the area has been described as a hard bottom rather than a coral reef because live corals contribute little to the configuration of the area. Of the corals that do exist in the Florida Middle Ground, the hydrozoan coral Millepora sp. is believed to be the main frame builder, although populations of hermatypic scleractinians (Porites, Dichocoenia, Madracis) are present at the upper depth ranges (26 to 30 m). Shallow-water alcyonaceans (Muricea, Plexaura, Eunicea) are also present, and the fauna bears a distinct dissimilarity to that of the Flower Garden Banks. Although the Florida Middle Ground provides a high-relief substratum for reef biota, its location is apparently too far northward to allow the establishment of massive hermatypic coral assemblages. Winter water temperatures can reach 15° to 16° C, and hermatypic corals require temperatures of 18° to 30° C for viable existence. Significantly productive areas in the Florida Middle Ground comprise about 12,100 ha (29,900 ac).

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3.3.B(6)(b) Live/hardbottom of the Mississippi-Alabama Shelf	GMFMC

The northeastern portion of the Central Gulf of Mexico exhibits a region of topographic relief, known as the "pinnacle trend," at the outer edge of the Mississippi-Alabama shelf between the Mississippi River and DeSoto Canyon. The pinnacles appear to be carbonate reef structure in an intermediate stage between growth and fossilization. The region contains a variety of features from low-relief rocky areas to major pinnacles, as well as ridges, scarps, and relict patch reefs. The heavily indurated pinnacles provide a surprising amount of surface area for the growth of sessile invertebrates and attract large numbers of fish. Additional hard-bottom features are located nearby on the continental shelf, outside the actual pinnacle trend.

The features of the pinnacle trend offer a combination of topographic relief, occasionally in excess of 20 m, and hard substrate for the attachment of sessile organisms and, therefore, have a greater potential to support significant live-bottom communities than surrounding areas on the Mississippi-Alabama Shelf. The species composition of the pinnacle trend has been compared to the Antipatharian Zone and Nepheloid Zone.

Biological assemblages dominated by tropical hard bottom organisms and reef fishes occupy a variety of topographic features that exist between 53 and 110 m in the northeastern Gulf of Mexico between the Mississippi River and DeSoto Canyon. Most appear to be deteriorating under the influence of bioerosional processes. Hard bottoms and associated organisms are evident on at least two salt domes within 50 km of the Mississippi River Delta.

Present-day biological assemblages on features in the Northeastern Gulf are dominated by suspension feeding invertebrates. On reefs containing extensive reef flats on their summits, there are rich assemblages distinguished by a high relative frequency of sponges, gorgonian corals (especially sea fans), crinoids, and bryozoans. Due to the generally accordant depth of flat-topped reefs (62-63 m), coralline algae are also in abundance. On reefs lacking this reef flat habitat, as well as on reef faces of flat-topped features, the benthic community is characterized by a high relative abundance of ahermatypic corals (both solitary and colonial scleractinians). Biological abundance and species diversity increase in relation to the amount of solid substrate exposed and to the variety of habitats available.

The most significant aspect of the hard bottoms and topographic features of the Mississippi-Alabama shelf lies in the fact that they form part of a chain of such features lying at comparable water depths around the entire rim of the Gulf of Mexico supporting similar biological communities. Located in a central position, the topographic features possibly facilitate genetic exchange between the faunas of such communities both to the east and west. Lying directly in the path of Loop Current intrusions, these are likely the first hard bottom communities to be encountered by species transported from the Caribbean. The presence of the Mississippi-Alabama hard banks may serve the function of "island hopping" for important reef species and may present the key habitat link between the reef fauna of the northwestern and northeastern Gulf of Mexico. In these respects, the hard bottoms and topographic features are important in terms of the larger Gulf of Mexico ecosystem as a whole.

Vertical relief of individual hard bottom features is the single most significant factor influencing live bottom community development. All of the major live bottom studies conducted in the northeastern Gulf have demonstrated higher frequencies of occurrence and higher numbers of species with increasing vertical relief.

The invertebrate faunal observations included two distinct areas that support low diversity communities of an apparently mixed tropical and temperate nature. The first was the sand-shell-coralline-algae slope immediately above and below the block ridges of limestone and the block substrate of the ridges. Two forms of attached pennatulaceid coelenterates, decapod crustaceans and asteroid echinoderms were encountered at the sand-shellcoralline-algae slope. There was also evidence of bioturbation by worms and molluscs that were not directly observed. Sponges, scleractinians, octocorals, solitary antipatharians, and some hydroids colonized the rocky ridges. Majid crabs, hermit crabs, whelks, and sea cucumbers were also present.

3.3.B(7) Soft Bottom (mud, clay, silt)	GMFMC

General Description

The Gulf of Mexico can be divided into two major sediment provinces, carbonate to the east of DeSoto Canyon and southward along the Florida coast, and terrigenous to the west of DeSoto Canyon past Louisiana to the Mexican border. The soft bottom sediments of the northwestern Gulf shelf represent a complex array of particle size distribution patterns with much local variation.

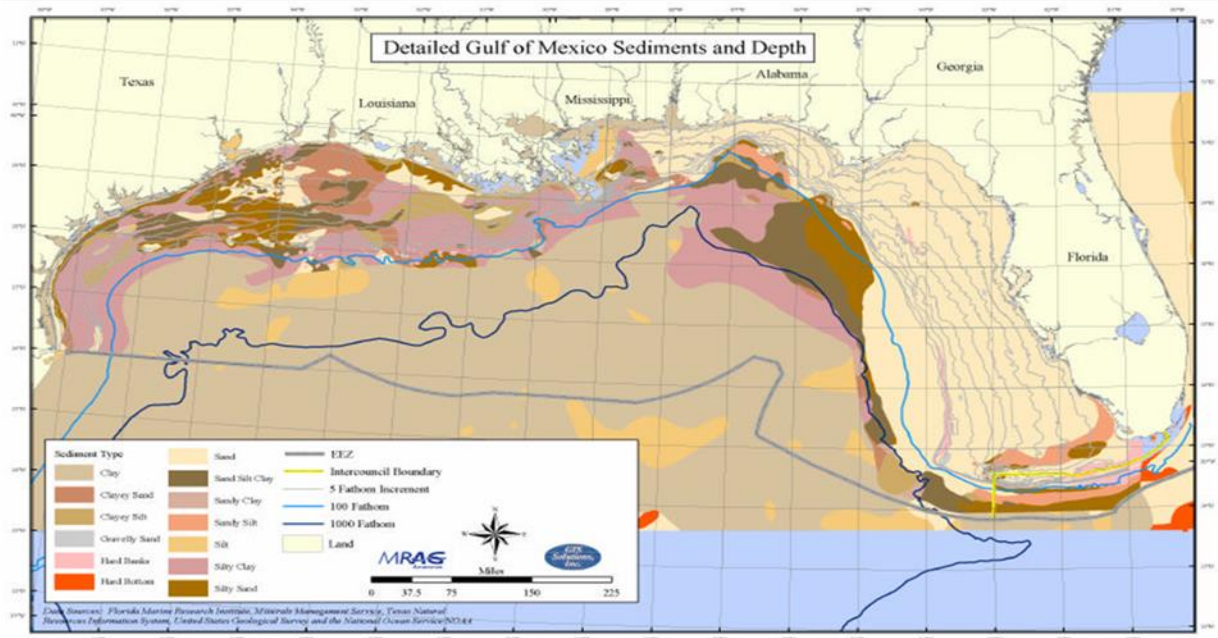

Figure 3-11. Map depicting Gulf sediments developed from Minerals Management Service. This effort consolidated the sediment data into four major classifications: clay, hard bottom, sand and silt.

Key Features & Characteristics

Coarse sediments make up the very shallow nearshore bottoms from the Rio Grande River to central Louisiana and comprise the dominant bottom type from shore to deeper water throughout the central third of the shelf. Thus, the fine sediments are limited largely to the eastern third of the shelf (which is under the influence of the Mississippi and Atchafalaya Rivers) and the southwestern third (influenced by the present or ancestral Rio Grande River). Fine sediments are also strongly represented on the outer shelf beyond the 80-m isobath. Surface sediments may affect shrimp and fish distributions directly in terms of feeding and burrowing activities or indirectly through food availability, water column turbidity, and related factors.

The continental shelf of the eastern Gulf of Mexico presents a diverse array of surface substrates. West of Mobile Bay, fine-grained organic-rich silts and clays of terrestrial origin are brought to the shelf by distributaries of the Mississippi, Pearl and other rivers. These fine sediments spread eastward from the Louisiana marshes to Mobile Bay, but off the Mississippi barrier islands they are interrupted by a band of coarser quartz sand that extends to a depth of about 40 m. Another tongue of fine sediments runs southwestward from the Everglades, extending the full length of the Florida Keys. Here the surface material is fine carbonate ooze that in the nearshore sector is mixed with some organic material. A third area of fine sediments lies along the eastern flank of DeSoto Canyon. This outer shelf carbonate deposit is a shallow extension of the fine-grained slope sediments.

Coarser surface deposits include quartz sand, carbonate sand, and mixtures of the two, and the carbonate material itself is rich in the fragmented remains of mollusks, sponges, corals, algae, and foraminifera in various proportions, depending upon the locality. Quartz sand predominates in the nearshore environment to a depth of 10 m to 20 m from the Everglades northward along the coast of Florida. However, from below Apalachicola Bay to Mobile Bay it covers the entire shelf out to at least a depth of 120 m, except the immediate eastern flank of DeSoto Canyon. The outer half to two-thirds of the Florida shelf is covered with a veneer of carbonate sand of detrital origin. Between the offshore carbonate and nearshore quartz there lies a band of mixed quartz/carbonate sand.

Ecosystem Functions

Sediment type is a major factor in determining the associated fish community. Shrimp distribution closely matches sediment distribution. White shrimp (Litopenaeus setiferus, formerly Penaeus setiferus) and brown shrimp (Farfantepenaeus aztecus, formerly P. aztecus), occupy the terrigenous muds, while pink shrimp (Farfantepenaeus duorarum, formerly P. duorarum) occur on calcareous sediments. Shrimp have been shown to actively select substrate type. Similar sediment-associated distributions have also been observed for many demersal fishes.

The carbonate sediments present east of DeSoto Canyon and southward along the west Florida shelf support a distinct fish community. The pink shrimp predominates on calcareous sediments, anddominant fish species include Atlantic bumper, Chloroscombrus chrysurus, silver jenny, Eucinostomus gula, sand perch, Diplectrum formosum, leopard searobin, Prionotus scitulus, fringed flounder, Etropus crossotus, pigfish, Orthopristis chrysoptera, and dusky flounder, Syacium papillosum. The bathymetric distribution of pink shrimp in the Gulf of Mexico extends to about 45 m.

The terrigenous sediments are divided into two communities. The brown shrimp grounds and the white shrimp grounds support distinct ichthyofauna. The two communities are separated by different bathymetric ranges (3.5-22 m and 22-91 m) based on shrimp distributions. The white shrimp ground (3.5-22 m) fishes have a strong affinity for estuaries, while the fishes of the brown shrimp ground (22-91 m) are independent of estuaries. Atlantic croaker, Micropogonias undulatus, is the dominant species of the white shrimp grounds. The most dominant family was the drums (Sciaenidae) along with representatives from the snake mackerels (Trichiuridae), threadfins (Polynemidae), sea catfishes (Ariidae), herrings (Clupeidae), jacks (Carangidae), butterfishes (Stromateidae), bluefishes (Pomatomidae), and lefteye flounders (Bothidae). The dominant family of the brown shrimp grounds is the porgies (Sparidae), and the longspine porgy, Stenotomus caprinus, is the dominant species. Important supporting fauna includes a variety of species from the drums (Sciaenidae), searobins (Triglidae), sea basses (Serranidae), lefteye flounders (Bothidae), lizardfishes (Synodontidae), snappers (Lutjanidae), jacks (Carangidae), butterfishes (Stromateidae), cusk-eels (Ophidiidae), toadfishes (Batrachoididae), batfishes (Ogcocephalidae), scorpionfishes (Scorpaenidae), goatfishes (Mullidae), and puffers (Tetraodontidae).

Sand/shell and soft bottoms are inhabited by various infauna (e.g. worms and crustaceans) and epifauna (e.g. sea pens) which act as ecosystem engineers and modify these habitats by the presence of their physical structure or burrowing in the substrate. In addition, some fishes like tilefish and red grouper constructs burrows or excavate depressions in sediments, increasing the habitat’s original complexity. As such, ecosystem engineers can be considered an integral part of the habitats they occur in. Activities which directly or indirectly kill or remove ecosystem engineer species may substantially alter the nature of these habitats.

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3.3.B(8) Oyster Reefs

GMFMC

General Description

Communities dominated by oysters are variously termed oyster reef, oyster bar, oyster bed, oyster rock, oyster ground, and oyster planting. Naturally occurring aggregations of live oysters and oyster shell with associated flora and fauna are collectively termed “oyster reef”.

Range and Abundance

Communities of eastern oysters and their tropical counterpart, C. rhizophorae are found in all areas of the Gulf of Mexico. The southernmost oysters in the U.S. are found in Oyster Bay, near Cape Sable, Florida Bay; north of that point, oysters grow almost everywhere in the Gulf of Mexico. Oyster reefs in the northern Gulf of Mexico are most extensive in Louisiana and Florida.

Key Features & Characteristics

Optimal temperatures and salinities for oysters range from 10 to 26 ºC and 12 to 25 ppt. Other factors that influence presence and abundance of oysters include substrate type, sedimentation, water circulation, competition, predation, disease and pollution. Estuarine areas containing suitable substrate that are relatively calm but have continuous water flow and low sedimentation are ideal habitats for oysters.

Mississippi Oyster Reefs - In Mississippi, oyster reefs cover approximately 4,047-4,451 ha. Seventeen natural reefs are managed by the state. There are six private leases ranging in size from 2 to 40.5 ha apiece. About 97% of the commercial harvest comes from western Mississippi Sound, mostly from Pass Marianne, Telegraph, and Pass Christian reefs. In this area of Mississippi Sound, most oyster reefs are subtidal (> 6 ft deep), but some intertidal reefs exist in eastern Mississippi Sound. In late 2002 a program was begun to distribute 3,950 cubic yards of oyster shell and other suitable cultch material at Telegraph Reef to increase areas where oyster larvae can successfully settle, and enhance oyster production.

Alabama Oyster Reefs - Oyster reefs in Alabama are still found in areas such as Mobile Bay, and were historically found in Weeks Bay before high sedimentation rates buried most of them. Some previously productive oyster reefs in Mobile Bay have become unproductive in recent years with one study citing low oxygen events, high sedimentation rates, and limited settlement sites for larvae as the principal causes of the decline. Restoration efforts are currently underway.

Florida (west coast) Oyster Reefs - Although there are nearly 74,465 ha of oyster reefs in Florida only approximately 5,600 ha are open to shell fishing. The other over 68,800 ha are closed to shell fishing because of unacceptable levels of coliform bacteria. Nearly 63% (1,428 ha) of the open area is public and most is located in the panhandle estuaries of Apalachicola Bay and St. George Sound. Eighty-three percent of the natural public reefs on the Gulf Coast are found in Apalachicola Bay.

Ecosystem Functions

Oysters are considered epibenthos or fouling organisms and require at least some hard substratum (“cultch”) upon which to settle. As the oyster grows, its shell provides additional substrate upon which other oysters can settle. Optimal conditions for oyster spat survival are oyster shell, other shell or another firm surface on which to settle coupled with good water circulation to provide food and oxygen and remove waste and sediments. Eventually, oysters may build a reef that ranges in shape and size from small mounds or patches to broad, long ridges that extend several miles. Extensive oyster reefs often divide bays and change circulation patterns, drastically altering the local estuarine environment and its associated flora and fauna. Oysters may also be found growing singly or in clumps on nearly any manmade or natural structure including pilings, sea walls, jetties, old tires, bottles and cans, rocks, and red mangrove roots.

Oyster reefs are generally composed of an upper zone that consists of live oysters and associated sessile and motile fauna, over a core of buried shell and mud. Mature oyster reefs usually extend into the intertidal zone but the maximum elevation of the reef depends on the minimum inundation time. Reefs are usually found only into the mid-intertidal because predation and siltation limit oyster populations in the lower intertidal and subtidal zones and exposure limits them in the upper intertidal. In protected salt marsh estuaries, such as those occurring in much of the northern Gulf of Mexico, oyster reefs are usually relatively small and found in tidally-exposed areas adjacent to emergent vegetation with the majority of living oysters found in the intertidal area. Densities of living oysters in these reefs are usually very high. Reefs found in large, less protected bays are typically much larger (up to 5 mi long in some bays in Texas) with a central "hogback" of dead oysters in the intertidal portion flanked by a living reef community in the adjacent subtidal zone.

Because they are sessile filter-feeders, adult oysters require low sedimentation and adequate water movement to supply them with food and remove wastes. Although oysters can tolerate thin layers of sediment or partial burial, complete burial by gradual, natural sediment accumulation or catastrophic events (e.g., flood, dredge material disposal) will kill them. In addition, both oyster feces and pseudofeces are significant sources of sediment on reefs and oysters that settle in areas with little water movement can smother themselves fairly rapidly. High-density oyster communities are found in areas where water flow is high enough to supply food to many individuals but too low to cause turbidity by stirring up the bottom.

As islands of hard substrate in areas where soft sediments predominate, oyster reefs help prevent erosion of intertidal wetlands, baffle water currents, regenerate nutrients and provide food and shelter for a variety of organisms. Oyster reefs provide structural complexity in soft sediment environments that lack complexity by increasing available surface area for use by other organisms. An estimated 50 m2 of surface area is available in every square meter of overall reef area. As many as 303 species have been documented on intertidal and subtidal oyster reefs. Sessile and tubiculous invertebrates such as mussels, limpets, chitons, barnacles (Balanus spp.), anemones, bryozoans, hydroids, sponges, amphipods (e.g., Corophiidae) and polychaetes (e.g., Serpulidae, Spionidae) as well as motile arthropods such as crabs (especially family Xanthidae), snapping shrimp (Alpheus spp.), isopods and amphipods, polychaetes (e.g., Nereidae, Syllidae) and gastropods such as the oyster drill (Stramonita haemastoma) may be found in oyster reef habitat.

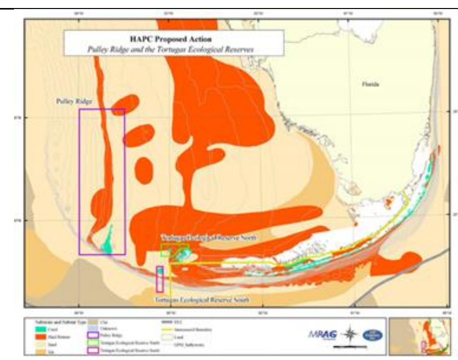
Oyster reefs serve as fish habitat by providing structure, protection and trophic support to juveniles and adults. The voids between and among the oysters and other sessile organisms provide hiding places for fish larvae and juveniles. The eggs, embryos, and larvae as well as the juveniles and adults of the epibenthic organisms provide food for a variety of motile invertebrates, particularly the stone crab, and forage fish that in turn provide food to predatory fish at higher trophic levels.

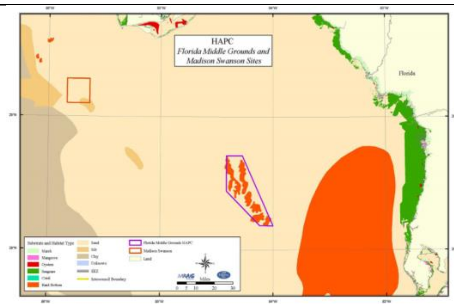
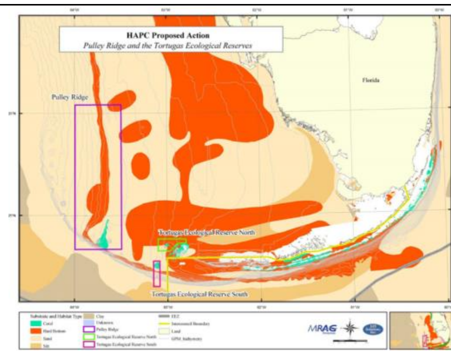
Three categories of finfish are found in oyster reefs: reef residents; facultative residents; and transients. Several offshore reef fish species including gag, mahogany snapper, and gray snapper are transients in oyster reefs during some portions of their life cycle. Pinfish and pigfish, species of finfish preyed upon by reef fish, also inhabit oyster reefs as transients. In the northern Gulf of Mexico (north of Galveston Bay, Texas to northwestern Florida) where seagrasses are not abundant, oyster reefs may function similarly to submerged vegetation. For example, spotted seatrout and red drum appear to favor oyster reefs as foraging areas in much the same way they use seagrass meadows in areas where seagrasses are abundant.

3.3.B(9) Habitats Areas of Particular Concern (EFH-HAPC) – Gulf of Mexico Fishery Management Council (GMFMC) [EPA Region 4 Only]

Habitat areas of particular concern within the Gulf of Mexico are identified and described in the GMFMC Generic Amendment Number 3 for Addressing Essential Fish Habitat Requirements, Habitat Areas of Particular Concern, and Adverse Effects of Fishing (March 2005, Gulf of Mexico Fishery Management Council pursuant to National Oceanic and Atmospheric Award No. NA03NMF4410028. Composed of only geographic area/locations, the EFH-HAPCs designated by GMFMC found within the Green zone are listed in Table VI-28. For the purposes of this biological assessment, the determination of the impacts of preauthorized use of dispersants and in-situ burn operations on each GMFMC EFH-HAPC geographic area/location is assumed the same as the determination of impacts to each of the corresponding EFH(s) described in Sections 3.3.B(1)-(9), and analyzed in Chapters 5 & 6, based on the shared characteristics between EFH-HAPC geographic area/locations and the EFH type(s) of which they are comprised.

Table 3-3. Gulf of Mexico Fishery Management Council Essential Fish Habitat – Habitat Areas of Particular Concern in the Green Zone

Name	EFH-HAPC Coordinates	EFH-HAPC Image
Florida Middle Grounds	**Boundary Coordinates** A 28 º 42.5’ 84 º 24.8’ B 28 º 42.5’ 84 º 16.3’ C 28 º 11.0’ 84 º 00.0’ D 28 º 11.0’ 84 º 07.0’ E 28 º 26.6’ 84 º 24.8’ A 28 º 42.5’ 84 º 24.8’	
Tortugas South	**Boundary Coordinates** A 24 º 33.0’ 83 º 09.0’ B 24 º 33.0’ 83 º 05.0’ C 24 º 18.0’ 83 º 05.0’ D 24 º 18.0’ 83 º 09.0’ A 24 º 33.0’ 83 º 09.0’	

Madison-Swanson Marine Reserve	**Boundary Coordinates** A 29 º 17.0’ 85 º 50.0’ B 29 º 17.0’ 85 º 38.0’ C 29 º 06.0’ 85 º 38.0’ D 29 º 06.0’ 85 º 50.0’ A 29 º 17.0’ 85 º 50.0’	
Pulley Ridge	**Boundary Coordinates** A 26 º 05’ B 24 º 40’ C 84 º 00’ D 83 º 30’ A 26 º 05’	

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3.3.C. Essential Fish Habitats and Habitats of Particular Concern - National Marine Fisheries Service

3.3.C(1) Essential Fish Habitat (NMFS)

For the purpose of this assessment, NMFS shares in the EFH identification and description provided by the Fishery Management Councils. Designations and descriptions for each of the EFH considered in this assessment; managed by the SAFMC and GMFMC, and shared by NMFS; are described in Sections 3.3.A. and 3.3.B.

3.3.C(2) Habitats of Particular Concern (EFH-HAPC) – National Marine Fisheries Service [EPA Region 4 Only]

NMFS has identified the Gulf of Mexico as its EFH-HAPC specific to highly migratory species for which NMFS is responsible for in their management. For the purposes of this biological assessment, the determination of the impacts of preauthorized use of dispersants and in-situ burn operations on the Gulf of Mexico EFH-HAPC is assumed the same as the impacts to each of the corresponding EFH(s) as described in Section 3.3.B.(1)-(8), and as analyzed in Chapters 5 & 6, based on the shared characteristics between EFH-HAPC geographic area/locations and the EFH type(s) of which they are comprised.

This information is from the NMFS Essential Fish Habitat – Gulf of Mexico Overview (National Marine Fisheries Service Southeast Region, NOAA Fisheries Service, Version: 08-2015).

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Chapter 4. Environmental Baseline

Section 4.1. Oil Production and Transportation in *Green Zone*

4.1.A. Sources of Oil and Type in *Green Zone*

Oil in Federal Region 4 at risk of discharge to the marine environment can be related to transportation of crude or refined petroleum products, or related to offshore production facilities. This section illustrates the geographical and relative volumes for oil transportation and production, which is used to develop likely discharge scenarios in Appendix II under which dispersant use might be considered.

4.1.B. Offshore Production

Through 2015, there is no active offshore production in the Atlantic Ocean and offshore production in the Gulf of Mexico is mostly within Federal Region 6, which includes USCG Sectors Corpus Christi, Galveston, and New Orleans. Offshore production in Federal Region 4 occurs only within the jurisdiction of USCG Sector Mobile. Bureau of Safety and Environmental Health (BSEE) reports in 2015 [228] nine active Oil Spill Response Plans (OSRPs) for offshore production facilities, three of which are primarily designed for natural gas production and have WCD volumes of less than 400 bbl (16,800 gal). Of the six crude production facilities, the average WCD is 184,000 bbl (7.73 Mgal) with a maximum of 241,000 bbl (1,012 Mgal). These facilities are located on average 92 mi offshore, with the closest facility at 75 mi, and (according to the OSRPs on file) are more likely to impact Plaquemines, Louisiana than Federal Region 4.

Active production platforms with OSRPs within the Gulf of Mexico are illustrated according to location and relative WCD size in Figure 4-1 and Figure 4-2.

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Figure 4-1. Active OSRPs Filed With BSEE for 2015 in the Gulf of Mexico [228]

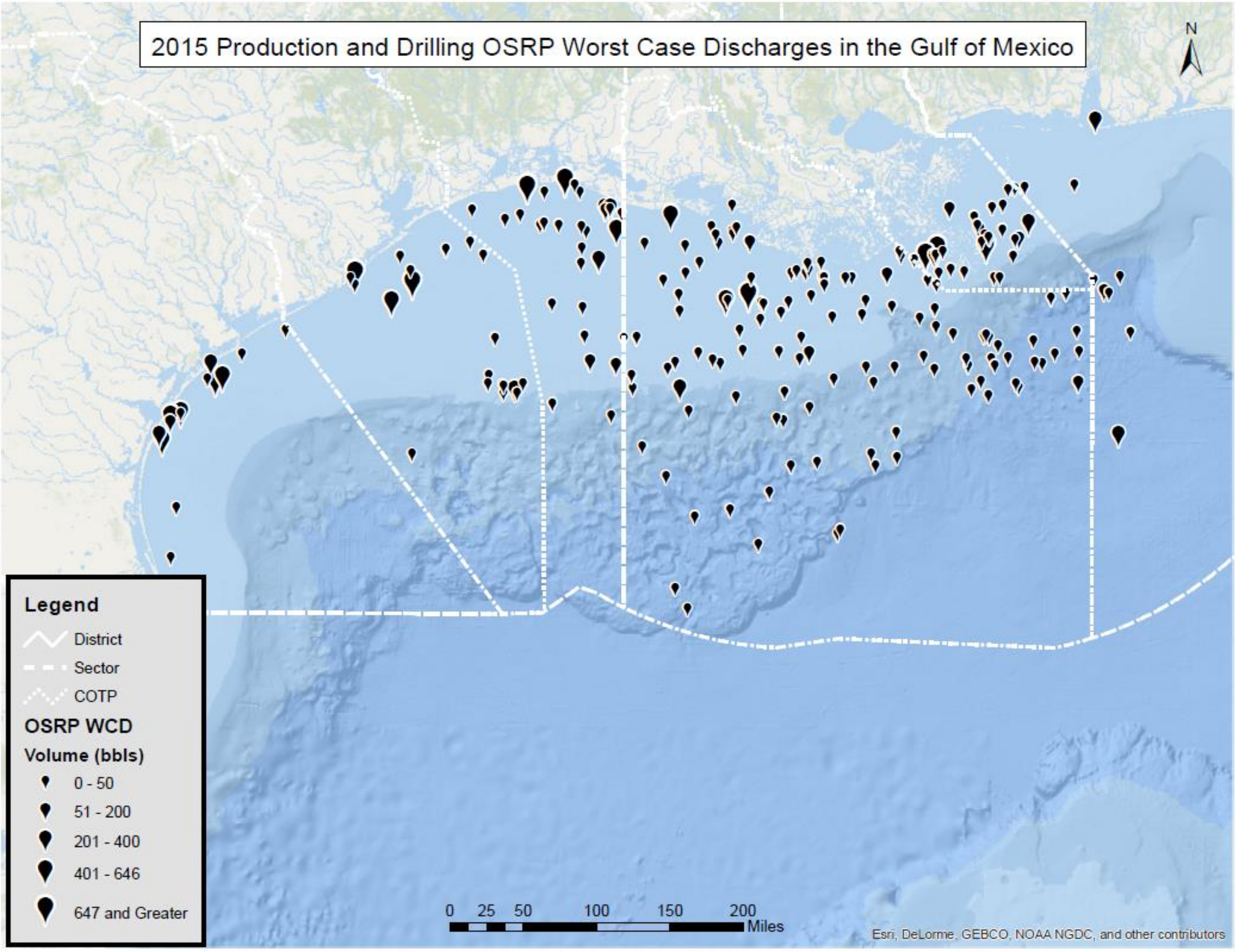

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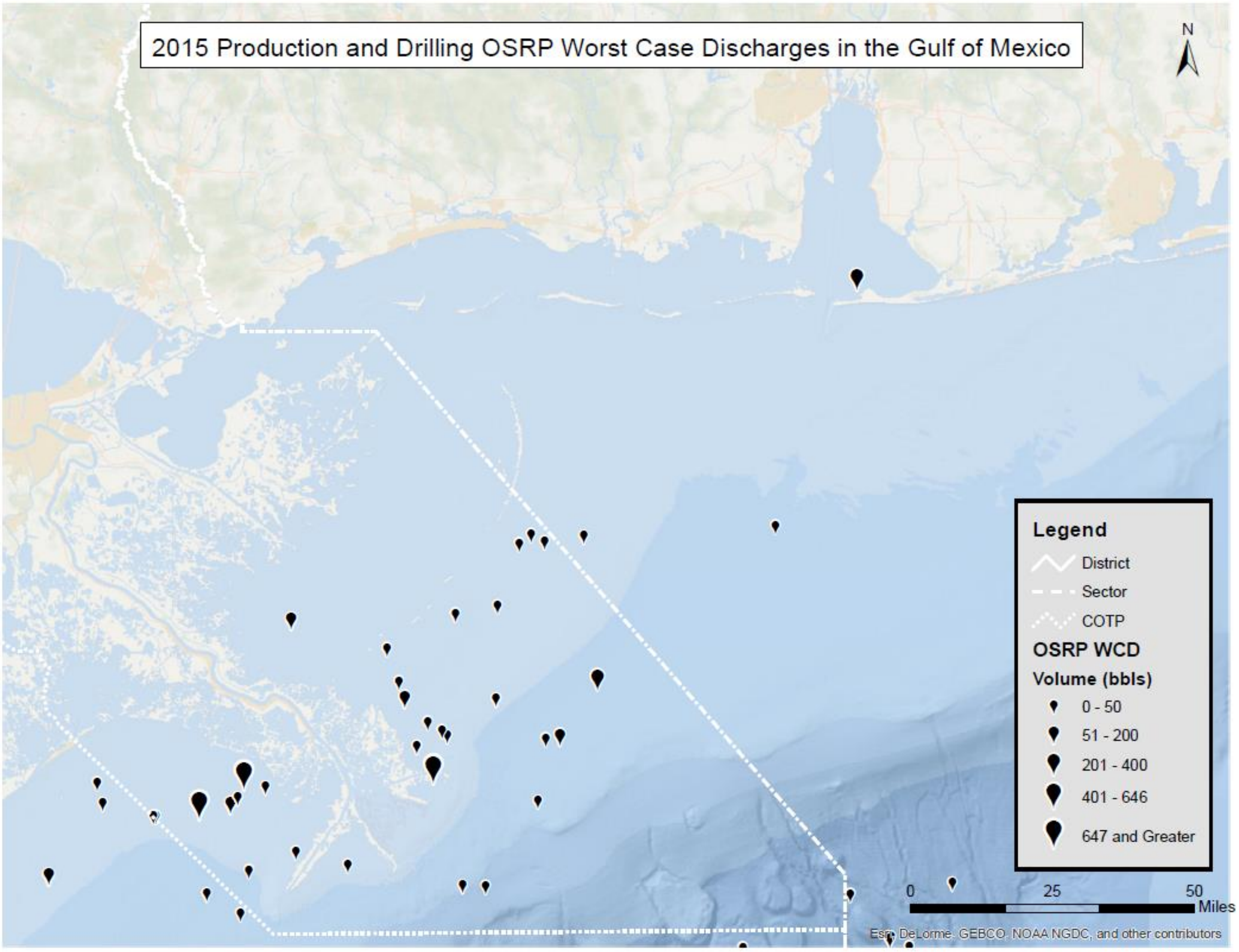
Figure 4-2. Active OSRPs Filed With BSEE for 2015 near Federal Region 4 [228]



One OSRP facility is located within State of Alabama jurisdictional waters and reports a WCD of 375 bbl (15,750 gal). The Geological Survey of Alabama State Oil and Gas Board reported 27 offshore wells within State of Alabama jurisdictional waters which were actively producing in 2015 [229]. These wells are primarily designed for natural gas production with only residual production of oil or condensate.

4.1.C. Marine Transportation by Geography

The highest concentration of offshore transportation of oil and petroleum products around Federal Region 4 is within deepwater routes near the Florida Panhandle and Pascagoula Harbor (Figure 4-3), each of which average more than eight billion gallons of petroleum movements per year (Table 4-1). The deepwater route between Key West, Miami, and Fort Lauderdale experiences approximately four billion gallons of petroleum movements each year (Table 4-3) while Tampa Bay in the Gulf and Fort Lauderdale in the Atlantic each host approximately four billion gallons of petroleum movements each year (Table 4-2 and Table 4-4).

Table 4-1. Federal Region 4 *Gulf Offshore* Shipping Lanes with Petroleum Commerce Averaging More Than 100 Million Gallons Per Year Since 2009* (in Millions of Gallons [Mgal])[230]

	2013 (Mgal)	Average (Mgal)
GULF DEEP WATER ACCESS		
Pascagoula	7,381	8,121
Tampa Bay	4,085	4,206
Mobile Bay	687	1,143
Key West	55	105
GULF DEEP WATER SPINE		
Cross FL Canal-Pensacola	10,440	9,524
Mobile-Pascagoula	8,665	8,602
Pensacola-Mobile	8,538	8,489
Tampa-Cross FL Canal	8,496	8,431
Pascagoula-New Orleans	7,766	7,711
Key West-Tampa	4,546	4,388

Table 4-2. Federal Region 4 Gulf Nearshore Shipping Lanes with Petroleum Commerce Averaging More Than 100 Million Gallons Per Year Since 2009* (in Millions of Gallons [Mgal])[230]

	2013 (Mgal)	Average (Mgal)
ALABAMA		
Mobile Bay	2,221	2,667
ICW (Mobile-New Orleans)	1,601	1,681
ICW (Mobile-Pensacola)	506	495
ICW (Pensacola-Mobile)	506	495
FLORIDA		
Tampa Bay	4,104	4,214
ICW (Pensacola-Mobile)	506	495
ICW (Pensacola-Panama City)	348	330
Pensacola Harbor	173	169
ICW (Panama City-Apalachee)	159	150
MISSISSIPPI		
Pascagoula Harbor	8,033	8,785
ICW (Mobile-New Orleans)	1,758	1,810

Data distributed in short tons; "Mgal" calculated using average oil density of 6.8 bbl/ton
Red bars represent relative values across each column
*Average value includes data from 2009, 2011, 2012, and 2013; available dataset from 2010 was incomplete and did not quality criteria

Active ports in Jacksonville, FL and Savannah, GA in the Atlantic average approximately 1.5 billion gallons of petroleum product movements annually (Table 4-4) with Mobile Bay, AL in the Gulf averaging slightly more at 2.6 billion gallons annually (Table 4-2). The states of South Carolina and North Carolina are the least active in Federal Region 4, with ports in Charleston, SC averaging less than 0.6 billion gallons and Wilmington, NC averaging less than 0.4 billion gallons (Table 4-4).

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Table 4-3. Federal Region 4 Atlantic Offshore Shipping Lanes with Petroleum Commerce Averaging More Than 100 Million Gallons Per Year Since 2009* (in Millions of Gallons [Mgal])[230]

	2013 (Mgal)	Average (Mgal)
ATLANTIC DEEP WATER ACCESS		
Fort Lauderdale	3,912	3,866
Jacksonville	1,268	1,488
Savannah	591	1,440
Charleston	368	585
Canaveral	545	495
Wilmington	270	389
Miami	172	183
ATLANTIC DEEP WATER SPINE		
Miami-Fort Lauderdale	4,486	4,125
Key West-Miami	4,458	4,106
Fort Lauderdale-Canaveral	1,818	1,564
Canaveral-Jacksonville	1,789	1,490
Savannah-Charleston	1,026	853
Jacksonville-Savannah	927	813
Wilmington-Virginia	1,044	773
Charleston-Wilmington	926	753
ATLANTIC-PUERTO RICO ACCESS		
Puerto Rico-New Jersey	0	393

Table 4-4. Federal Region 4 Atlantic Nearshore Shipping Lanes with Petroleum Commerce Averaging More Than 100 Million Gallons Per Year Since 2009* (in Millions of Gallons [Mgal])[230]

	2013 (Mgal)	Average (Mgal)
FLORIDA		
Fort Lauderdale	3,952	3,939
Jacksonville Harbor	1,287	1,504
Canaveral Harbor	557	519
Miami Harbor	172	213
GEORGIA		
Savannah Harbor	695	1,452
NORTH CAROLINA		
Wilmington Harbor	276	437
Atlantic ICW	274	398
SOUTH CAROLINA		
Charleston Harbor	368	585

Data distributed in short tons; "Mgal" calculated using average oil density of 6.8 bbl/ton
Red bars represent relative values across each column
*Average value includes data from 2009, 2011, 2012, and 2013; available dataset from 2010 was incomplete and did not quality criteria

Petroleum commodity movements in the Gulf of Mexico and U.S. South Atlantic are illustrated in Figure 4-3 and Figure 4-4, respectively, by mapping relative petroleum volume movements along transportation routes of the U.S. National Waterway Network [230].

Figure 4-3. 2013 National Waterway Network Total Petroleum Commodity Movements in the Gulf of Mexico [230]

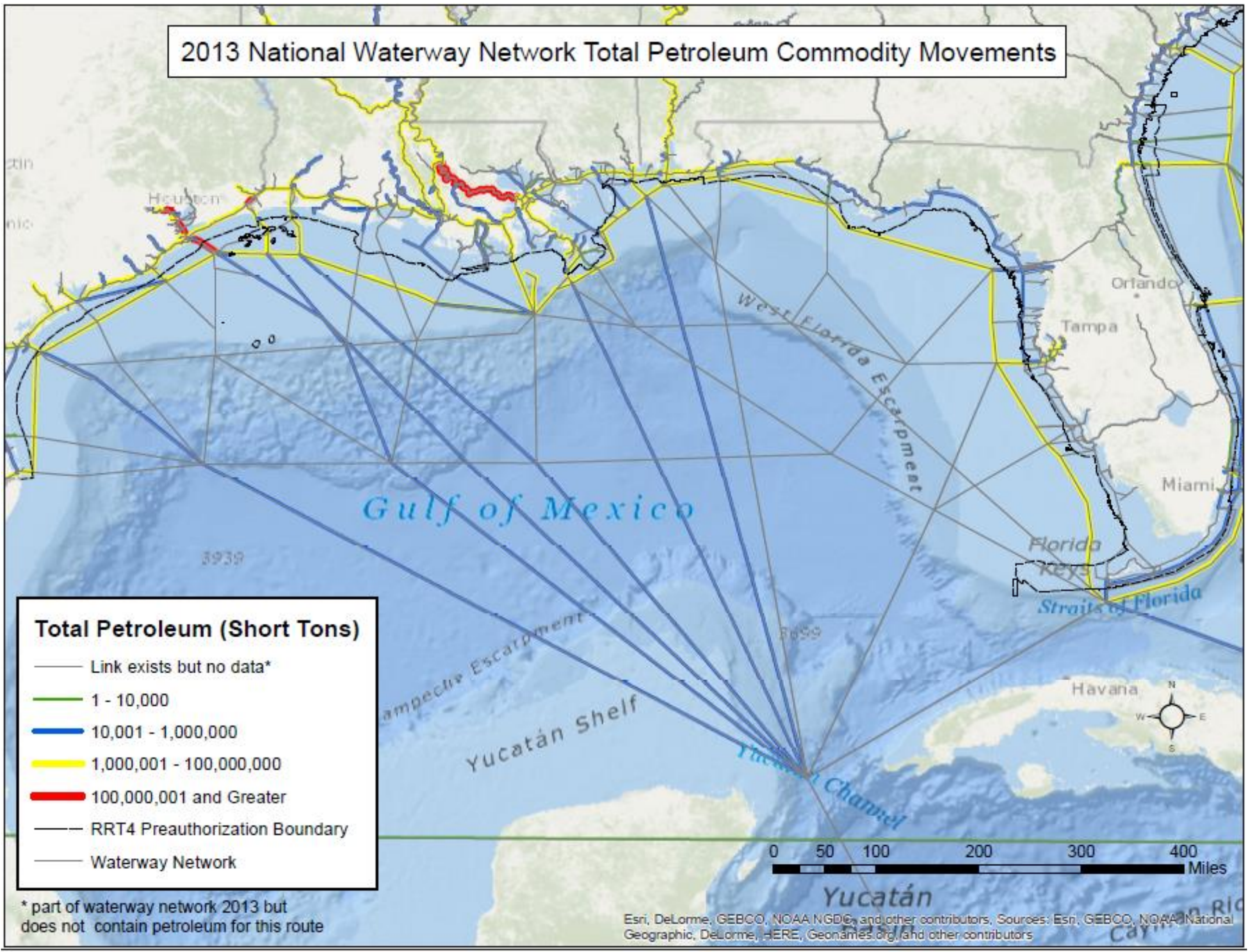

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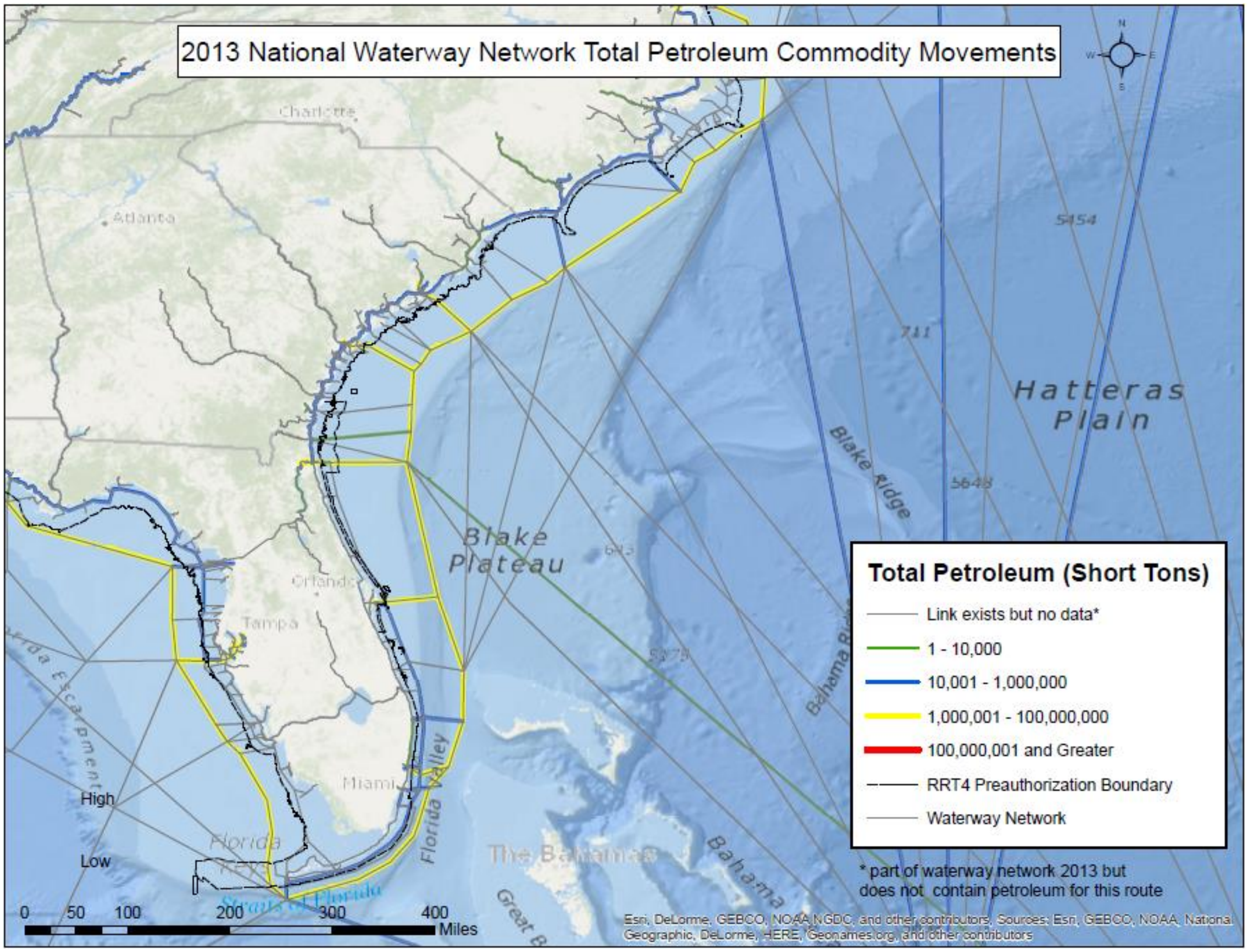
Figure 4-4. 2013 National Waterway Network Total Petroleum Commodity Movements in the Atlantic [230]

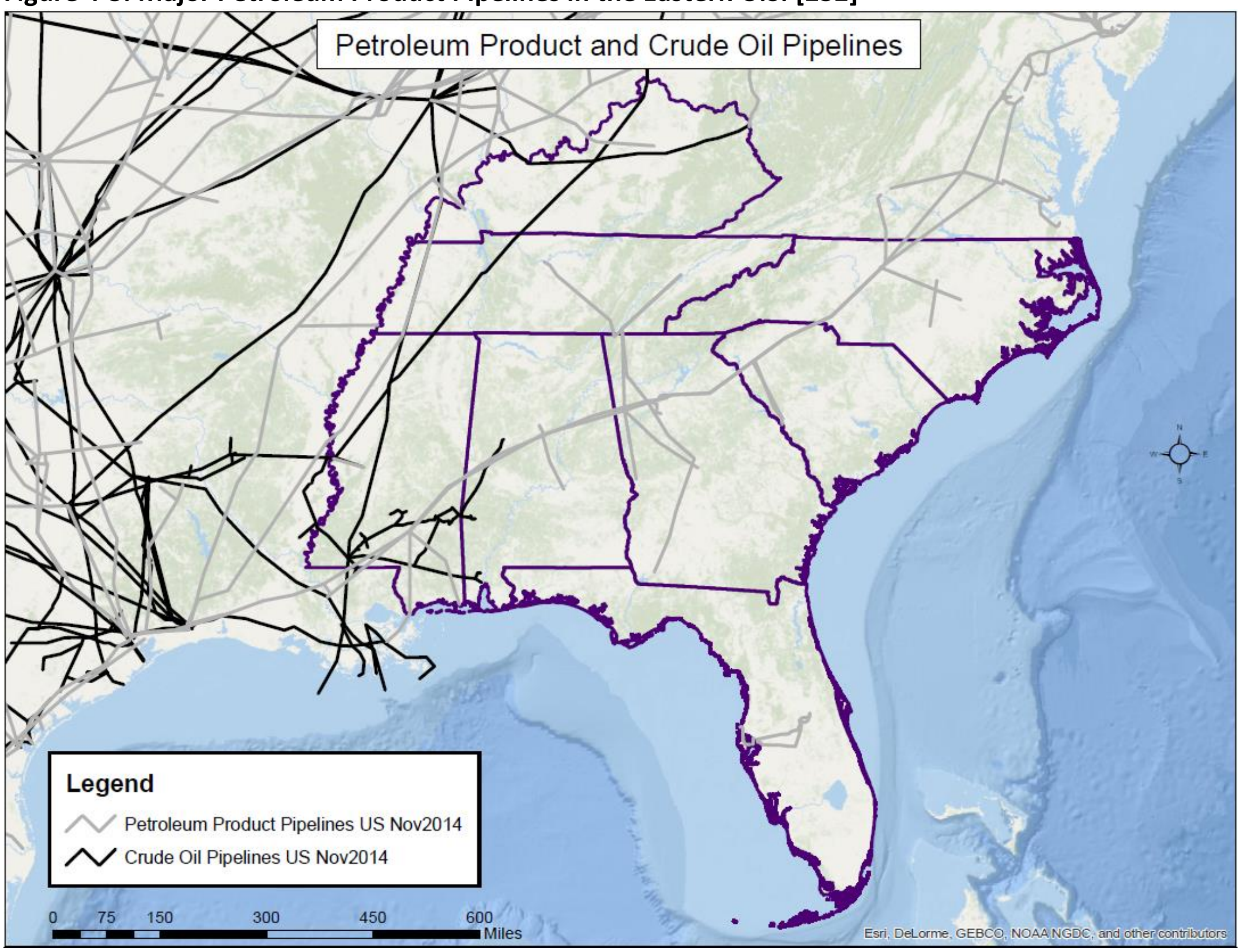


Petroleum commodity movements are noticeably decreased when tracking volumes from west to east and south to north. This is likely due to the concentration of refineries to the west of Region 4, most of which are located in Federal Region 6 (Texas and Louisiana) while only six refineries are located within Region 4 in Alabama (3) and Mississippi (3) (Table 4-5) and only two of these are located on or near the Gulf Coast: Saraland, AL and Pascagoula, MS. Refined products from these facilities can be distributed to inland or coastal terminals by ship (Figure 4-3 and Figure 4-4) or by pipeline (Figure 4-5) and will take the most cost-effective route. Major petroleum product pipelines (Kinder Morgan Inc.'s Plantation Pipeline and Colonial Pipeline Co.'s Colonial Pipeline) transport refined products from Alabama to North Carolina but are geographically remote from Florida, meaning that refined products for consumption within Florida may be more likely to be transported by ship. This is a potential reason for the concentration of petroleum commodity movements around the panhandle and south coast of Florida (Table 4-1 and Table 4-3).

Table 4-5. Projected Oil Refinery Capacity (in million gallons we) within Federal Region 4 for 2016 [231]

		Total Operating Capacity 2016 (Mgal/stream-day)	Total Operating Capacity (Mgal/day)
Alabama			
Atmore, AL	Goodway Refining, LLC	0.21	0.38
Saraland, AL	Shell Chemical LP	3.78	7.14
Tuscaloosa, AL	Hunt Refining Co.	1.68	3.19
Mississippi			
Pascagoula, MS	Chevron USA, Inc.	15.12	28.98
Sandersville, MS	Hunt Southland Refining Co.	0.53	0.99
Vicksburg, MS	Ergon Refining, Inc.	1.05	2.02
Grand Total		**22.37**	**42.70**

Figure 4-5. Major Petroleum Product Pipelines in the Eastern U.S. [232]



Data from the Waterborne Commerce Statistics Center [233] illustrate that crude oil movements within harbors of Region 4 primarily occur in Mobile Harbor and Pascagoula Harbor (Table 4-6) where four to five billion gallons can move through Pascagoula annually. These trends correlate with the location of oil refineries in Saraland, AL and Pascagoula, MS (Table 4-5). A smaller amount of crude oil (100-400 Mgal, annually) moves through Savannah, GA but with decreased volume from 2010 to 2012 and no reported movements in 2013 (Table 4-6). Light petroleum products such as gasoline and distillate fuel oil (No. 1 or No. 2 fuel oil; includes diesel fuel) dominate much of the commodity movements throughout Florida, Georgia, South Carolina and North Carolina (Table 4-6 and Table 4-7); incidents involving these products, even in large quantities, are unlikely candidates for dispersant use [234] because they usually spread into thin slicks that naturally disperse or volatize [235]. Heavier petroleum products, such as residual fuel oil (No. 6 fuel oil), asphalt tar or pitch, and petroleum coke, are found in lesser quantities than lighter refined products but still move through Pascagoula, MS (400-600 Mgal/year), Mobile, AL (100-240 Mgal/year), Tampa, FL (100-140 Mgal/year), Jacksonville, FL (120-270 Mgal/year), Savannah, GA (180-340 Mgal/year), and Charleston, SC (80-170 Mgal/year) (Table 4-5 and Table 4-6). Compared against lighter refined products, crude oils and residual fuel oils are more likely candidates for dispersant use in the event of a large discharge due to relatively lower evaporation and natural dispersant rates [234]. However, effectiveness of dispersant application can decrease quickly due to weathering, particularly for the residual fuel oils [15].

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Table 4-6. Commodity Volume Movements (in Millions of Gallons) for Top 5 Petroleum Products within Federal Region 4 Gulf Harbors Averaging More Than 100 Million Gallons of Total Petroleum Per Year Since 2009 [233]

	2006	2007	2008	2009	2010	2011	2012	2013
ALABAMA								
MOBILE HARBOR								
Crude Petroleum	1,662	1,371	1,535	1,190	1,212	1,112	564	540
Gasoline	422	472	389	384	341	338	385	372
Distillate Fuel Oil	116	96	160	190	122	79	84	63
Residual Fuel Oil	186	170	151	107	133	169	101	84
Asphalt, Tar & Pitch	53	54	50	43	72	95	48	54
FLORIDA								
PENSACOLA HARBOR								
Gasoline	133	143	143	154	144	148	153	147
Distillate Fuel Oil	31	21	23	24	34	25	19	27
Residual Fuel Oil			1	6	1			
Asphalt, Tar & Pitch	3	5	4	0				
Lube Oil & Greases		3						
TAMPA HARBOR								
Gasoline	3,934	4,755	3,685	3,118	3,542	3,406	3,664	3,452
Distillate Fuel Oil	1,023	1,017	840	818	796	794	836	726
Asphalt, Tar & Pitch	110	89	3	57	53	53	59	66
Petroleum Coke	25	51	110	58	79	61	60	62
Liquid Natural Gas	81	90	94	107	74	21	18	2
MISSISSIPPI								
PASCAGOULA HARBOR								
Crude Petroleum	5,211	4,305	4,179	5,321	4,605	4,832	4,235	3,981
Gasoline	1,223	1,289	982	955	1,173	967	1,058	845
Distillate Fuel Oil	392	386	578	255	518	559	661	778
Petroleum Coke	319	291	251	325	306	334	348	287
Residual Fuel Oil	308	201	218	136	182	175	73	110

Data distributed in 1000 short tons; "Mgal" calculated using average oil density of 6.8 bbl/ton
Weighted red coloring in each cell represents relative values across the entire table

Table 4-7. Commodity Volume Movements (in Millions of Gallons) for Top 5 Petroleum Products within Federal Region 4 Atlantic Harbors Averaging More Than 100 Million Gallons of Total Petroleum Per Year Since 2009 [233]

	2006	2007	2008	2009	2010	2011	2012	2013
FLORIDA								
CANAVERAL HARBOR								
Gasoline	124	111	75	89	163	291	236	234
Residual Fuel Oil	61	108	26	22	4	19	19	4
Distillate Fuel Oil	38	47	37	52	60	72	94	83
Kerosene					7	20		44
Naphtha & Solvents	4	6	1		4	3		18
JACKSONVILLE HARBOR								
Gasoline	712	601	518	382	401	438	549	677
Distillate Fuel Oil	368	337	433	477	443	435	227	125
Petroleum Coke	134	115	200	132	152	85	30	99
Lube Oil & Greases	144	1	2	6	1	0		1
Residual Fuel Oil	136	114	142	106	142	95	86	73
KEY WEST HARBOR								
Gasoline	1			5	4	15	13	
Distillate Fuel Oil		1			11			
Residual Fuel Oil	1	1				3		
MIAMI HARBOR								
Distillate Fuel Oil	66	83	84	115	138	132	107	122
Residual Fuel Oil	103	116	63	55	42	8	16	18
Gasoline	2	7	6	0	9	24	8	1
Naphtha & Solvents	9	5	3	7	1	1	1	1
Petroleum Coke	0	0	5	0	0	2	0	0
PORT EVERGLADES (FORT LAUDERDALE)								
Gasoline	2,135	2,375	2,280	2,369	2,096	2,302	2,473	2,401
Distillate Fuel Oil	446	467	593	657	715	727	559	544
Residual Fuel Oil	222	135	68	48	26	13	7	28
Kerosene	87	76	115	23	73	44	68	108
Crude Petroleum	29	27	23	6	6	13	16	35
GEORGIA								
SAVANNAH HARBOR								
Liquid Natural Gas	1,084	1,307	996	1,157	823	585	428	118
Distillate Fuel Oil	375	325	232	286	267	413	297	122
Gasoline	411	321	267	281	236	260	232	68
Crude Petroleum	388	386	410	291	310	174	106	
Residual Fuel Oil	224	199	187	260	243	338	294	184
NORTH CAROLINA								
WILMINGTON HARBOR								
Gasoline	227	196	213	200	117	82	85	77
Distillate Fuel Oil	54	48	60	63	179	219	38	26
Residual Fuel Oil	98	65	39	128	93	23	4	12
Asphalt, Tar & Pitch	30	36	8	43	58	46	41	41
Petroleum Coke	36	22	28	5	1	6	2	2
SOUTH CAROLINA								
CHARLESTON HARBOR								
Gasoline	288	286	223	232	183	167	231	107
Distillate Fuel Oil	148	132	110	89	187	226	198	56
Residual Fuel Oil	77	65	58	95	109	120	119	84
Petroleum Coke	96	29	9	5	1	1	1	0
Lube Oil & Greases	1	2	1	0	0	12		1

Data distributed in 1000 short tons; "Mgal" calculated using average oil density of 6.8 bbl/ton
Weighted red coloring in each cell represents relative values across the entire table

Trends in waterborne intrastate crude movements have shifted dramatically over the last 30 years. During the early to mid-1980s approximately 9 billion gallons of crude was moved over-water from Pacific domestic sources to refineries in the Gulf of Mexico and in the Northeast (Figure 4-6). By 1990 that trend was halved and by 1996 it was nearly eliminated. Intrastate crude movements were often less than 200 million gallons per year from 1997-2006; however, they have increased to over 2 billion gallons per year by 2014; approximately 25% of these movements occur on open water between the Gulf of Mexico and Atlantic states.

Figure 4-6. Intrastate Crude Oil Movements (origin – destination) by Tanker or Barge from 1981 to 2014 [236]

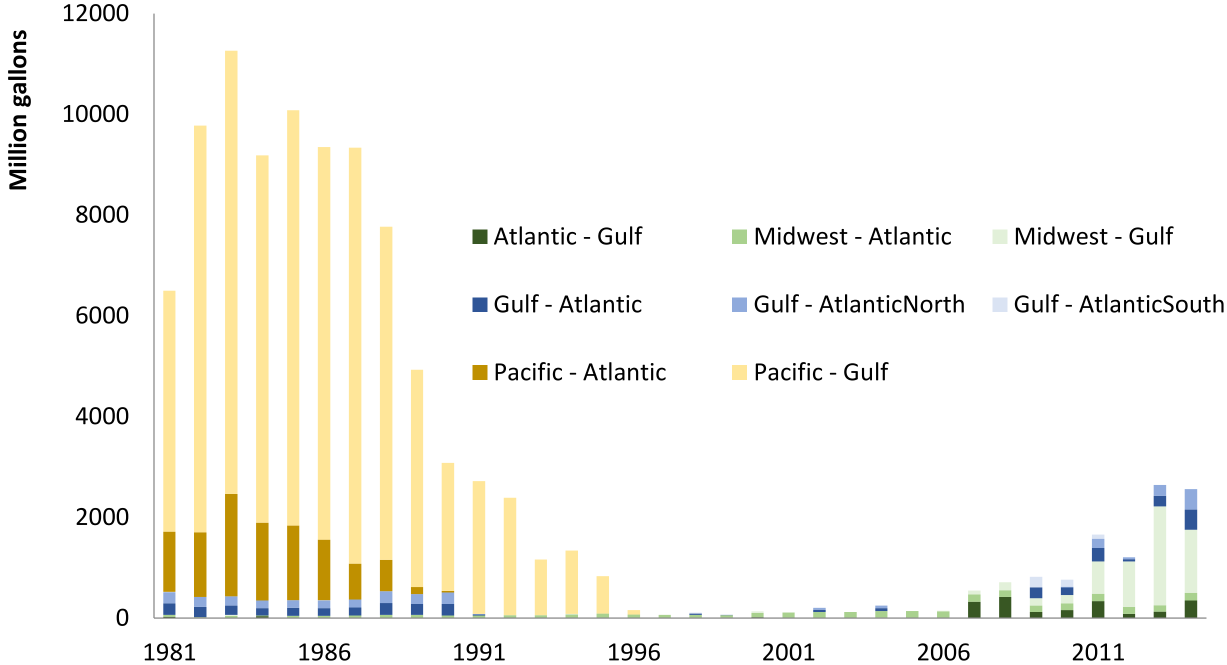
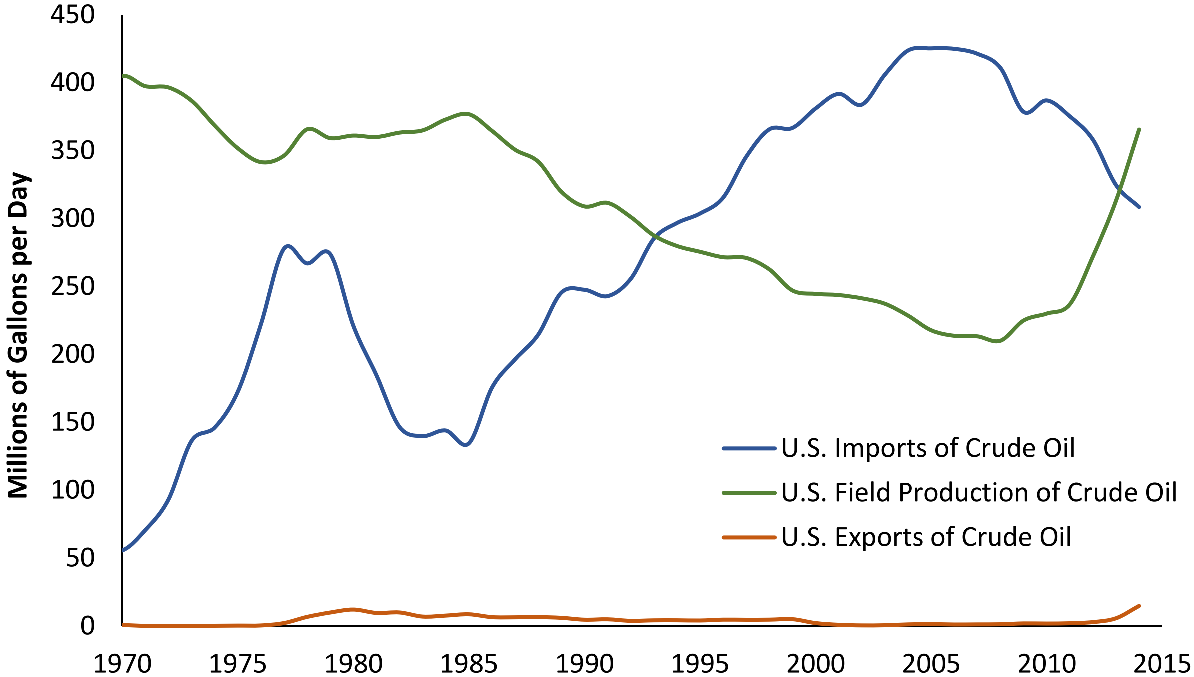


Figure 4-7 illustrates the trend of crude oil imports against domestic field production since 1970. The pattern seen in Figure 4-7 is due, in part, to the shift from domestic to foreign production sources, which overtook domestic production in 1993 and fell below again in 2013 (Figure 4-7). Due the to the resulting shift in the nature of ship types, cargo sizes, traffic patterns, frequency, and offshore production activities, changes in production and waterborne oil commerce should be reflected in oil discharge incident trends over the same period.

Figure 4-7. U.S. Supply and Disposition of Crude Oil from 1970 to 2014 [236]



Section 4.2. Maritime Transportation and Port Expansion

The purpose of this section is to address existing and future trends in maritime transportation and port expansion within the Region 4, where such increased awareness of the facts and trends of these activities will allow for a proper evaluation, both separately and in combination with other activities described in this Chapter, in determining the overall impact(s) of the preauthorized dispersant use and *in-situ* burn plans.

4.2.A. Maritime Transportation

Region 4 encompasses some of the highest cargo density shipping routes across the globe, which are further concentrated by the Department of Transportation's America's Marine Highway Program. Of the 18 total marine corridors of this program, four can be found within Region 4: M-95 runs offshore from the coasts of Florida, Georgia, South Carolina, and North Carolina; M-10 runs offshore from the coasts of Florida, Alabama, and Mississippi; M-65 runs inland beginning inside the Port of Mobile in Alabama; and M-55 which runs along the western borders of the states of Mississippi and Tennessee. For the purpose of this Biological Assessment, M-95 and M-10 are the corridors of focus given their nexus to the *Green Zone*.

Figure 4-8. Cargo Densities of Global Shipping Routes [237]

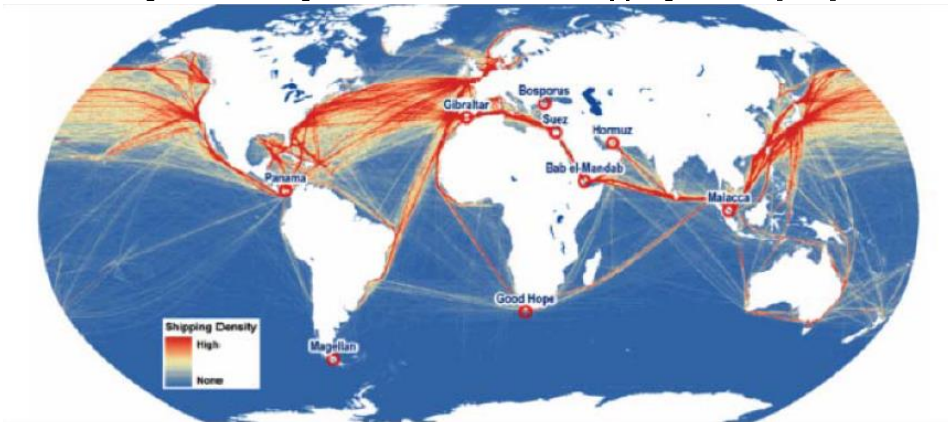
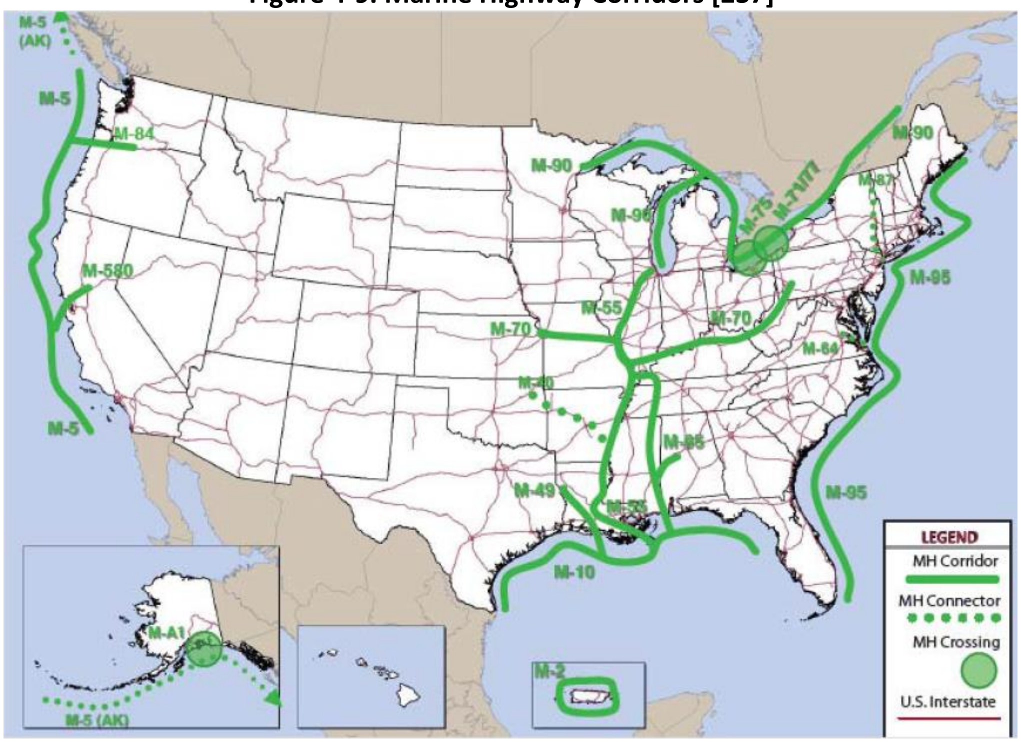


Figure 4-9. Marine Highway Corridors [237]



A major driver of the high density of shipping along the marine corridors throughout Region 4 is U.S. trade, both imports and exports. Data analysis performed by the Department of Transportation offers “baseline projections” that “the total volume of U.S. imports from all world regions and by all modes (water, air and land) is projected to more than double over 30 years— from 1.2 billion tons in 2010 to 2.6 billion tons in 2040 — at an average annual growth rate of 2.7 percent ($5.7 trillion value). Exports are forecasted to grow significantly more quickly than imports, although from a much lower base [of 0.8 billion tons in 2010 to a forecasted 1.8 billion tons in 2040– at an average annual growth rate of 3.0 percent ($4.2 trillion value)]” [237]. Specific to waterborne trade alone which is accounted for in the above figures, “container trade is projected to triple from 2010 to 2040” [237]. Analysis of the impacts of the Panama Canal

Expansion have not been factored in to this baseline data, which will likely affect the transportation modes and volume capacity of imported and exported goods, but not necessarily directly change the percent increase of forecasted imports and exports affected by supply and demand. Therefore, this Biological Assessment assumes the forecasted increases in U.S. imports and exports, and the associated high density of maritime shipping involved in the movement of various cargos.

Lastly, to accompany the above information, the following top U.S. Container Ports by volume (TEU = twenty-foot equivalent unit) are located in Region 4: Port of Wilmington (NC) (~0.5 million TEUs), Port of Charleston (SC) (~3-5 million TEUs), Port of Savannah (GA) (~5-8 million TEUs), Port of Jacksonville (FL) (~1-2.5 million TEUs), Port Everglades (FL) (~1-2.5 million TEUs), Port of Miami (FL) (~1-2.5 million TEUs), Port of Mobile (AL) (0.5 million TEUs), and Port of Gulfport (MS) (0.5 million TEUs). Each of these ports are either evaluating or are currently undergoing expansion projects to include improvements in port infrastructure as well as channel dredging projects to increase the depths from a range of 42-45 ft to a range of greater than 42 ft to greater than 50 ft.

Figure 4-10. Top 20 U.S. Container Ports by Volume (TEUS) and Depth [237]

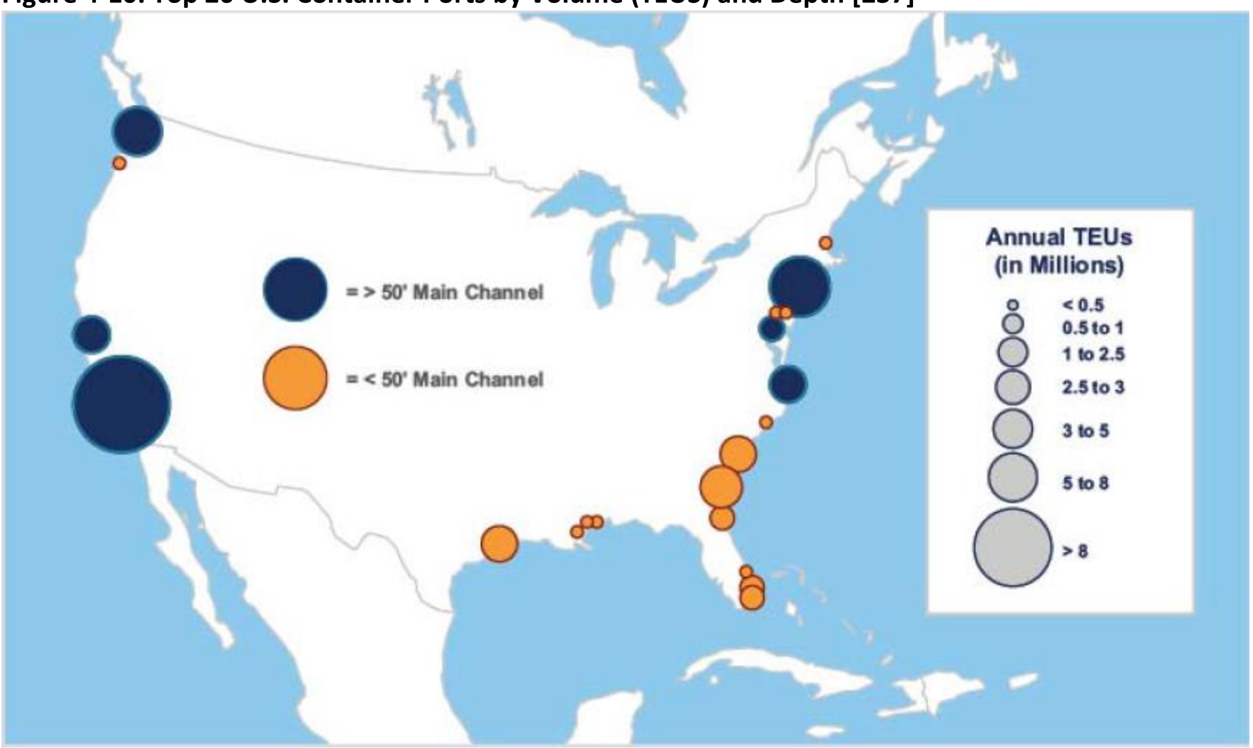


Table 4-8. Channel Depths at Primary East Coast Container Ports [237]

Port	MLW Channel Depth	Planned Channel Depth	Scheduled Completion Year
Boston	40 ft (12.2 m)	48-50 ft (14.6-15.2 m)	Currently under study[33]
New York	45-50 ft (13.7-15.2 m)	50 ft (15.2 m)	2014[34]
Delaware River	40 ft (12.2 m)	45 ft (13.7 m)	2017[35]
Baltimore	50 ft (15.2 m)	No immediate plans	No immediate plans[36]
Hampton Roads	50 ft (15.2 m)	55 ft (16.8 m)	Not available[37]
Wilmington, NC	42 ft (12.8 m)	>42 ft (>12.8 m)	Currently under study (Report Expected Jun. 2014)
Charleston	45 ft (13.7 m)	>47 ft (>14.3 m)	Currently under study (Report Expected Sept. 2015)
Savannah	42 ft (12.8 m)	≥47 ft (≥14.3 m)	2016[38]
Jacksonville	40 ft (12.2 m)	45-47 ft (13.7-14.3 m)	Currently under study[39]
Port Everglades	42-45 ft (12.8-13.7 m)	>48 ft (>14.6 m)	Currently under study[40]
Miami	42 ft (12.8 m)	50 ft (15.2 m)	2014[41]
Mobile	45 ft (13.7 m)	≥50 ft (≥15.2 m)	Currently under study[42]
New Orleans	45 ft (13.7 m)	50 ft (15.2 m)	Currently under study
Houston	45 ft (13.7 m)	No immediate plans	No immediate plans

4.2.B. Panama Canal Expansion

From the Phase I Report of the Panama Canal Expansion Study, the following are the key points regarding the Panama Canal expansion project (DOT, 2013):

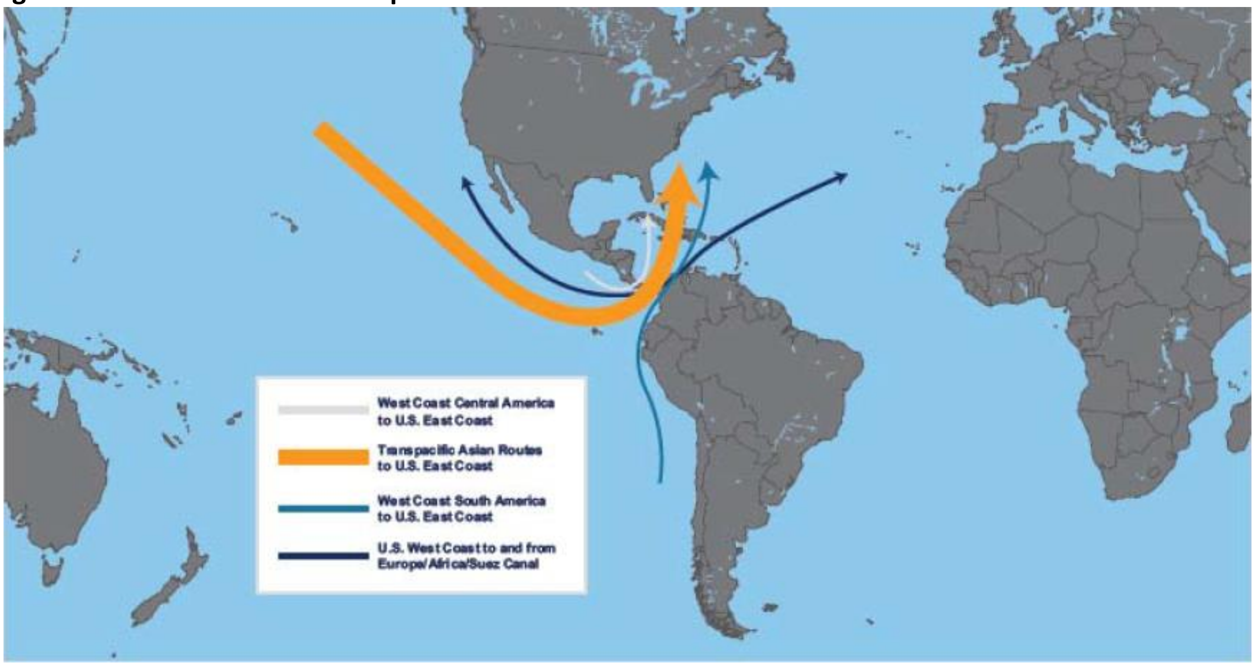
- The Panama Canal is an important link in global trade, accommodating an estimated five percent of the world's total cargo volume.
- Panama Canal expansion will double Canal capacity and allow passage of much larger ships than those currently able to transit the Canal.
- The maximum-size container ship that can transit through the Canal will increase from those with a 5,000 TEU capacity (current "Panamax" size) to those with capacity for 13,000 TEUs or slightly more.

Increased cargo capacity. Although only 12 to 14 additional vessels per day can be accommodated in the new lock system, the increased size of the vessels will result in doubling Panama Canal throughput from 300 million PCUMS tons to 600 million PCUMS tons. [PCUMS is an acronym for Panama Canal Universal Measurement System, the basis upon which vessels are charged for use of the Canal. It is approximately 100 cubic feet of cargo space. A twenty-foot long container (TEU) is equivalent to approximately 13 PCUMS tons] [237].

Significant shares of U.S. trade with Asia, Australia/New Zealand, and the West Coast of Central and South America move through the Panama Canal.

The major North American trade routes (by volume) that transit the Panama Canal. The U.S. trade lane most likely to be impacted by Panama Canal expansion is Northeast Asia-East Coast U.S. trade because it is the largest trade lane and because it is where larger ships are most likely to be deployed. East Coast U.S.-West Coast of South America trade, the second-largest trade lane in terms of tonnage, could also be affected. There is likely to be minimal impact on trade lanes with smaller volumes, such as U.S. East Coast trade with the West Coast of Central America, which are handled by feeder services using smaller vessels and transshipment through Panamanian ports.

Figure 4-11. Panama Canal Principal Trade routes



4.2.C. Environmental Impacts of Maritime Transportation and the Panama Canal Expansion in Region 4.

As freight transport operations increase through the Panama Canal corridor, accidents may increase. Accidental collision of whales and other marine mammals with vessels approaching and leaving ports has been a significant mortality source, but may moderate with recent speed restrictions. Increases in oil discharges and other contaminants spills are also possible with increased traffic [238].

Freight transport is expected to grow most rapidly in the Southeast Atlantic and Pacific regions because of high regional population growth rate. In the Southeast, more harbor expansion is needed to accommodate the largest vessel sizes. In addition, in the Southeast Atlantic Region environmental impact mitigation may be more costly because of greater wetland and federally listed species vulnerability. Growth and expansion projects in the Gulf are anticipated to be comparatively smaller than those in the Southeast Atlantic [238].

The effects of Panama Canal expansion have the potential to redistribute some freight transport growth from Pacific Coast ports to Southeastern ports. The canal expansion may also favor more transport of agricultural products on the Upper Mississippi and Illinois Rivers. Shifting trends in maritime transportation from west coast to east coast ports will subsequently result in shifting railroad and highway patterns resulting in increased emission rates from those sources along southeast transportation corridors [238].

Section 4.3. Pollution and Environmental Toxicants

Reduced water quality results from discrete point sources, spills, widespread non-point sources, and atmospheric deposition. The USEPA [239] rates water quality in the Southeast Atlantic Coast and Gulf of Mexico Coast as fair with fair-to-poor and poor ratings, respectively, for sediment quality in these areas. Benthic areas in the Gulf of Mexico are also rated poorly.

Excess nutrients can come from point sources (e.g. sewage treatment plants), non-point sources (e.g. runoff from farms and suburbs), and small particles deposited from the atmosphere. Effects of nutrients are pervasive, especially in estuaries and coastal waters, overstimulating algal growth and leading to eutrophication [240, 241]. According to a NOAA report [240], approximately two-thirds of the estuaries along the coasts of the continental U.S. exhibited at least moderate symptoms of eutrophication in 2004. Oxygen levels that are too low cannot support marine life, and the loss of submerged aquatic vegetation reduces important habitat and food for many estuarine and coastal species [242]. Algal blooms have been implicated in the mortality of fish and marine mammals along coastal areas leading to potential disruptions throughout the food chain. Portions of U.S. fishing areas are closed each year due to sewage contamination or concentrations of algal toxins in shellfish. Many substances, including metals, pesticides, and other organic compounds, can bioaccumulate, increasing in concentration in the tissues of animals that feed on contaminated food sources.

Marine debris is widely distributed and results from numerous sources, including at-sea dumping, land-based littering, and illegal dumping. NOAA defines marine debris as “any persistent solid material that is manufacture or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes” [74 FR 45555; 15 CFR §909.1(a)]. It can cause physical damage to fragile habitats, introduce contaminants and pathogens, and impede accessibility within habitats. Marine debris poses a risk to some endangered or threatened sea birds, marine mammals, and turtles. For example, sea turtles could ingest plastic bags that closely resemble jellyfish and may die of starvation due to blockage of their digestive tracts. Discarded or lost fishing gear such as gillnet panels, traps, crab pots, and longlines with hundreds of hooks may continue to capture aquatic life (“ghost fishing”) several years after abandonment [242].

Section 4.4. Invasive Species[51]

Invasive species are prevalent in all aquatic habitat types and regions. The major ecological impacts of invasive species are: (1) outright loss of native species or decline in abundance of native species due to competition for food and space, predation, and habitat alteration; (2) changes in ecosystem structure and function, such as nutrient cycling and hydrology; (3) rearrangement of trophic relations; or (4) the introduction of virulent plant and animal diseases and parasites [244-246].

Genetic effects also occur through hybridization and interbreeding with native species [247]. Invasive species – both terrestrial and aquatic – can affect endangered and threatened species. Of 30 extinct fishes in the U.S., invasive species were a factor in the extinction of 24 [246]. Impacts on other species also can be indirect: the spread of horsetail Australian pines (*Casuarina*

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[51] See: 243. U.S. EPA, *An Initial Survey of Aquatic Invasive Species Issues in the Gulf of Mexico Region*. 2000, U.S. Environmental Protection Agency, Invasive Species Focus Team, Gulf of Mexico Program.

equisetifolia) on sandy coasts and barrier islands has altered the beach profile, hampering the ability of endangered loggerhead and green sea turtles to nest [246, 248].

4.4.A. Lionfish

Lionfish, introduced into the southeast Atlantic in the 1980s, are firmly established in a range of the Atlantic from North Carolina to South America, including the Gulf of Mexico [249]. Lionfish are considered an aggressive threat to native fish populations. Invasive lionfish continue to cause ecological damage along temperate and tropical reefs from North Carolina to the Gulf of Mexico and the Caribbean islands to the Atlantic coast of South America. Lionfish predation has been shown to affect fish species composition, with variable impacts realized across species and size groups [250]. Significant reductions in fish recruitment have been observed in experimental patch reefs with a single small lionfish [251] and sharp declines in prey biomass have been observed on natural Bahamian coral reefs [252]. Lionfish occupy similar habitats and consume similar prey to many species of native fish predators [252, 253] and macroinvertebrates. Lionfish grow significantly more quickly and may consume prey at rate far faster than native predators (*Cephalopholis fulva*), which raises concerns that lionfish could outcompete some native predators for food resources on invaded habitats [250].

Section 4.5. Habitat Degradation

A wide range of human activities in coastal watersheds causes habitat loss and fragmentation. While the effects of individual projects may be small, there are substantial cumulative effects. Placement of structures over-water, for shoreline protection, and for water-control can have serious impacts on local habitat, including removal of vegetation and natural substrates, and blocking the sunlight needed by aquatic plants. Dredging removes bottom habitat, degrades water quality through increased turbidity and siltation, releases oxygen-consuming substances and contaminants, and alters physical habitat and hydrographic regimes. Disposal of dredged material can have these same effects and can smother benthic habitats. The loss or fragmentation of habitat reduces the ecological services that the habitat provides. The majority of fishery and protected-species stocks that NMFS manages use estuarine and shallow-marine habitats. Even species that spend most of their lives far out at sea, such as some anadromous fishes, marine mammals, and seabirds, depend on these heavily-impacted habitats for certain key aspects of their life histories, such as spawning, larval or juvenile growth, calving, or nesting [242].

Even before the DWH oil spill, the health and function of the Gulf of Mexico ecosystems and economies have endured decades of human and natural stressors. The Gulf has experienced erosion of barrier islands, imperiled fisheries, water quality degradation, impacts from invasive species, and substantial coastal land loss due to natural forces, the alteration of hydrology, and impacts from other human activities. In addition, the Gulf Coast region has endured repeated natural catastrophes, including major hurricanes such as Katrina, Rita, Gustav, and Ike [254].

Section 4.6. Climate Change and Ocean Acidification[52]

[52] see: 255. BOEM, *Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas, Final Programmatic Environmental Impact Statement*. 2014, U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region: New Orleans.

Most of the observed increases in global average temperatures since the mid-20th century are very likely due to the observed increase in anthropogenic greenhouse gas concentrations [256, 257].

The Intergovernmental Panel on Climate Change [256] projects further global warming of 1.1-6.4°C (2.0-11.5°F) by the year 2100. Because of thermal expansion of the oceans and ice melting, global mean sea level has been rising at an average rate of 1-2 mm (0.04-0.08 in) per year over the past 100 years. The projected increase in sea level by 2100 is anywhere from 0.18 to 0.59 m (7.1-23.2 in) .

Another effect of carbon dioxide emissions is ocean acidification. Approximately 30–50% of global anthropogenic carbon dioxide emissions are absorbed by the world's oceans, which is expected to increase surface ocean acidity by 0.14–0.35 pH units over the next century. Ocean acidification likely will impact the ability of marine calcifiers, such as corals and mollusks, to make their shells and skeletons from the calcium carbonate dissolved in sea water. Coral bleaching[53] is a symptom of environmental stresses such as diseases, sedimentation, pollution, and increased temperature. From the fisheries perspective, loss of the living coral means that the habitat it provides for coral reef-dwelling fish will also be lost. Ocean acidification may indirectly affect fish and marine mammals through reduced abundance of marine calcifiers that form the base of the food web and that provide habitat structure [242].

Globally, many environmental effects include spatial changes in precipitation patterns, changes in the frequency of extreme weather events, changes in the timing of spring events such as bird migration and egg-laying, poleward shifts in ranges of plant and animal species, and acidification of marine environments [256, 258, 259]. Documented changes in marine and freshwater biological systems are associated with rising water temperatures, as well as related changes in salinity, oxygen levels, and circulation. These include shifts in ranges and changes in algal, plankton, and fish abundance in high-latitude oceans [256]. In addition, there is evidence that suggests organisms are very sensitive to temperature changes and the associated impacts from climate change are more prevalent along ecosystem boundaries. This is especially true in some marine environments where in certain areas a small increase in temperature can result in abrupt ecosystem shifts across multiple trophic levels [260] suggests that there may be strong interactions between trophic levels within the ecosystem due to temperature changes. Continued changes in precipitation could affect the water quality and marine ecology of by altering the quantity and quality of runoff into estuaries. Over the next century, the IPCC [256] projects that global temperature increases will cause significant global environmental changes, more frequent extreme heat waves and heavy precipitation events; an increase in the intensity of tropical cyclones (hurricanes and typhoons); and numerous hydrological, ecological, social, and health effects. Regionally, the U.S. Global Change Research Program [257] predicts similar long-term changes for the southeastern U.S., including increased shoreline erosion due to sea level rise and increases in hurricane intensity, and a precipitous decline in wetland-dependent fish and shellfish populations due to loss of coastal marshes. Reasonably foreseeable marine environmental changes that could result from climate change over the next century include altered migratory routes and timing (e.g., for marine mammals and migratory birds); changes in shoreline

[53] In a bleaching event, coral polyps expel the photosynthetic cells of unicellular algae, called zooxanthellae, which normally live symbiotically within their tissues and provide nutrients and a characteristic color.

configuration that could adversely affect sea turtle and shorebird and seabird nesting beaches and prompt increased levels of beach restoration activity (and increased use of OCS sand sources); changes in estuaries and coastal habitats due to interactive effects of climate change along with development and pollution; and impacts on calcification in plankton, corals, crustaceans, and other marine organisms due to ocean acidification [261]. Positive impacts may include increased habitat availability for some warm-water species. Some species will be negatively impacted under most scenarios by climate change, while other species may benefit.

Section 4.7. Fishery Impacts

4.7.A. Vessel Strikes

Whales are at risk of ship strikes throughout their range. The proportion of struck whales that strand has been estimated to range from <5% to 17% of true mortality, suggesting ship strikes could be at least 10 times higher than the number documented [262]. Anthropogenic activities accounted for 50% of all confirmed right whale deaths from 1985 to 2005; 38% were due to ship collisions and 12% were due to fishing gear entanglement. In addition, 75% of all right whales show scars from gear interaction at some time in their lives [223].

Increased ship traffic could increase the probability of collisions between ships and marine mammals, resulting in injury or death to some animals. Dolphins may approach vessels that are in transit to bow-ride. Vessel strike is the most common human-induced mortality factor for manatees, and most manatees bear prop scars from contact with vessels. The rapid increase in the exploration and development of petroleum resources in deep oceanic waters of the northern Gulf of Mexico has increased the risk of OCS vessel collisions with sperm whales and other deep-diving cetaceans (e.g., and beaked whales). Deep-diving whales may be more vulnerable to vessel strikes [263] because of the extended surface period required to recover from extended deep dives [255]

While most cases of injury to a whale relate to speed (>14 knots) and size (>80 m) of vessels, sailing vessels, while smaller, can have serious impacts on whales due to the high speeds that can be reached (>20 knots). Many animals may sink or float away or collisions may go unreported, therefore the collision rate may be underestimated.[220]

In an effort to reduce ship collisions with critically endangered North Atlantic right whales, an early warning system (EWS; the Right Whale Sighting Advisory System) was instigated in 1994 along the southeastern U.S. coast and in 1999 a Mandatory Ship Reporting System was implemented. Based upon recent modeling of North Atlantic right whale distribution and influence of water temperature, high whale densities have been shown to extend more northerly than the current boundary of the calving critical habitat. In November 2006, NOAA established new recommended routes for vessels leaving the ports of Jacksonville and Fernandina, Florida; Brunswick, Georgia; and Cape Cod Bay, Massachusetts [264].

In the southeast United States, boat strikes are also a concern for sea turtles. Between 1986 and 1988, 7.3% of all sea turtle strandings documented in U.S. Atlantic and Gulf of Mexico waters sustained some type of propeller or collision injuries (how much damage was post-mortem versus cause of death could not be determined). The highest numbers of deaths occur where boat traffic is highest, including the Florida Keys and the U.S. Virgin Islands" [265]. In Florida, over 560 hawksbills stranded dead on coastal beaches from 1980 to 2007. Of these stranded turtles, 9% had definitive propeller wounds indicating the turtle collided with a motorized boat [266, 267].

4.7.B. Noise

There is growing concern that the sound levels in the ocean are increasing with increased vessel traffic, geophysical surveys, and other ocean activities. Underwater noise from anthropogenic sources has grown in the last 50 years due to increased oil and gas exploration, sonar use (both military and commercial), shipping traffic, and recreational boating [223]. Surface shipping is the most widespread source of anthropogenic, low frequency (0 to 1,000 hertz [Hz]) noise in the oceans. The background ocean noise level at 100 Hz has been increasing by about 1.5 decibels (dB) per decade since the advent of propeller-driven ships. An association may exist between long-term exposure to low frequency sounds from shipping and an increased incidence of marine mammal mortalities caused by collisions with ships. Prop-driven vessels also generate high frequency noise through cavitation, which accounts for approximately 85% or more of the noise emitted by a large vessel [220].

The sounds generated by ships overlap significantly with the frequency range used by many cetacean species, especially with low-frequency vocalizers such as blue, fin, and humpback whales [262]. Responses to sound vary among species, individuals, and time of exposure [268]. Odontocete (toothed whale) sensitivity is most impacted by high-frequency noises (> 10kHz) but is less sensitive to low frequency noises. Mammals such as the West Indian Manatee are more sensitive to low frequency noises such as below 1 kHz where many industrial activity noises occur [255]. Studies of North Atlantic right whales show that animals do not respond to ship noise but react strongly to alert signals produced by vessels. Typical reaction was a rapid surfacing behavior, which may make them more vulnerable to ship strike [269]. Right whales, like many large cetaceans, communicate over large distances in the open ocean using low-frequency, long wavelength sounds, which are subject to masking by human activities. Studies have indicated that whales may respond to increased noise by leaving certain habitats, changing behavior, and changing their vocalization patterns… Noise pollution has been correlated to an increase in stress-related fecal hormone metabolites in North Atlantic right whales. Chronic elevations of these fecal hormone metabolites have been shown to negatively affect growth, immune system response, and reproduction in a variety of vertebrate species [223].

Whales exposed to sonar that rapidly change their dive behavior may not be able to manage nitrogen loads during the dive and are physiologically impaired when gas bubbles form in the blood and tissue (decompression sickness). Sperm whales exposed to LFAS and MFAS continued deep dives but the dives were shallower, which increased their risk of decompression sickness although the risk was within the normal range for sperm whales. However, necropsies conducted on fresh stranded cetaceans found higher than normal concentrations of gas bubbles in the tissue of deep-diving whales, including sperm whales, compared to shallow divers [220].

Seismic surveys may impact foraging behavior in sperm whales despite not exhibiting avoidance behavior at the surface. Additionally, sperm whales are likely sensitive to aircraft; while they react to fixed-wing aircraft or helicopters in some circumstances they may not react in others.[220]

Section 4.8. Military Training

To account for the impacts of military training within the Region 4 area of responsibility and its impacts on federally listed species, critical habitats, and essential fish habitats, this assessment incorporates the facts and opinions documented in the Biological Opinion and Conference Opinion on Atlantic Fleet Training and Testing Activities (2013-2018) FPR-2012-9025. Using terminology from this opinion to define the types of military training ongoing in the Region 4 area of responsibility, the Navy categorizes training exercises and testing activities into functional warfare areas called primary mission areas, including:

- Anti-air warfare
- Strike warfare
- Anti-submarine warfare
- Mine warfare
- Amphibious warfare
- Anti-surface warfare
- Electronic warfare
- Naval special warfare

The geographic extent of the Navy's military training is termed The Atlantic Fleet Training and Testing (AFTT) FEIS/OEIS Study Area, which "is located in the western Atlantic Ocean and encompasses the east coast of North America and the Gulf of Mexico. The Study Area covers approximately 2.6 million square nautical miles (nm2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pier side locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. The Study Area also includes several Navy testing ranges and range complexes [270].

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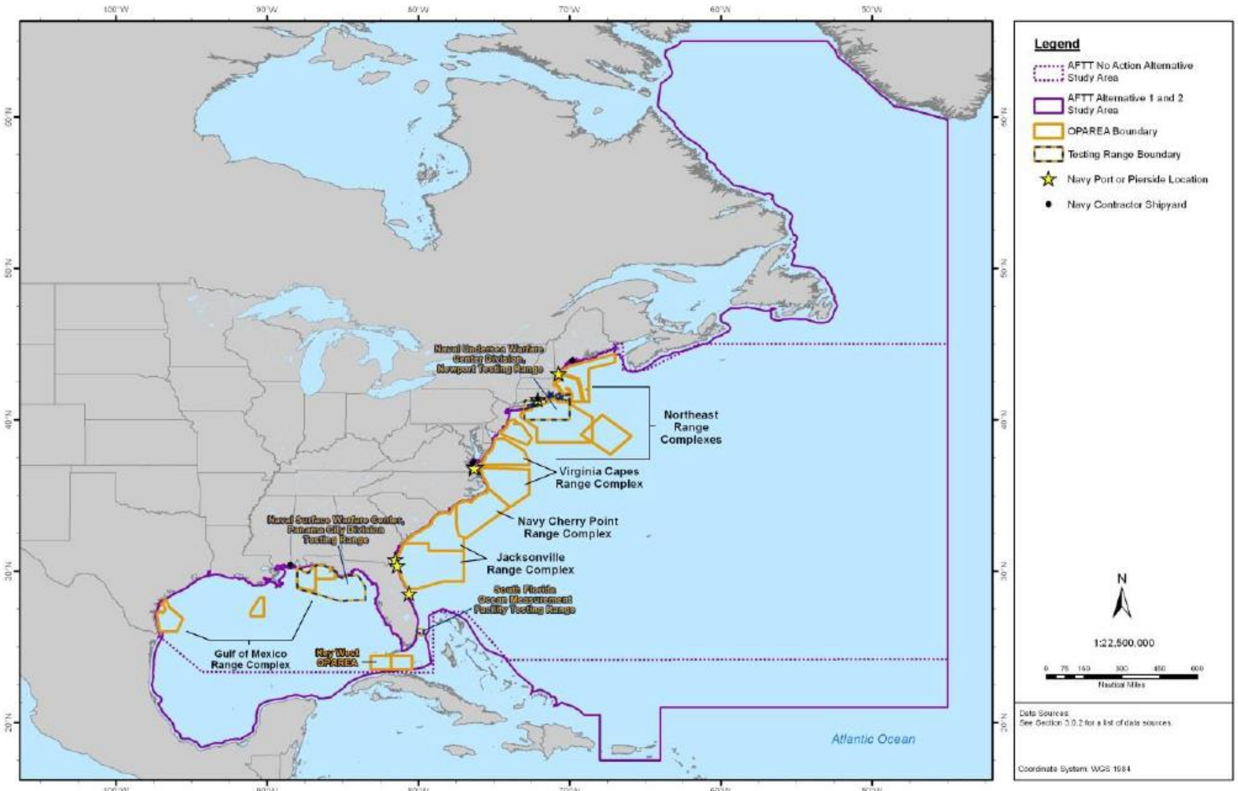
Figure 4-12. Atlantic Fleet Training and Testing (AFTT) Study Area [270]



Based on NMFS consideration of potential cumulative impacts, NMFS concluded that one of the three primary stressors (the probability of a ship strike) accumulated in the sense that the probabilities of collisions associated with multiple transits are higher than the probabilities associated with a single transit [270]. NMFS concluded that two of the three primary stressors associated with the U.S. Navy training (active sonar and underwater detonations) do not accumulate in either of the two senses of cumulative impacts. Specifically, the effects of multiple exposures to active sonar or underwater detonations were not likely to accumulate through altered energy budgets caused by avoidance behavior (reducing the amount of time available to forage), physiological stress responses (mobilizing glucocorticosteroids, which increases an animal’s energy demand), or the canonical costs of changing behavioral states (small decrements in the current and expected reproductive success of individuals exposed to the stressors). In particular, species would be exposed on foraging areas and would experience trivial increases in feeding duration, effectiveness, or both, that would not accumulate in a manner that is likely to result in avoidance behavior or altered energy budgets [270].

With respect to threatened and endangered marine mammals, NMFS concluded that the aggregate number of exposures over the five-year duration of the MMPA regulations or and into the reasonably foreseeable future is unlikely to result in accumulated adverse impacts [270].

Chapter 5. Effects of Preauthorized Use of Dispersants on Listed Species, Critical Habitats, and Essential Fish Habitats

Section 5.1. Effects of the Action

In this section, potential effects of the Proposed Federal Action are discussed for each individual listed and proposed species under the Endangered Species Act (ESA), and designated critical habitat, as well as for EFH. For the purpose of this *Biological Assessment*, direct and indirect effects of the Proposed Federal Action within the *Green Zone* are considered and defined as follows:

> *Direct effects* are explicitly defined as those caused by the Proposed Federal Action and occur at the same time and place as the Action; and
>
> *Indirect effects* are explicitly defined as those caused by the Proposed Federal Action and are later in time, but are reasonably certain to occur[54].

Effects are assumed to occur when there is a clear pathway of exposure, when a Proposed Federal Action has been undertaken, and when the receptors or critical habitats are physically present (Figure 5-1).

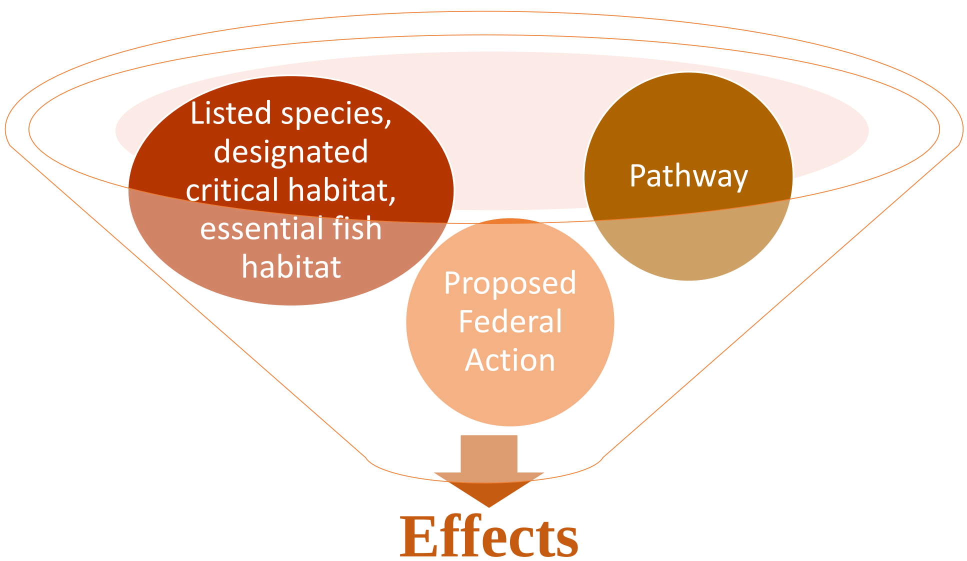


Figure 5-1. Components required for potential effects to resources of concern.

[54] 50 CFR 402.02- https://www.law.cornell.edu/cfr/text/50/402.02

A complete exposure pathway to dispersants or chemically dispersed oil can only occur when all of the following elements are present (modified from [271, 272]):

1. An oil spill incident requiring the use of dispersants resulting in chemically dispersed oil in the water column;
2. Media (i.e., water, air, or sediment) must be present for dispersants and/or chemically dispersed oil to travel;
3. Listed species, designated critical habitat or EFH must be present and come into direct contact with dispersants and/or chemically dispersed oil; and
4. A pathway of exposure leading to direct contact the body (i.e., ingestion, inhalation, and dermal contact and absorption)

As discussed in Section 2.1.H, the acute toxicity (based on LC50 and EC50 data) of the preauthorized dispersants listed for use is generally low (in excess of 20 mg/L even for sensitive species; see Figure 2-2 and Figure 2-3) when compared to the toxicity (based on LC50 and EC50 data) of chemically dispersed oil (in excess of 2 mg/L even for sensitive species; Figure 2-4 and Figure 2-5) (see also [14, 268]). It is unlikely that, when using the ASTM standard dispersant application rates (5 gal/acre at a prescribed 1:20 dispersant to oil ratio; ca. 5 mg/L instantaneous dispersant concentration in the water column) [22], dispersants would contribute significantly to the toxicity of chemically dispersed oil. Furthermore, best management practices during dispersant use are in place to minimize impacts to wildlife, especially threatened and endangered species, listed critical habitats, and EFH (Appendix IV). For example, specific wildlife measures are implemented to minimize direct dispersant spray on marine mammals, sea turtles, and birds. As a result, direct effects associated with dispersant use to listed and proposed species under the ESA, designated critical habitat, and EFH would most likely result from exposures to oil that has been chemically dispersed into the water column. Based on at-sea field studies and as demonstrated through several oil spills scenarios in the Atlantic and Gulf Regions (see Section 2.1.H), generally, the concentration of chemically dispersed oil in the water column rapidly declines to background levels within hours of dispersant treatment of an oil slick in the marine environment. Consequently, direct effects to listed and proposed species in the water column, and designated critical habitats, would most likely be confined to the approximate footprint of the treated area, and limited to several hours after dispersant application.

As define above, indirect effects of the Proposed Federal Action on listed and proposed species, designated critical habitat and EFH, are those that are caused by the action and are later in time, but still reasonably certain to occur. Scientific data documenting such indirect effects are limited, and consequently, indirect effects are difficult to assess. However, indirect effects that could occur include sublethal effects of chemically dispersed oil that could result in delayed effects to listed and proposed species (e.g., reduced growth or reproductive fitness at the individual animal level and subsequent impacts to the population or entire species). Indirect effects also include effects on other species that are ecologically connected to the listed species (e.g., prey, competitors, predators), and that could affect individuals or the entire population of the listed or proposed species (e.g., reduced energy for growth, development, and reproduction). The open-water environment in the *Green Zone* is highly dynamic and would, in most cases, dilute dispersants to concentrations below those associated with toxicological effects (Section 2.1.H). As a result, any indirect effects to prey, competitors, or predators of listed and proposed species in the water column would be most likely from exposures to chemically dispersed oil, confined to the approximate footprint of the treated area, and limited to a few hours post dispersant application.

For the purpose of this *Biological Assessment* direct and indirect effects from dispersants and chemically dispersed oil are determined based on appropriate scientific information. Due to similarities in life history, behavior and physiology, species are grouped by taxa in the discussion of effects, but determinations are made on individual species and critical habitats. Similar analyses are included for EFH. The agencies' determination on the potential effect for each species and designated critical habitat, and EFH is listed in summary tables in Section 5.6. Only species, critical habitat, or EFH known to be present within the *Green Zone* are included in the following sections, or when located within the immediate vicinity of the *Green Zone*.

Section 5.2. Effects on Species and Designated Critical Habitat under the Jurisdiction of the National Marine Fisheries Service

There are a number of published studies on the direct effects of dispersant and chemically dispersed oil on marine fish and invertebrates (Section 2.1.G), serving as surrogate information for assessing potential effects to marine and anadromous fish. By comparison, there is little information of impacts to cetaceans and sea turtles. These two groups could be exposed to elevated levels of chemically dispersed oil (50-100+ mg/L) in the upper few meters (typically 10 m) of the water column if they move to the surface to breathe within the footprint of the treated area immediately following dispersant application. Under a non-continuous oil release, any exposure to detrimental levels of chemically dispersed oil is expected to be limited to a few hours due to the rapid dilution of the chemically dispersed oil (discussed in Section 2.1.H). Cetaceans and sea turtles could also be exposed to volatile hydrocarbons, which could result in inflammation of the membranes of the eyes and mouth, similar to that expected during exposure to surface oil (see Section 2.1.G and citations therein).

5.2.A. Marine Mammals

There are six listed species of marine mammals that could be affected by dispersant use in the *Green Zone*. Summaries of the known impacts to marine mammals from exposure to dispersants and chemically dispersed oil are presented in Section 2.1.G. Best management practices during dispersant use are in place to ensure that marine mammals spotted at the water surface are not accidentally sprayed with dispersants during these operations (Appendix IV). It is important to recognize that the likelihood of exposure and effects to chemically dispersed oil are species specific, and depend on their distribution patterns and movements, habitat utilization, feeding behavior, and degree of slick/sheen avoidance.

5.2.A(1) Toothed whales

Sperm whale ***Physeter macrocephalus***

5.2.A(1)(a) Direct Effects

The distribution range of the sperm whale encompasses all areas within the *Green Zone* (Section 3.1.A(1)). As whales encounter surface oil, the primary pathways of exposure to dispersants and chemically dispersed oil would be via surface contact, ingestion, inhalation of toxic volatile compounds, and contamination of prey.

Detrimental effects of exposure of dispersants or chemically dispersed oil on the skin of sperm whales are not likely because the dermal shield is considered to be a highly effective barrier to the toxic compounds found in oil [89]. For toothed whales, inhalation of volatile compounds originating from a fresh oil slick at the surface may pose the greatest risk [89, 90], but adverse direct effects may be more likely to result from chronic exposures to volatile compounds [96]. During the *Exxon Valdez* oil spill humpback whales were not severely affected [273], while numbers of killer whale in the resident AB pod[55] declined significantly [95, 273] Although direct links between the *Exxon Valdez* oil spill and the decline in numbers of killer whales were not completely resolved, explanations for these declines included recurrent inhalation of volatile compounds and ingestion of heavily contaminated prey [95]. However, there are little empirical data on the potential effects of dispersants and chemically dispersed oil to toothed whales. Initial assessments of acoustic activity and abundance data following the DWH oil spill appear to indicate changes in the distribution of sperm whales in the Gulf of Mexico further away from the spill site [274], but the exact causes of this shift remain under investigation. Sperm whales feed on squid taken at depths of 500-1,000 m [NMFS 275]. Because of the prey types and foraging methods, and preferential feeding in deep waters, toothed whales are not likely to directly ingest dispersants or chemically dispersed oil during feeding.

5.2.A(1)(b) Indirect Effects

Toothed whales feed at depth or on mobile prey unlikely to be entrained within the top few meters of the water column (i.e., squid, sharks, skates, etc.). Only prey entrained within the top few meters of the water column in the approximate footprint of the treatment area may be affected by chemically dispersed oil, likely representing a small fraction of the available food source.

Toothed whales are not expected to scavenge oil-tainted fish tissues [89]. Because hydrocarbons do not biomagnify up the food chain (as discussed in Section 2.1.G) [140], toothed whales are unlikely to be exposed to significant hydrocarbon levels via their food. In summary, indirect effects on toothed whales from dispersant use in the *Green Zone* are not likely.

5.2.A(2) Baleen whales

North Atlantic right whale, *Eubalaena glacialis*, and designated critical habitat

Humpback whale, *Megaptera novaeangliae*

Fin whale, *Balaenoptera physalus*

Sei whale, *Balaenoptera borealis*

Brydes whale, *Balaenoptera adeni*

5.2.A(2)(a) Direct Effects

The distribution range of baleen whales encompasses all areas within the *Green Zone* (Sections 3.1.A(2) through 3.1.A(6)). Field observations suggest that cetaceans typically make no attempt to avoid surface oil and generally behave in a normal manner when exposed to oil on the water surface [89, 91, 94, 273, 276-278]. As baleen whales encounter surface oil, the primary pathways

[55] The AB pod is a cohesive long-term social unit of the larger population of Southeast Alaska resident killer whales.

of exposure to dispersants and chemically dispersed oil would include surface contact, fouling of baleen, ingestion, inhalation of toxic volatile compounds, and contamination of prey.

Detrimental effects on the skin of baleen whales from exposures to dispersants or chemically dispersed oil are not likely because the dermal shield is considered to be a highly effective barrier to the toxic compounds found in oil [89]. There is no available scientific information on how direct contact with dispersants would affect whale skin, but any direct contact would be short as dispersants are water soluble and would be washed off during dives. Fouling of the baleen plates with oil while feeding at or near the surface of the ocean has been suggested to present a potential risk to the feeding capabilities of baleen whales (see Section 2.1.G), but these effects are likely to be short term. In contrast, inhalation of volatile compounds from a fresh oil slick at the surface may pose great risks to cetaceans [89, 90], but adverse direct effects may be more likely to result from chronic exposures to volatile compounds (e.g., [96]).

Ingestion of oil, either directly or through the intake of contaminated food, has been also suggested as a potential exposure route for petroleum hydrocarbons in cetaceans. Baleen whales could be exposed to chemically dispersed oil while feeding at or near the water surface. Geraci [89] estimated that an adult whale would have to consume approximately 150 gallons of oil to induce deleterious effects. Goldbogen et al. [279] calculated that fin whales engulf 71 m^3 of water when lunge feeding and 83 lunges per day would be needed to meet their energetic demand based on average krill concentration of 15 kg/m^3. If whales were feeding in the water column that contained 1 mg/L TPH[56], approximately 0.22 gal of oil would be filtered per lunge equivalent to approximately 18 gal of oil per day. It is, therefore, unlikely that whales could ingest enough chemically dispersed oil in the water column to cause deleterious effects. Furthermore, the distribution of their prefer prey is not limited to the top few meters of the water column and can be found at depths as great as 200 m [280, 281], indicating that exposure to whales would be limited only to their surface-feeding period. Another route of exposure to chemically dispersed oil by baleen whales is via ingestion of contaminated food either filtered from the water column or bottom sediments. Geraci [89] calculated that more than 10% by weight of the 1,600 kg of food consumed by a 40-ton fin whale would have to be oil to reach a dose of 150 gal of oil, which was not considered likely.

5.2.A(2)(b) Indirect Effects

Baleen whale prey items (e.g., plankton, euphausiids [krill], small schooling fish, and squid) may be exposed to various concentrations of chemically dispersed oil for up to several hours (discussed in Section 2.1.G) while in the top few meters of the water column, and would likely consume some hydrocarbons while feeding. There is also a possible reduction in the quantity of prey from chemically dispersed oil-related mortality from large-scale and continuous releases of oil [282]. Studies performed under worst-case exposure conditions (e.g., static conditions) have documented the toxicity of dispersants and physically and chemically dispersed oil to marine plankton and small fish [18, 27, 40, 47, 71, 283-289]. However, as discussed in Section 2.1.G, the acute toxicity of the preauthorized dispersants, under laboratory settings that address the dilution that occurs in open waters (96 h spiked exposures) is low (in excess of 20 mg/L even for

[56] Note that based on trajectory modeling (see Section 2.1.H) using conservative and worst-case conditions (35% of all treated oil effectively dispersed), under most scenarios, concentrations fall below 1 mg/L TPH after approximate 60 hours post treatment. Only under larger spill volumes concentrations remain above 1 mg/L TPH beyond the simulation period (120 hours).

sensitive species) when compared to the toxicity of crude oil (in excess of 2 mg/L even for those sensitive species) (see also [NRC 14, NRC 15]. As discussed previously and based on at-sea field studies and trajectory modeling of maximum most probable non-continuous discharge volumes (see Section 2.1.H), the concentration of chemically dispersed oil generally declines to background levels within hours of dispersant treatment of oil slicks. Consequently, effects of chemically dispersed oil to prey of baleen whales would be most likely confined to the footprint of the treated area and limited to a few hours post dispersant application. In addition, the distribution of their preferred prey is not limited to the top few meters of the water column [280, 281], and consequently only prey entrained within the top few meters of the water column may be impacted, likely representing a small fraction of the available food source. Furthermore, as discussed in Section 2.1.G, most aquatic organisms are able to metabolize and excrete oil-related compounds indicating little risk of bioaccumulation and biomagnification. Based on the existing information, the effect on the baleen whale food supply is expected to be minor from dispersant use in the *Green Zone*.

5.2.A(2)(c) Critical Habitat

NMFS designated critical habitat for the North Atlantic right whale along the Southeastern U.S. (Sections 3.1.A(2)(a) and 3.1.A(2)(b)) encompassing the entire *Green Zone*. The Primary Constituent Element (PCE)[57] used by NOAA to define this critical habitat is the local habitat features (i.e., proximity to shore, water depth and temperature, calm surface conditions, protection from wave action during calving, and other essential calving features) of nearshore waters of the continental shelf off Florida and Georgia. Chemically dispersed oil and dispersants may have transitory and short-lived effects on water quality, but are unlikely to alter any of the PCEs. In addition, best management practices during dispersant use are in place to minimize impacts to critical habitats (Appendix IV).

5.2.A(2)(d) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on listed and proposed marine mammals and designated critical habitat for the North Atlantic right whale from dispersant use in the *Green Zone* are summarized in Table 5-1. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to listed marine mammals and designated critical habitat are not available, and assessments are based on their behavior and distribution.

Table 5-1. Summary of the direct and indirect effects of the Proposed Federal Action to listed marine mammals.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Sperm whale, *Physeter macrocephalus*	Unlikely as whales would be in contact with the spray only	Unlikely because of the low risk of ingestion: sperm	Unlikely as dispersant concentrations are	Unlikely as chemically dispersed oil

[57] Primary Constituent Elements (PCEs) represent the environmental conditions or habitat attributes that are essential for persistence of a management species. The Endangered Species Act requires protection of PCEs to promote recovery and sustainability of a protected species and/or distinct population, but provides no specific guidance for determining boundaries of protected areas.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
	when on the surface for short periods of time, and dispersant spraying would be performed with caution if whales were observed in the area.	whales feed at depths over large areas during foraging episodes.	expected to be below effects levels for prey.	concentrations are expected to be below effects levels. Only prey entrained within the top few meters of the water column may be impacted, likely representing only a small fraction of the available food source.
North Atlantic right whale, *Eubalaena glacialis* **Humpback whale, *Megaptera novaeangliae*** **Fin whale, *Balaenoptera physalus*** **Sei whale, *Balaenoptera borealis*** **Brydes whale, *Balaenoptera adeni***	Unlikely as whales would be in contact with the spray only when on the surface for short periods of time, and dispersant spraying would be performed with caution if whales were observed in the area.	Unlikely because the amount of oil potentially ingested during feeding is below the levels thought to be deleterious.	Unlikely as dispersant concentrations are expected to be below effects levels for prey.	Unlikely as chemically dispersed oil chemically dispersed oil concentrations are expected to be below effects levels. Only prey entrained within the top few meters of the water column may be impacted, likely representing only a small fraction of the available food source.
Critical Habitat for the North Atlantic right whale, *E. glacialis*	Unlikely to have impacts on PCEs.	Unlikely to have impacts on PCEs.	None	None

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species.

5.2.B. Sea Turtles

There are five listed species of sea turtles that could be affected by dispersant use in the *Green Zone*. Summaries of the known impacts to sea turtles from exposure to chemically dispersed oil are presented in Section 2.1.G. Best management practices during dispersant use operations are in place to ensure that sea turtles spotted at the water surface are not accidentally sprayed (Appendix IV). It is important to recognize that the likelihood of exposure and effects to chemically dispersed oil are species specific, and depend on their distribution patterns and movements, habitat utilization, feeding behavior, and degree of slick/sheen avoidance.

5.2.B(1) Sea turtles

Kemp's ridley sea turtle, *Lepidochelys kempii*

Green sea turtle, *Chelonia mydas*

Loggerhead sea turtle, *Caretta caretta*, and designated critical habitat

Leatherback sea turtle, *Dermochelys coriacea*

Hawksbill sea turtle, *Eretmochelys imbricate*

5.2.B(1)(a) Direct Effects

The range of these sea turtles extends offshore of the Southeast and Gulf of Mexico coasts (Sections 3.1.B(1) through 3.1.B(5)). They spend a large part of the time on the water surface where they could be exposed to dispersant spray. Kemp's ridley, green, loggerhead and hawksbill sea turtles are mostly benthic feeders and are not likely to be exposed to chemically dispersed oil during feeding, but only when they come to the surface to breathe or rest between dives, as described for marine mammals [89, 90]. In contrast, leatherback sea turtles feed on soft-bodied animals (e.g., jellyfish, sea nettles and salps, and pyrosomes) within the water column and at the water surface particularly in the summer. With the exception of Kemp's ridley sea turtles, all other species of sea turtles found within the *Green Zone* nest on beaches along the southern U.S. and Gulf of Mexico, though nesting is minor for leatherback sea turtles, and rare for hawksbill. However, dispersants and chemically dispersed oil do not pose a threat to nesting beaches. In contrast, hatchlings and juveniles from all five sea turtle species may be found within the *Green Zone*, and could therefore be exposed to dispersants and chemically dispersed oil. There are currently no specific data on the potential effects of dispersants and chemically dispersed oil on sea turtles. However, any effects from exposure to dispersants or chemically dispersed oil would be most likely be confined to the approximate footprint of the treated area and limited to a few hours post dispersant application due to dilution in the offshore water column (Section 2.1.H). In addition and as discussed in Section 2.1.G, exposure of sea turtles to volatile chemicals of dispersants (i.e., petroleum distillates, 2-butoxyethanol) and chemically dispersed oil through inhalation is expected to be less than that of the volatile compounds of the untreated oil [104, 105].

5.2.B(1)(b) Indirect Effects

Kemp's ridley, green, loggerhead and hawksbill sea turtles feed primarily on benthic prey that are unlikely to be adversely impacted by dispersants and chemically dispersed oil. The aggregations of jellyfish, sea nettles, and salps that are the preferred prey of leatherback sea turtles are often aggregated near the water surface. Thus, indirect effects on sea turtles from dispersant use in the *Green Zone* are only likely for leatherback sea turtles. Chemically dispersed oil and dispersants may have the same transitory effects on prey abundance for sea turtles as discussed above for cetaceans. To date, there is little information on the toxicity of dispersants and chemically dispersed to jellyfish. A recent laboratory study found LC50 values as low as 0.15 mg/L for a 3-day continuous exposure of larvae gelatinous zooplankton to physically dispersed oil [290]. The same study also found bioaccumulation of PAHs in 6-day continuous exposures. Unfortunately, effects concentrations and bioaccumulation factors were reported on a nominal, and not on a measured basis, limiting the applicability of this study to the assessment of the effects of chemically dispersed oil on jellyfish. As discussed in Section 2.1.H, the peak concentration of chemically dispersed oil and dispersants will occur in the top few meters of the water column (typically <10 m) immediately after application of dispersants; with both time and distance (both vertical and horizontal) the concentrations of dispersed oil and dispersants will attenuate due to dilution and biodegradation. While dispersants and chemically dispersed oil may have minor impacts on prey of leatherback sea turtles, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by dispersant use. Consequently, effects of chemically dispersed oil to prey of leatherback sea turtles would be most likely confined to the approximate footprint of the treated area and limited to a few hours post dispersant application due to dilution in the offshore water column.

5.2.B(1)(c) Critical Habitat

NMFS designated critical habitat for the loggerhead sea turtle along the U.S. coast (Sections 3.1.B(3)(a) though 3.1.B(3)(b)), with five critical habitats (i.e., migratory, winter, nearshore reproductive, breeding and *Sargassum*) overlapping the *Green Zone*. The PCE used by NMFS to define this critical habitat is the local habitat features (i.e., access, transit, egression, waters free of obstructions, proximity to shore, water depth and temperature). Chemically dispersed oil and dispersants may have transitory and short-lived effects on water quality, but are unlikely to alter any of the PCEs. The only PCE that directly addresses prey (i.e., support adequate prey abundance and cover) applies to *Sargassum* as a critical habitat. However, as discussed previously, the effects of dispersants and chemically dispersed oil to prey of loggerhead sea turtles would be most likely confined to the approximate footprint of the treated area and limited to a few hours post dispersant application due to dilution in the offshore water column. In addition, best management practices during dispersant use are in place to minimize impacts to critical habitats (Appendix IV).

5.2.B(1)(d) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on listed sea turtles and critical habitat for the loggerhead sea turtle from dispersant use in the *Green Zone* are summarized in Table 5-2. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to listed sea turtles and designated critical habitat are not available, and assessments are based on their behavior and distribution.

Table 5-2. Summary of the direct and indirect effects of the Proposed Federal Action to listed sea turtles.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Kemp's ridley sea turtle, *Lepidochelys kempii* **Green sea turtle, *Chelonia mydas***	Possible exposure of individual sea turtles in the spray area, though there is no information on effects.	Possible exposure of individual sea turtles in the footprint of the treated slick, though there is no	Unlikely as dispersant concentrations are expected to be below effects levels for prey.	Unlikely as chemically dispersed oil concentrations are expected to be below effects

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Loggerhead sea turtle[1], *Caretta caretta* **Hawksbill sea turtle, *Eretmochelys imbricate***		information on effects.		levels. Only prey entrained within the top few meters of the water column may be impacted, likely representing only a small fraction of the available food source.
Leatherback sea turtle, *Dermochelys coriacea*	Possible exposure of individual sea turtles in the spray area, though there is no information on effects.	Possible exposure of individual sea turtles in the spray area, though there is no information on effects.	Unlikely as dispersant concentrations are expected to be below effects levels for prey.	Possible as important prey entrained within the top few meters of the water column may be impacted particularly during the feeding season. Only prey entrained within the top few meters of the water column may be impacted, likely representing only a small fraction of the available food source.
Critical Habitat for loggerhead sea turtle, *C. caretta*	Unlikely to have impacts on PCEs.	Unlikely to have impacts on PCEs.	None	None

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin). This includes direct exposure to designated critical habitat for the Leatherback sea turtle; [b] Likely indirect effects would include effects on the primary prey species. This includes direct exposure to resources within the designated critical habitat for the leatherback sea turtle; [1] Northwest Atlantic DPS.

5.2.C. Marine and Anadromous Fish

There are six listed species of marine and anadromous fish that could be affected by dispersant use in the *Green Zone*. Summaries of the known impacts to fish from exposure to dispersants and chemically dispersed oil are presented in Section 2.1.G. It is important to recognize that the likelihood of exposure and effects to chemically dispersed oil are species specific, and depend on their distribution patterns and movements, habitat utilization, and degree of slick/sheen avoidance.

5.2.C(1) Marine and anadromous fish

Smalltooth sawfish (U.S. DPS), *Pristis pectinate*, and designated critical habitat

Gulf sturgeon, *Acipenser oxyrinchus desotoi*, and designated critical habitat

Scalloped hammerhead (Central and Southwest Atlantic DPS), *Sphyrna lewini*

Atlantic sturgeon (South Atlantic DPS), *Acipenser oxyrinchus oxyrinchus*

Atlantic sturgeon (Carolina DPS), *Acipenser oxyrinchus oxyrinchus*

Shortnose sturgeon, *Acipenser brevirostrum*

Nassau grouper, *Epinephelus striatus*

5.2.C(1)(a) Direct Effects

The range of the listed or proposed fishes extends along the entire Southeast and Gulf of Mexico U.S. coast (Sections 3.1.C(1) through 3.1.C(7)) and in some cases it overlaps the *Green Zone*. Juvenile and adult fish could come in contact with both dispersants and chemically dispersed oil in the water column in the immediate area around surface applications of dispersants. As discussed in Section 2.1.G the acute toxicity of the preauthorized dispersants and chemically dispersed oil, under laboratory settings that address the dilution that occurs in open waters (96-h spiked exposures), are in excess of 20 mg/L and 2 mg/L, respectively, even for sensitive species and early life stages (larvae and eggs) (see also [14, 15]). As discussed previously and based on at-sea field studies and trajectory modeling of maximum most probable non-continuous discharge volumes (see Section 2.1.H), the concentration of chemically dispersed oil generally declines to background levels within hours of dispersant treatment of oil slicks. Juvenile and adult fish in the open water conditions of the *Green Zone* are mobile and able to avoid or move away from chemically dispersed oil in the water column, resulting in temporary exposures. Consequently, effects of chemically dispersed oil to marine and anadromous fish would be most likely confined to the approximate footprint of the treated area and limited to a few hours post dispersant application.

5.2.C(1)(b) Indirect Effects

Plankton and fish serve as prey for some of the listed fish species, though most of these species (except for scalloped hammerhead) are primarily benthic feeders. Several at-sea field studies and models (see Section 2.1.H) have documented rapid declines in the concentration of chemically dispersed oil to background levels within hours of dispersant treatment of oil slicks. Consequently, only prey entrained within the top few meters of the water column may be affected, likely representing a small fraction of the available food source for marine and anadromous fish. In addition, while dispersants and chemically dispersed oil may have minor impacts on prey of listed marine and anadromous fish, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by dispersant use.

5.2.C(1)(c) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on listed marine and anadromous fish and designate critical habitat for smalltooth sawfish and the Gulf sturgeon from dispersant use in the *Green Zone* are summarized in Table 5-3. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to listed marine and anadromous fish, and critical habitat are not available, and assessments are based on their behavior and distribution.

Table 5-3. Summary of the direct and indirect effects of the Proposed Federal Action to listed fish.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Smalltooth sawfish[1], *Pristis pectinate* **Gulf sturgeon, *Acipenser oxyrinchus desotoi*** **Scalloped hammerhead[2], *Sphyrna lewini*** **Atlantic sturgeon[3], *Acipenser oxyrinchus oxyrinchus*** **Atlantic sturgeon[4], *Acipenser oxyrinchus oxyrinchus*** **Shortnose sturgeon, *Acipenser brevirostrum*** **Nassau grouper, *Epinephelus striatus***	Unlikely as dispersant concentrations are expected to be below effects levels.	Unlikely as elevated concentrations of chemically dispersed oil are confined to the approximate footprint of the treated slick and limited to a few hours post dispersant application. Mobile fish are expected to be directly exposed for short periods of time.	Unlikely as dispersant concentrations are expected to be below effects levels for prey.	Unlikely as chemically dispersed oil concentrations are expected to be below effects levels. Only prey entrained within the top few meters of the water column may be impacted, likely representing only a small fraction of the available food source.

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species. [1] U.S. DPS; [2] Central and Southwest Atlantic DPS; [3] Carolina DPS; [4] South Atlantic DPS.

5.2.D. Corals

There are seven listed species of corals that could be affected by dispersant use in the *Green Zone*. Summaries of the known impacts to corals from exposure to dispersants and chemically dispersed oil are presented in Section 2.1.G. Response actions have the potential to affect the early life stages of listed corals should a preauthorized dispersant application be used to address a surface slick in the area where spawning is occurring. It is important to recognize that the likelihood of exposure and effects to chemically dispersed oil are life-stage specific, and depend on their distribution patterns and habitat utilization.

Elkhorn coral, *Acropora palmata*, and designated critical habitat

Staghorn coral, *Acropora cervicornis*, and designated critical habitat

Rough cactus coral, *Mycetophyllia ferox*

Mountainous star coral, *Orbicella faveolta*

Lobed star coral, *Orbicella annularis*

Pillar coral, *Dendrogyra cylindrus*

Boulder star coral, *Orbicella franksi*

5.2.D(1)(a) Direct Effects

The range of the listed corals extends along the southernmost point of the Florida coast and may overlap with the *Green Zone* (Sections 3.1.D(1) through 3.1.D(7)). Early life stages of the listed coral species could come in contact with both dispersants and chemically dispersed oil in the water column in the immediate area around surface applications. These exposures could be of greater concern if chemical treatment of oil slicks coincides with the spawning season. As discussed in Section 2.1.G the acute toxicity of the preauthorized dispersants and chemically dispersed oil, under laboratory settings that address the dilution that occurs in open waters (96-h spiked exposures), are in excess of 20 mg/L and 2 mg/L, respectively, even for sensitive species and early life stages (larvae and eggs) (see also [NRC 14, 15]). As discussed previously and based on at-sea field studies and trajectory modeling of maximum most probable non-continuous discharge volumes (see Section 2.1.H), the concentration of chemically dispersed oil generally declines to background levels within hours of dispersant treatment of oil slicks.[58]. In addition, sessile life stages of corals in the immediate vicinity of the oil treated with dispersants may experience pulse-exposures lasting a few hours (see Figure 2-6). Early life stages may not be able to avoid or move away from chemically dispersed oil in the water column, resulting in temporary exposures. Consequently, effects of chemically dispersed oil to the sessile life stages of corals would be most likely confined to the approximate footprint of the treated area and limited to a few hours post dispersant application.

5.2.D(1)(b) Indirect Effects

Plankton serve as prey for these coral species. As discussed previously and based on at-sea field studies and trajectory modeling of maximum most probable non-continuous discharge volumes (see Section 2.1.H), the concentration of chemically dispersed oil generally declines to background levels within hours of dispersant treatment of oil slicks. Consequently, only prey entrained within the top few meters of the water column may be affected, likely representing a small fraction of the available food source for corals.

[58] Note that based on trajectory modeling (see Section 2.1.H) using conservative and worst-case conditions (35% of all treated oil effectively dispersed), under most scenarios, concentrations fall below 1 mg/L TPH after approximate 60 hours post treatment. Only under larger spill volumes concentrations remain above 1 mg/L TPH beyond the simulation period (120 hours).

5.2.D(1)(c) Critical Habitat

NMFS designated critical habitat for elkhorn and staghorn corals on (Sections 3.1.D(1)(a) through 3.1.D(1)(b)). The PCEs used by NOAA to define this critical habitat in nearshore and marine waters include: suitable and available substrate to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. However, since these designated critical habitats do not overlap the *Green Zone*, dispersant use is unlikely to impact any PCEs. As discussed previously and based on at-sea field studies and trajectory modeling of maximum most probable non-continuous discharge volumes (see Section 2.1.H), the concentration of chemically dispersed oil generally declines to background levels within hours of dispersant treatment of oil slicks. Consequently, effects of chemically dispersed oil to PCEs for elkhorn and staghorn corals would be most likely confined to the outermost edge of the critical habitat (outside the *Green Zone*) and limited to a few hours post dispersant application due to dilution in the offshore water column. In addition, best management practices during dispersant use are in place to minimize impacts to critical habitats (Appendix IV).

5.2.D(1)(d) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on listed corals and designated critical habitat for elkhorn and Staghorn corals from dispersant use in the *Green Zone* are summarized in Table 5-4. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to listed corals are not available, and assessments are based on their behavior and distribution.

Table 5-4. Summary of the direct and indirect effects of the Proposed Federal Action to listed corals.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Elkhorn coral, *Acropora palmate* **Staghorn coral, *Acropora cervicornis*** **Rough cactus coral, *Mycetophyllia ferox*** **Mountainous star coral, *Orbicella faveolta*** **Lobed star coral, *Orbicella annularis*** **Pillar coral, *Dendrogyra cylindrus***	Unlikely as dispersant concentrations are expected to be below effects levels.	Unlikely, except during the spawning season, as elevated concentrations of chemically dispersed oil are confined to the approximate footprint of the treated slick and limited to a few hours post dispersant application.	Unlikely as dispersant concentrations are expected to be below effects levels for prey.	Unlikely as chemically dispersed oil concentrations are expected to be below effects levels. Only prey entrained within the top few meters of the water column may be impacted, likely representing only a small fraction of the available food source.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Boulder star coral, *Orbicella franksi*				
Critical Habitat for elkhorn coral, *A. palmata* and Staghorn coral, *A. cervicornis*,	Unlikely to have impacts on PCEs.	Unlikely to have impacts on PCEs.	None	None

[a] Likely direct effects would include exposure via ingestion (digestion), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species.

5.2.E. Seagrass

There is one seagrass listed that could be affected by dispersant use in the *Green Zone*. Summaries of the known impacts to seagrasses from exposure to dispersants and chemically dispersed oil are presented in Section 2.1.G. Response actions have the potential to affect seagrasses should a preauthorized dispersant application be used to address a surface slick in the area where the Johnson's seagrass occurs. It is important to recognize that the likelihood of exposure and effects to chemically dispersed oil are life-stage specific, and depend on their distribution patterns and habitat utilization.

5.2.E(1) Seagrass

Johnson's seagrass, *Halophila johnsonii*, and designated critical habitat

5.2.E(1)(a) Direct Effects

The range of Johnson's seagrass extends along sections of the Southeast Florida coast and it is mostly limited to shallow waters (≤5 m depth) (Section 3.1.E(1)), thus it is likely outside the *Green Zone*. Deeper patches of Johnson's seagrass could come in contact with both dispersants and chemically dispersed oil in the water column in the immediate area around surface applications. As discussed in Section 2.1.G the acute toxicity of the preauthorized dispersants and chemically dispersed oil, under laboratory settings that address the dilution that occurs in open waters (96-h spiked exposures), are in excess of 20 mg/L and 2 mg/L, respectively, even for sensitive species and early life stages (larvae and eggs) (see also [NRC 14, 15]), and likely higher for seagrasses. As discussed previously and based on at-sea field studies and trajectory modeling of maximum most probable non-continuous discharge volumes (see Section 2.1.H), the concentration of chemically dispersed oil generally declines to background levels within hours of dispersant treatment of oil slicks. In addition, seagrass beds in the immediate vicinity of the oil treated with dispersants may experience pulse-exposures lasting a few hours (see Figure 2-6). Seagrasses are not able to avoid or move away from chemically dispersed oil in the water column, resulting in temporary exposures. Consequently, effects of chemically dispersed oil to

Johnson's seagrass would be most likely confined to the approximate footprint of the treated area and limited to a few hours post dispersant application.

5.2.E(1)(b) Indirect Effects

Impacts to water quality that temporarily reduce light penetration in the water column could have minor impacts on photosynthetic efficiency. Several at-sea field studies and models (see Section 2.1.H) have documented rapid declines in the concentration of chemically dispersed oil to background levels within hours of dispersant treatment of oil slicks. These studies may serve as surrogates for the potential impacts of chemically dispersed oil on water quality. However, it is expected that these impacts would be short lived and transitory.

5.2.E(1)(c) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on listed seagrass and designated critical habitat from dispersant use in the *Green Zone* are summarized in Table 5-5. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to listed corals are not available, and assessments are based on their behavior and distribution.

Table 5-5. Summary of the direct and indirect effects of the Proposed Federal Action to listed seagrass.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Johnson's seagrass, *Halophila johnsonii*	Unlikely as dispersant concentrations are expected to be below effects levels.	Unlikely as elevated concentrations of chemically dispersed oil are confined to the approximate footprint of the treated slick and limited to a few hours post dispersant application.	None.	Unlikely, but it may be limited to minor impacts on photosynthetic efficiency from a temporary reduction in light penetration.

[a] Likely direct effects would include exposure via dermal contact and absorption (skin); [b] Likely indirect effects would include effects on photosynthetic efficiency.

Section 5.3. Effects on Species and Designated Critical Habitat under the Jurisdiction of the U.S. Fish and Wildlife Service.

There is one marine mammal listed that could be affected by dispersant use in the *Green Zone*. Based on the information provided by the USFWS, there are no designated critical habitat in the *Green Zone*. Therefore discussions below focus only listed species.

5.3.A. Marine Mammals

Summaries of the known impacts to marine mammals from exposure to dispersants and chemically dispersed oil are presented in Section 2.1.G. Response actions have the potential to affect the West Indian manatee should a preauthorized dispersant application be used to address a surface slick in the area where the West Indian manatee occurs. It is important to recognize that the likelihood of exposure and effects to chemically dispersed oil are life-stage specific, and depend on their distribution patterns and habitat utilization.

West Indian Manatee, *Trichechus manatus*

5.3.A(1)(a) Direct Effects

The West Indies manatee is unlikely to be present in waters more than 3 nm off the coast (Section 3.2.A(1)) and thus would have a low likelihood of being exposed during the application of dispersants, either at the dispersant application point or through over-spray. In addition, best management practices during dispersant use are in place to minimize impacts to the West Indies manatee (Appendix IV). There is no documented information on the effects of the aerial application of dispersants sprayed directly on the West Indies manatee. The West Indies manatee may be affected by oil vapors at the water surface, primarily from benzene, toluene, ethyl benzene, and xylenes (BTEX) from freshly spilled oil. Based on information on other nearshore marine mammals (sea otters), vapors can cause corneal irritation and inhaled vapors can cause effects ranging from mild irritation to more permanent damage of the nervous system, mucosal membranes, lungs, and other organs [278, 291-294]. Depending on an oil spill's distance from shore, diluted concentrations of chemically dispersed oil may reach water masses occupied by this species. This assertion is supported by both field and modeling studies (discussed in Section 2.1.H).

5.3.A(1)(b) Indirect Effects

The West Indies manatee feeds on nearshore plants (hyacinths, hydrilla, seagrass, etc.). Nearshore benthic vegetation are unlikely to be exposed to chemically dispersed oil as concentrations are expected to decline rapidly in both space and time, and be substantially diluted when reaching nearshore waters. Consequently, it is unlikely that the prey species of the West Indies manatee would be adversely affected by dispersants and chemically dispersed oil from dispersant use in the *Green Zone*.

5.3.A(1)(c) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on West Indies manatee from dispersant use in the *Green Zone* are summarized in Table 5-6. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to this species are not available, and assessments are based on their behavior and distribution.

Table 5-6. Summary of the direct and indirect effects of the Proposed Federal Action to listed marine mammals.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
West Indian Manatee, *Trichechus manatus*	Direct spray on surface animals is unlikely because most animals occur inland of the *Green Zone*. No data available on effects of aerial applications on manatee.	Unlikely as elevated concentrations of chemically dispersed oil are confined to the approximate footprint of the treated slick and limited to a few hours post dispersant application.	Unlikely as dispersant concentrations in the water column are expected to be below effects levels for primary prey to be impacted.	Unlikely as preferred prey are primarily benthic vegetation in nearshore waters where concentrations from surface applications are the most diluted.

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species.

5.3.B. Anadromous Fish

There one listed species of anadromous fish that could be affected by dispersant use in the *Green Zone*. Summaries of the known impacts to fish from exposure to dispersants and chemically dispersed oil are presented in Section 2.1.G. It is important to recognize that the likelihood of exposure and effects to chemically dispersed oil depends on the distribution patterns and movements and habitat utilization of this species.

Marine and anadromous fish

<u>Gulf sturgeon</u>, *Acipenser oxyrinchus desotoi*

5.3.B(1)(a) Direct Effects

The range of the Gulf sturgeon extends along the entire Gulf of Mexico coast (Section 3.1.C(2)) and may overlap the *Green Zone*. Adult sturgeon could come in contact with both dispersants and chemically dispersed oil in the water column in the immediate area around surface applications of dispersants. As discussed in Section 2.1.G the acute toxicity of the preauthorized dispersants and chemically dispersed oil, under laboratory settings that address the dilution that occurs in open waters (96-h spiked exposures), are in excess of 20 mg/L and 2 mg/L, respectively, even for sensitive species and early life stages (larvae and eggs) (see also [14, 15]). As discussed previously and based on at-sea field studies and trajectory modeling of maximum most probable non-continuous discharge volumes (see Section 2.1.H), the concentration of chemically dispersed oil generally declines to background levels within hours of dispersant treatment of oil slicks. Adult fish in the open water of the *Green Zone* are mobile and able to avoid or move away from chemically dispersed oil in the water column, resulting in temporary exposures. Consequently, effects of chemically dispersed oil to the Gulf sturgeon would be most likely confined to the approximate footprint of the treated area and limited to a few hours post dispersant application.

5.3.B(1)(b) Indirect Effects

The Gulf sturgeon is a benthic feeder and its prey are unlikely to be affected by dispersants and chemically dispersed oil (see Section 2.1.H). In addition, impacts are likely limited to a small area relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by dispersant use.

5.3.B(1)(c) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on the Gulf sturgeon from dispersant use in the *Green Zone* are summarized in Table 5-7. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to the Gulf sturgeon are not available, and assessments are based on their behavior and distribution.

Table 5-7. Summary of the direct and indirect effects of the Proposed Federal Action to listed fish.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Gulf sturgeon, *Acipenser oxyrinchus desotoi*	Unlikely as dispersant concentrations are expected to be below effects levels.	Unlikely as elevated concentrations of chemically dispersed oil are confined to the approximate footprint of the treated slick and limited to a few hours post dispersant application. Mobile fish are expected to be directly exposed for short periods of time.	Unlikely as dispersant concentrations are expected to be below effects levels for prey.	Unlikely as chemically dispersed oil concentrations are expected to be below effects levels. Only prey entrained within the top few meters of the water column may be impacted, which are not an important food source.

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species.

5.3.C. Birds

There are two listed bird species that could be affected by dispersant use in the *Green Zone*. Summaries of the known impacts to bids from exposure to dispersants and chemically dispersed oil are presented in Section 2.1.G. Best management practices during dispersant use are in place to ensure that birds spotted at or near the water surface are not accidentally sprayed with dispersants during these operations (Appendix IV). It is important to recognize that the likelihood of exposure and effects to chemically dispersed oil are species specific, and depend on their distribution patterns and movements, habitat utilization, feeding behavior, and degree of slick/sheen avoidance. For a direct exposure to dispersants to occur, listed birds would have to be present in the same location of the targeted oil slick or within the area of over-spray or drift.

Red Knot, ***Calidris canutus rufa***

Roseate tern, ***Sterna dougalli***

5.3.C(1)(a) Direct Effects

The red knot does not use the offshore marine environment to any degree, relying primarily on coastal environments (Section 3.2.C(1)). Birds may transit during their migration period over the *Green Zone* and could be directly exposed to dispersant spray in the event of a dispersant application in this area, though the risk is likely minimal. The red knot feeds in the intertidal zone and is not likely to be exposed to chemically dispersed oil in the water column.

The roseate tern could occur on occasion as far offshore as the *Green Zone*, but this is uncommon as their foraging area concentrates in areas ≤2.1 mi (7 km) from shore, at water depths less than 16.5 ft. (5 m), and in shallow bays, tidal inlets and channels, tide-rips and sandbars (3.2.C(1)). There is a low risk of direct exposure to dispersants and chemically dispersed oil in the water column when roseate terns dive into the water to feed because concentrations of dispersants and chemically dispersed oil are expected to decline rapidly in both space and time, and be substantially diluted when reaching nearshore waters. Thus, its risk of exposure is minimal. In addition, birds may transit during their migration period over the *Green Zone* and could be directly exposed to dispersant spray in the event of a dispersant application in this area, though the risk is likely minimal.

5.3.C(1)(b) Indirect Effects

The red knot feeds on small clams, mussels, snails, and other invertebrates found in wet sand of the intertidal zone and beaches. Prey found on these areas are unlikely to be exposed to oil as concentrations found within the *Green Zone* are expected to decline rapidly in both space and time, and be substantially diluted to below effects levels (see Section 2.1.G) when reaching nearshore waters. Consequently, it is unlikely that the red knot would be indirectly affected by dispersants and oil from dispersant use in the *Green Zone*.

The roseate tern feeds on small schooling marine fish in shallow waters. Prey found on these areas are unlikely to be exposed to oil as concentrations found within the *Green Zone* are expected to decline rapidly in both space and time, and be substantially diluted to below effects levels (see Section 2.1.G) when reaching nearshore waters. Most aquatic organisms, and particularly fish, are able to metabolize and excrete oil-related compounds indicating little risk for their bioaccumulation and biomagnification. Consequently, it is unlikely that roseate terns would be indirectly affected by dispersants and chemically dispersed oil from dispersant use in *Green Zone*.

5.3.C(1)(c) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on the red knot and the roseate tern from dispersant use in the *Green Zone* are summarized in Table 5-8. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to the red knot and the roseate tern are not available, and assessments are based on their behavior and distribution.

Table 5-8. Summary of the direct and indirect effects of the Proposed Federal Action to listed birds.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Red Knot, *Calidris canutus rufa*	Unlikely as this species does not occur in the *Green Zone*. Thus there is essentially little to no risk of direct exposure.	Unlikely because these birds do not dive into water and concentrations are expected to be dilute with little risk of fouling of feathers.	Unlikely as dispersant concentrations are expected to be below effects levels. Furthermore, their prey are unlikely to be exposed.	Unlikely as chemically dispersed oil concentrations are expected to be below effects levels. Furthermore, their prey are unlikely to be exposed.
Roseate tern, *Sterna dougalli*	Low risk of exposure but only to birds flying through the *Green Zone* during their migration.	Possible exposure only when diving into nearshore waters containing diluted chemically dispersed oil, Concentrations are expected to be diluted with little risk of fouling of feathers.	Unlikely as dispersant concentrations are expected to be below effects levels in the areas where they feed.	Unlikely as chemically dispersed oil concentrations are expected to be below effects levels in areas where they feed. Only prey entrained within the top few meters of the water column may be impacted, likely representing only a small fraction of the available food source.

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species.

Section 5.4. Essential Fish Habitat

Under the Magnuson-Stevens Fishery Conservation and Management Act, consultations with the NMFS are required on Federal Actions that may result in adverse effects to Essential Fish Habitat (EFH). As stated in Chapter 4, EFH in the South Atlantic region is managed by the South Atlantic Fisheries Management Council (SAFMC), while EFH in the Gulf of Mexico is managed by the Gulf of Mexico Fishery Management Council (GMFMC). Evaluations on the potential effects of dispersant use within the *Green Zone* to each EFH by Management Council are described here, noting that best management practices during dispersant use are in place to minimize impacts to EFH (Appendix IV). For the purpose of this *Biological Assessment* direct and indirect effects from dispersants and chemically dispersed oil are determined based on appropriate scientific information. Due to their spatial distribution and distribution within the water column, all EFH by Management Council are discussed concurrently, but determinations are made on individual EFHs. Only EFH known to be present within the *Green Zone* are included in the following sections, or when located within the immediate vicinity of the *Green Zone*.

5.4.A. Essential Fish Habitat Managed by the South Atlantic Fishery Management Council

5.4.A(1)(a) Direct Effects

The known impacts from exposure to dispersants and chemically dispersed oil are generally reported based on impacts to species (see Section 2.1.G), and not commonly on habitats or ecosystems. While there may be concerns on the impacts to water quality from increase contaminant loading with dispersant use (see Section 2.1.G and Section 2.1.H), these impacts are more likely concentrated in the few top meters of the water column. As discussed previously and based on at-sea field studies and trajectory modeling of maximum most probable non-continuous discharge volumes (see Section 2.1.H), the concentration of chemically dispersed oil generally declines to background levels within hours of dispersant treatment of oil slicks. Consequently, impacts are generally limited to the immediate proximity of the treated oil slick. As a result, EFH managed by the SAFMC that may be more likely to experience temporary impacts on water quality is the Water Column EFH. EFH in deeper waters or mostly concentrated in nearshore environments, and in some instances outside the *Green Zone* (i.e., Coral Reefs and Coral Communities, Deepwater Coral, Live/Hard Bottom, Marine Soft Bottom, Seagrasses, Oyster Reefs, Artificial Reefs, as well as most Habitats of Particular Concern [i.e., shrimp, red drum, snapper grouper complex, spiny lobster, coastal migratory pelagics, coral, coral reef and live/hard bottom, dolphin wahoo, *Oculina* bank])) may not be directly exposed to dispersants and chemically dispersed oil. If exposed, these exposures would be short in nature (Section 2.1.H) and unlikely to have long-lasting adverse impacts. EFH that may overlap physically with offshore oil spills (i.e., *Sargassum*) may be temporarily and directly exposed to dispersants and chemically dispersed oil if entrained within the water mass of the treated oil slick. One of the primary direct impacts of oil spills on vegetated habitats (see Section 2.1.G) is smothering of plant surfaces causing suffocation, with sublethal impacts ranging from alteration of enzyme systems, reduced photosynthesis and respiration, among others. However, and as noted previously (see Section 2.1.G and Section 2.1.H), dispersants enhance the partitioning of oil into the water column followed by the rapid dilution of oil levels to below those associated with adverse effects. Consequently any direct effects from dispersants and chemically dispersed oil on EFH managed by the SAFMC are anticipated to be minor, short-lived, and transitory, and likely limited to a relatively small fraction of the each EFH.

5.4.A(1)(b) Indirect Effects

There are no known indirect effects of dispersants and chemically dispersed oil on EFH managed by the SAFMC.

5.4.A(1)(c) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on EFH managed by the SAFMC from dispersant use in the *Green Zone* are summarized in Table 5-9. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to specific EFHs are not available, and assessments are based on their distribution.

Table 5-9. Summary of the direct and indirect effects of the Proposed Federal Action to EFH managed by the SAFMC.

Essential Fish Habitat	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Water Column	Unlikely as concentrations are not enough to impact water quality. Any, impacts are likely limited to a small fraction of the entire EFH.	Unlikely as concentrations are not enough to impact water quality. Any, impacts are likely limited to a small fraction of the entire EFH.	None	None
Coral Reefs and Coral Communities, Deepwater Coral, Live/Hard Bottom, Marine Soft Bottom, Seagrasses, Oyster Reefs, Artificial Reefs	Unlikely as there is essentially little to no risk of direct exposure. Any, impacts are likely limited to a small fraction of the entire EFH.	Unlikely as there is essentially little to no risk of direct exposure. Any, impacts are likely limited to a small fraction of the entire EFH.	None	None
Sargassum	Unlikely as concentrations are likely below concentrations that may lead to adverse impacts. Any, impacts are likely limited to a small fraction of the entire EFH.	Unlikely as concentrations are likely below effects levels. Impacts, in particular smothering, are likely limited to a small fraction of the entire EFH.	None	None

[a] Likely direct effects would include exposure via physical contact; [b] None known.

5.4.B. Essential Fish Habitat Managed by the Gulf of Mexico Fishery Management Council

5.4.B(1)(a) Direct Effects

The known impacts from exposure to dispersants and chemically dispersed oil are generally reported based on impacts to species (see Section 2.1.G), and not commonly on habitats or ecosystems. While there may be concerns on the impacts to water quality from increase contaminant loading with dispersant use (see Section 2.1.G and Section 2.1.H), these impacts are more likely concentrated in the few meters of the water column. As discussed previously and based on at-sea field studies and trajectory modeling of maximum most probable non-continuous discharge volumes (see Section 2.1.H), the concentration of chemically dispersed oil generally declines to background levels within hours of dispersant treatment of oil slicks. Consequently, impacts are generally limited to the immediate proximity of the treated oil slick. As a result EFH managed by the GMFMC that may be more likely to experience temporary impacts on water quality is the Pelagic (water column) EFH. EFH in deeper waters or mostly concentrated in nearshore environments, and in some instances outside the *Green Zone* (i.e., Shelf Edge/Slope, Coral Reefs, Submerged Aquatic Vegetation [including seagrasses and benthic algae], Hard Bottom, Soft Bottom, Oyster Reefs, as well Habitats of Particular Concern [i.e., highly migratory species]) may not be directly exposed to dispersants and chemically dispersed oil. If exposed, these exposures would be short in nature (Section 2.1.H) and unlikely to have long-lasting negative impacts. EFH that may overlap physically with offshore oil spills (i.e., Drift Algae [*Sargassum*, pelagic *Sargassum* community]) may be temporarily and directly exposed to dispersants and chemically dispersed oil if entrained within the water mass of the treated oil slick. One of the primary direct impacts of oil spills on vegetated habitats (see Section 2.1.G) is smothering of plant surfaces causing suffocation, with sublethal impacts ranging from alteration of enzyme systems, reduced photosynthesis and respiration, among others. However, and as noted previously (see Section 2.1.G and Chapter 2.1.H), dispersants enhance the partitioning of oil into the water column followed by the rapid dilution of oil levels to below those associated with adverse effects. Consequently any direct effects from dispersants and chemically dispersed oil on EFH managed by the GMFMC are anticipated to be minor, short-lived and transitory, and likely limited to a relatively small fraction of the each EFH.

5.4.B(1)(b) Indirect Effects

There are no known indirect effects of dispersants and chemically dispersed oil on EFH Managed by the GMFMC.

5.4.B(1)(c) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on EFH managed by the GMFMC from dispersant use in the *Green Zone* are summarized in Table 5-10. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to specific EFHs are not available, and assessments are based on their distribution.

Table 5-10. Summary of the direct and indirect effects of the Proposed Federal Action to EFH managed by the GMFMC.

Essential Fish Habitat	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Pelagic (Water Column)	Unlikely as concentrations are not enough to impact water quality. Any, impacts are likely limited to a small fraction of the entire EFH.	Unlikely as concentrations are not enough to impact water quality. Any, impacts are likely limited to a small fraction of the entire EFH.	None	None
Shelf Edge/Slope	Unlikely as there is essentially little to no risk of direct exposure. Any,	Unlikely as there is essentially little to no risk of direct exposure. Any,	None	None

Essential Fish Habitat	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Coral Reefs, Submerged Aquatic Vegetation (including seagrasses and benthic algae) **Hard Bottom, Soft Bottom, Oyster Reefs**	impacts are likely limited to a small fraction of the entire EFH.	impacts are likely limited to a small fraction of the entire EFH.		
Drift Algae (*Sargassum*, pelagic *Sargassum* community)	Unlikely as concentrations are likely below concentrations that may lead to adverse impacts. Any, impacts are likely limited to a small fraction of the entire EFH.	Unlikely as concentrations are likely below effects levels. Impacts, in particular smothering, are likely limited to a small fraction of the entire EFH.	None	None

[a] Likely direct effects would include exposure via physical contact; [b] None known.

5.4.C. Essential Fish Habitats and Habitats Areas of Particular Concern under the management of the National Marine Fisheries Service

5.4.C(1)(a) Direct Effects

The known impacts from exposure to dispersants and chemically dispersed oil are generally reported based on impacts to species (see Section 2.1.G), and not commonly on habitats or ecosystems. While there may be concerns on the impacts to water quality from increase contaminant loading with dispersant use (see Section 2.1.G and Section 2.1.H), these impacts are more likely concentrated in the few meters of the water column. As discussed previously and based on at-sea field studies and trajectory modeling of maximum most probable non-continuous discharge volumes (see Section 2.1.H), the concentration of chemically dispersed oil generally declines to background levels within hours of dispersant treatment of oil slicks. Consequently, impacts are generally limited to the immediate proximity of the treated oil slick. As a result EFH-HAPC managed by the NMFS may experience temporary impacts on water quality, but these would be short in nature (Section 2.1.H) and unlikely to have long-lasting negative impacts. Consequently any direct effects from dispersants and chemically dispersed oil on EFH-HAPC managed by the NMFS are anticipated to be minor, short-lived and transitory, and likely limited to a relatively small fraction of the EFH-HAPC.

5.4.C(1)(b) Indirect Effects

There are no know indirect effects of dispersants and chemically dispersed oil on EFH-HAPC managed by the NMFS.

5.4.C(1)(c) Summary

The direct and indirect effects from exposure to dispersants and chemically dispersed oil on EFH-HAPC managed by the NMFS from dispersant use in the *Green Zone* are summarized in Table 6-10. Note that specific studies on the potential direct effects of dispersants and chemically dispersed oil to specific EFH-HAPCs are not available, and assessments are based on their distribution.

Table 5-10. Summary of the direct and indirect effects of the Proposed Federal Action to EFH-HAPC managed by the NMFS.

Essential Fish Habitat	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Habitat Areas of Particular Concern	Unlikely as there is essentially little to no risk of direct exposure. Any, impacts are likely limited to a small fraction of the entire EFH-HAPC.	Unlikely as there is essentially little to no risk of direct exposure. Any, impacts are likely limited to a small fraction of the entire EFH-HAPC.	None	None

[a] Likely direct effects would include exposure via physical contact; b None known.

Section 5.5. Cumulative Effects

Cumulative effects under the ESA are defined in 50 CFR 402.02 as effects that are reasonably certain to occur in the *Green Zone* as a result of future state, tribal, local or private actions, not involving Federal activities. For the purpose of this *Biological Assessment*, only non-federal activities that are reasonably certain to occur in the foreseeable future are included in this section. Future Federal Actions that are unrelated to the proposed action are not considered in this section because they require separate consultations pursuant to Section 7 of the ESA. Non-federal actions that are reasonably that are reasonably certain to occur in the foreseeable future include (see Chapter 4. Environmental Baseline):

- Oil and gas development and production
- Renewable energy development
- Commercial and private marine transportation

- Commercial and recreational fishing

In addition, global trends that are expected to contribute to cumulative effects on species, critical habitat and EFH within the *Green Zone* include global climate change, marine debris, invasive species (see Chapter 4), and other processes that directly or indirectly affect food availability, induce shifts in species distribution, or cause direct impacts on species and habitats. The potential impacts arising from these activities are discussed based on primary stressors.

5.5.A. Changes in Food Availability

There are several factors that contribute to changes in food availability on the marine environment including overfishing and large scale processes (e.g., climate change) [295-298]. The potential for habitat alteration and changes in food availability for ESA species in the *Green Zone* and surrounding areas as a result of climate change is substantial. Marine food webs that support most listed and proposed species included in this *Biological Assessment* are highly dependent to the production and abundance of plankton. Phytoplankton support zooplankton, which then feed larval fish, invertebrates and, subsequently, larger fish, marine birds, sea turtles, and marine mammals. Scientists have found that the average global phytoplankton concentration in the upper ocean is declining at an annual rate of 1%. Since 1950 alone, algal biomass decreased by around 40%, possibly in response to ocean warming [299]. Ocean acidification also poses substantial risks to marine species that form and maintain shells and skeletons made of calcium carbonate (i.e., corals, zooplankton) [300, 301]. An increase in ocean acidification would also have consequences on biomass production associated with specific habitats (i.e., coral reefs), as their long-term survival depends on important biochemical interactions with the surrounding waters. Invasive species also pose threat the long-term persistence of listed species and critical habitats as invasive species could deplete key prey items, alter the composition of prey species within habitats, and lead to increase rates in habitat degradation. For example, the widespread occurrence of lionfish (*Pterois volitans*) and potentially of a sympatric species (*P. miles*) on several reefs along the Atlantic coast shows that this invasive species has become established in these habitats [302] and poses threats to reef habitats because of its voracious appetite and lack of known predators [251, 302], with negative consequences on ecosystems (e.g., predator interactions) and ecosystem services [303].

5.5.B. Water and Environmental Quality

Commercial or recreational fishing and maritime transportation, oil and gas development and production, and renewable energy operations may contribute to the increase of contaminants to the water column through leaks or accidental spills of fuel, chemicals, or waste products, as well as from emissions generated through their operations. Depending on their magnitude and spatial location (see Appendix II), spills could have significant effects on animals that spend a significant amount of time on the water surface (e.g., [278]). Habitat degradation is commonly mentioned as one of the factors leading to species declines. Many marine fish species, and particularly anadromous species, face serious threats from loss and degradation of spawning habitat through construction of dams, water diversions, and increased water temperatures, turbidity, and sedimentation.

5.5.C. Behavioral or Physical Disturbance

Anthropogenic activities that occur on-water have the potential to disturb species that rely on those habitats for food, refuge, breeding or rearing of young. Virtually all anthropogenic activities produce noise in the marine environment (e.g., transportation, oil exploration and development, alternative energy development, sand mining, military training, etc.), which may temporarily alter the normal behavior of some listed species. For instance, the sounds generated by ships overlap with the frequency range used by many cetaceans, especially with low-frequency vocalizers (e.g., blue, fin, and humpback whales) (see section 4.7.B). There is growing concern that the sound levels in the ocean are increasing with increased vessel traffic, geophysical surveys, and other ocean activities, and such increases may affect a wide range of marine animals particularly whales [268, 304]. For example, exposure to underwater vessel noise has been linked to both short- and long-term behavioral disturbances in whales, including habitat abandonment, disruption of foraging activity, suppression or alteration of vocalization, and other effects, and lead to chronic stress [262]. To date, only one study has evaluated the potential impacts of vessel noise on sperm whales (*P. macrocephalus*) in the Gulf of Mexico [305] documenting changes in behavior following exposure to large class size vessel traffic from major shipping lanes, which is consistent with an earlier study documenting ship avoidance by this species [306]. There is growing evidence that repeated habitat/area avoidance can lead to population impacts through permanent habitat displacement and reduced abundance [307-309], possibly leading to decreased reproductive success [310].

5.5.D. Direct Impacts

Some anthropogenic activities have the potential to induce direct impacts on listed species, critical habitats, and EFH. For example, marine vessel traffic from commercial or recreational fishing and maritime transportation could be involved in ship strikes with listed or proposed species (e.g., marine mammals, sea turtles). Vessel strikes have been frequently cited as an existing threat to many marine species, particularly marine mammals and sea turtles (see section 4.7.A). Earlier research found that fin, right, humpback, and sperm whales are commonly involved in vessel strikes [311], and that vessel strikes is the leading cause of mortality of the North Atlantic right whale [312]. Stranding data on loggerheads in the U.S. Atlantic and Gulf of Mexico regions from 1997 to 2005 have also shown that 15% of all strandings had sustained some type of propeller or collision injuries, although it is not known what proportion of these injuries were post- or ante-mortem [NMFS and USFWS 313].

Incidental captures in fisheries continues to be a threat to many marine species, and in particular to marine mammals and sea turtles. In the U.S. the bycatch of marine mammals between 1990 and 1999 exceeded 6,000 animals [314], with most animals killed in gill-net fisheries. Worldwide estimates of marine sea turtle bycatch in gillnet, longline, and trawl fisheries between1990 to 2008 indicates a bycatch of ~85,000 turtles, likely an underestimate given limited information from small-scale fisheries [315]. While bycatch intensity is generally lower along the U.S. compared to other parts of the world, bycatch continues to be an issue to many marine species, and in particular to listed species, with cumulative effects representing a threat to species viability and ecosystem process [316].

For several decades, marine debris and entanglements with fishing gear has been problematic for many marine species [317, 318]. Entanglement with fishing gear is known to be lead to the mortality of many marine mammal species, but in the case of whales, these are less likely to be detected and reported [319]. Marine turtles living in the pelagic environment commonly ingest or become entangled in marine debris (e.g., tar balls, plastic bags, plastic pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts, where debris and their natural food items converge (e.g., [320, 321]). This is especially problematic for turtles that spend all or significant portions of their life cycle in the pelagic environment (e.g., leatherbacks, juvenile loggerheads, and juvenile green turtles). Schuyler et al. [322] synthesized the results of 37 studies published in 1985-2012 and found that the probability of green and leatherback turtles ingesting debris increased significantly over time, and plastic was the most commonly ingested debris. Smaller, oceanic-stage turtles and those that feed on jellyfish were more likely to ingest debris than coastal foragers or carnivorous species.

5.5.E. Cumulative Effects on Species, Critical Habitats, and Essential Fish Habitat

5.5.E(1) Cumulative Effects on Marine Mammals

Marine mammals continue to be negatively impacted by ship strikes, entanglement with fishing gear, marine debris, increase noise in the marine environment, changes in prey availability, and impacts from changes in environmental quality, among other threats. The preauthorized use of dispersants may result in the exposure of marine mammals to dispersants and chemically dispersed oil. This could cumulatively add stressors to the current threats on listed and proposed marine mammal species discussed in this *Biological Assessment*. However, the localized use of dispersants to treat offshore oil spills is anticipated to have minimal and temporary effects on marine mammals. In addition, the use of dispersants is expected to reduce direct effects of oil spills on marine mammals (e.g., [15, 265, 323, 324]), and therefore, the preauthorized use of dispersants would not contribute to the cumulative effects on marine mammals in the region.

The PCEs used by NMFS to define the critical habitat of the North Atlantic right whale is the local habitat features (i.e., proximity to shore, water depth and temperature, calm surface conditions, protection from wave action during calving, and other essential calving features). Exposure to dispersants and chemically dispersed oil could cumulatively add stressors to the PCEs. However, due to the localized used of dispersants to treat offshore oil spills, these effects are anticipated to be discountable and insignificant for the critical habitat.

5.5.E(2) Cumulative Effects on Sea Turtles

Sea turtles continue to be negatively impacted by illegal harvesting of eggs from nesting grounds, degradation and loss of nesting habitat, illegal harvesting of adults, entanglement with fishing gear and marine debris, vessel strikes, and incidental capture by fisheries, among other threats. The preauthorized use of dispersants may result in the exposure of sea turtles to dispersants and chemically dispersed oil. This could cumulatively add stressors to the current threats on listed sea turtles discussed in this *Biological Assessment*. However, the localized use of dispersants to treat offshore oil spills is anticipated to have minimal and temporary effects on sea turtles. In addition, the use of dispersants is expected to reduce direct effects of oil spills on sea turtles and their nesting beaches (e.g., [15, 265, 323, 324]), and therefore, the preauthorized use of dispersants would not contribute to the cumulative effects on sea turtles in the region.

The PCEs used by NMFS to define the five critical habitats of the loggerhead sea turtle is the local habitat features (i.e., access, transit, egression, waters free of obstructions, proximity to shore, water depth and temperature). Exposure to dispersants and chemically dispersed oil could cumulatively add stressors to the PCEs, but these effects are anticipated to be discountable and insignificant for the critical habitat. The only PCE that is directly addresses to prey (i.e., support adequate prey abundance and cover) applies to *Sargassum* as a critical habitat. Exposure to dispersants and chemically dispersed oil could cumulatively add stressors to this PCE. However, the use of dispersants is expected to reduce direct effects of oil spills on organisms founds on the water surface (e.g., [15]), including *Sargassum*. In addition, due to the localized use of dispersants to treat offshore oil spills, these effects are anticipated to be discountable and insignificant for *Sargassum*.

5.5.E(3) Cumulative Effects on Marine and Anadromous Fish

Marine and anadromous fish continue to be negatively impacted by bycatch in fisheries, historical overfishing and illegal harvesting, degradation and loss of rearing habitat, and shifts in habitat resulting from climate change, among other threats. The preauthorized use of dispersants may result in the exposure of marine and anadromous fish to dispersants and chemically dispersed oil. This could cumulatively add stressors to the current threats on listed and proposed marine and anadromous fish species discussed in this *Biological Assessment*. However, the localized use of dispersants to treat offshore oil spills is anticipated to have minimal and temporary effects on marine and anadromous fish. Therefore, the preauthorized use of dispersants would not contribute to the cumulative effects on marine and anadromous fish in the region.

The PCEs used by NMFS to define the critical habitat of the smalltooth sawfish and the Gulf sturgeon include: a migratory corridor between estuarine and marine habitats, water quality ensuring adequate dissolved oxygen levels and low levels of contaminants, and food resources for subadults and adults (e.g., benthic invertebrates and fish). However, since these designated critical habitats do not overlap the *Green Zone*, dispersant use is unlikely to impact any PCEs. Any exposures to dispersants and chemically dispersed oil could cumulatively add stressors to the PCEs. However, due to the localized used of dispersants to treat offshore oil spills, these effects are anticipated to be discountable and insignificant for the critical habitat.

5.5.E(4) Cumulative Effects on Corals

Corals continue to be negatively impacted by habitat degradation and loss, eutrophication and sedimentation, bleaching, diseases, physical damage from natural and anthropogenic sources, and ocean acidification, among other threats. The preauthorized use of dispersants may result in the exposure of corals to dispersants and chemically dispersed oil. This could cumulatively add stressors to the current threats on listed and proposed corals species discussed in this *Biological Assessment*. However, the localized use of dispersants to treat offshore oil spills is anticipated to have minimal and temporary effects on corals. In addition, the use of dispersants is expected to reduce direct effects of oil spills on corals (e.g., [54, 324]), and therefore, the preauthorized use of dispersants would not contribute to the cumulative effects on corals in the region.

The PCEs used by NMFS to define the critical habitat of elkhorn and staghorn corals include suitable and available substrate to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. However, since these designated critical habitats do not overlap the *Green Zone*, dispersant use is unlikely to impact any PCEs. Any exposures to dispersants and chemically dispersed oil could cumulatively add stressors to the PCEs. However, due to the localized used of dispersants to treat offshore oil spills, these effects are anticipated to be discountable and insignificant for the critical habitat.

5.5.E(5) Cumulative Effects on Seagrass

Johnson's seagrass continue to be negatively impacted by habitat degradation and loss, eutrophication, and sedimentation, among other threats. The preauthorized use of dispersants may result in the exposure of corals to dispersants and chemically dispersed oil. This could cumulatively add stressors to the current threats on Johnson's seagrass. However, the localized use of dispersants to treat offshore oil spills is anticipated to have minimal and temporary effects on Johnson's seagrass. In addition, the use of dispersants is expected to reduce direct effects of oil spills on shallow water and nearshore habitats (e.g., [15, 265, 323, 324]) including Johnson's seagrass, and therefore, the preauthorized use of dispersants would not contribute to the cumulative effects on Johnson's seagrass in the region.

The PCEs used by NMFS to define the critical habitat of Johnson's seagrass include water quality, salinity levels, water transparency, and stable, unconsolidated sediments that are free from physical disturbance. However, since the designated critical habitat does not overlap the *Green Zone*, dispersant use is unlikely to impact any PCEs. Any exposures to dispersants and chemically dispersed oil could cumulatively add stressors to the PCEs. However, due to the localized used of dispersants to treat offshore oil spills, these effects are anticipated to be discountable and insignificant for the critical habitat.

5.5.E(6) Cumulative Effects on Birds

The red knot continues to be negatively impacted by loss of nesting habitat (outside of the U.S.), human disturbances, coastal development of beaches and other nearshore habitats, predation, and reduced food sources, among other threats. Similarly, the roseate tern continues to be threaded by human disturbance of nesting habitats, habitat degradation, among other threats. Because the use of dispersant to treat oil spills in offshore waters is expected to reduce the amount of oil that may strand on intertidal habitats and shoreline habitats (e.g., [15, 265, 323, 324]) where these species overwinters and feeds, the preauthorized use of dispersants will not contribute to the cumulative effects on the red knot and roseate tern in the region.

5.5.E(7) Cumulative Effects on Essential Fish Habitat and Essential Fish Habitat-Habitat Areas of Particular Concern

Essential Fish Habitat (EFH) and Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPC) continues to be negatively impacted by habitat degradation and loss (i.e., inadequate fishing practices, localized pollution, reduced water quality). The preauthorized use of dispersants may result in the exposure of some EFHs and EFH-HAPCs to dispersants and chemically dispersed oil. This could cumulatively add stressors to the current threats on EFH and EFH-HAPCs discussed in this *Biological Assessment*. However, the localized use of dispersants to treat offshore oil spills is anticipated to have minimal and temporary effects on EFH and EFH-HAPCs. In addition, the use of dispersants is expected to reduce direct effects of oil spills on EFH and EFH-HAPCs, and therefore, the preauthorized use of dispersants would not contribute to the cumulative effects on EFH in the region.

Section 5.6. Determination of Action

This section presents the summary of the determinations of adverse effects on ESA-listed species and designated critical habitat, and EFH from implementation of the use of dispersants during an oil spill in offshore waters. Final determinations were based on:

1. A synthesis of toxicological and effects information of dispersants and chemically dispersed oil on closely related animal groups (Section 2.1.G);
2. Assessments of the potential modeled environmental concentrations resulting from worst case spills scenarios (Section 2.1.H);
3. Species-specific information of their presence and potential geographic distribution in relation to the *Green Zone* (Chapter 3);
4. Assessments on the likelihood of potential direct and indirect effects based on relevant information (1, 2, and 3 above) (Section 5.1), and driven by information on:
   - The potential temporal and spatial overlap between species, designated critical habitat and EFH and modeled environmental concentrations of chemically dispersed oil, and based on information from previous field studies (Section 2.1.H);
   - An understanding of potential mitigation strategies that are in place to minimize impacts to wildlife, especially threatened and endangered species, listed critical habitats, and EFH (Appendix IV).

Effects determinations are summarized in Table 5-11, Table 5-12, Table 5-13, and Table 5-14, with determinations further specified by RRT IV's Areas of Operation.

5.6.A. Determination of the Proposed Federal Action on Species and Designated Critical Habitat under the Jurisdiction of the National Marine Fisheries Service

5.6.A(1) Marine Mammals

5.6.A(1)(a) Toothed whales

Sperm whale, *Physeter macrocephalus*

The action may affect, but is not likely to adversely affect (directly or indirectly), sperm whales.

The distribution range of sperm whales overlaps the *Green Zone*; therefore, this species could be exposed to dispersants and chemically dispersed oil. Sperm whales exposed to dispersants or dispersed oil in the water column or at the surface might experience irritation of the eyes and mucous membranes. All of these effects would be transitory and spatially limited. Furthermore, because of their prey types and foraging strategy, sperm whales are not likely to directly ingest dispersants or chemically dispersed oil during feeding. Chemically dispersed oil in the water column is not likely to adversely affect the food supply of sperm whales as they feed at depth or on mobile prey. In addition, their preferred prey (fish) are able to metabolize and excrete hydrocarbons leading only to a small risk for oil bioaccumulation and biomagnification (discussed in Section 2.1.G). In addition, the use of dispersants at the water surface could reduce the adverse effects of oil spills by reducing exposure to toxic volatile fractions [104, 105], and by reducing dermal exposure to whole oil [15, 265, 323, 324]. Any effects would be transitory and spatially limited. Thus it is not likely that the use of dispersants in the *Green Zone* would adversely affect these species.

5.6.A(1)(b) Baleen whales

North Atlantic right whale, *Eubalaena glacialis*, and designated critical habitat

Humpback whale, *Megaptera novaeangliae*

Fin whale, *Balaenoptera physalus*

Sei whale, *Balaenoptera borealis*

Brydes whale, *Balaenoptera adeni*

The action may affect, but is not likely to adversely affect (directly or indirectly), baleen whales listed above, including North Atlantic right whale designated critical habitat.

The distribution range of baleen whales overlaps the *Green Zone*; therefore, this species could be exposed to dispersants and chemically dispersed oil. Baleen whales exposed to dispersants or dispersed oil in the water column or at the surface might experience irritation of the eyes and mucous membranes and fouling of the baleen plates. All of these effects would be transitory and spatially limited. It is not likely that baleen whales could ingest enough chemically dispersed oil in the water column to cause deleterious effects (discussed in Section 2.1.G). Dispersants and chemically dispersed oil in the water column may cause temporary changes to the food supply of baleen whales. Effects of dispersants and chemically dispersed oil to prey of baleen whales would be most likely confined to the footprint of the treated area and generally limited to a few hours post dispersant application (Section 2.1.H)[59]. In addition, many of their prey (e.g., small fish) are able to metabolize and excrete hydrocarbons leading to only a small risk of bioaccumulation and biomagnification (discussed in Section 2.1.G). Furthermore, the use of dispersants at the water surface could reduce the adverse effects of oil spills by reducing exposure to toxic volatile fractions [104, 105], and by reducing dermal exposure to whole oil (e.g., [15, 265, 323, 324]). Thus it is not likely that the use of dispersants in the *Green Zone* would adversely affect these species.

It is unlikely that the entire critical habitat of the North Atlantic right whale within the *Green Zone*, would be impacted by dispersant use. Thus it is not likely that the use of dispersants in the *Green Zone* would adversely affect the critical habitat of the North Atlantic right whale.

5.6.A(2) Sea Turtles

Kemp's ridley sea turtle, *Lepidochelys kempii*

Green sea turtle, *Chelonia mydas*

Loggerhead sea turtle, *Caretta caretta*, and designated critical habitat

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[59] Note that based on trajectory modeling (see Section 2.1.H) using conservative and worst-case conditions (35% of all treated oil effectively dispersed), under most scenarios, concentrations fall below 1 mg/L TPH after approximate 60 hours post treatment. Only under larger spill volumes concentrations remain above 1 mg/L TPH beyond the simulation period (120 hours).

<u>Leatherback sea turtle</u>, *Dermochelys coriacea*

<u>Hawksbill sea turtle</u>, *Eretmochelys imbricate*

The action may affect, but is not likely to adversely affect (directly or indirectly), sea turtles listed above, including loggerhead sea turtle designated critical habitat.

With the exception of Kemp's ridley sea turtles, nesting of all other species of sea turtles occurs along the coast bordering the *Green Zone*; therefore, dispersant and chemically dispersed oil pose threats to newly hatched turtles. However, studies indicate no effects from exposures to dispersants and chemically dispersed oil at concentrations expected to occur in nearshore waters (discussed in Section 2.1.G and Section 2.1.H). Dispersants could reduce the adverse effects of oil spills that originate outside nesting areas by reducing the volume and extent of spilled oil entering this habitat (e.g., [265]), and by reducing impacts associated with nearshore oil spill response efforts. Sea turtles encountering dispersants or chemically dispersed oil might experience irritation of eyes and mucous membranes, but any effects are likely to be temporary (discussed in Section 2.1.G). Kemp's ridley, green, loggerhead and hawksbill sea turtles feed primarily on benthic prey that are not likely to be impacted by dispersants and chemically dispersed oil. Aggregations of the preferred prey of leatherback sea turtles near the water surface may be at increased the risk of indirect impacts of dispersant use in the *Green Zone*. However, peak concentrations of dispersants and chemically dispersed oil may be limited to the top few meters of the water column immediately after application of dispersants, with rapid attenuation due to dilution and biodegradation (Section 2.1.H). While dispersants and chemically dispersed oil may have minor impacts on prey of leatherback sea turtles, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by dispersant use. Furthermore, the use of dispersants at the water surface could reduce the adverse effects of oil spills by reducing exposure to toxic volatile fractions [104, 105], and by reducing dermal exposure to whole oil (e.g., [15, 265, 323, 324]), and possible ingestion of tar balls. Thus, owing in large part to their widespread distribution, it is not likely that the use of dispersants in the *Green Zone* would adversely affect any of the listed sea turtle species.

As discussed previously, the effects of dispersants and chemically dispersed oil to prey of loggerhead sea turtles associated with *Sargassum* would be most likely confined to the approximate footprint of the treated area and limited to a few hours post dispersant application due to dilution in the offshore water column. Thus, it is not likely that the use of dispersants in the *Green Zone* would adversely affect the critical habitat of the loggerhead sea turtle.

5.6.A(3) <u>Marine and Anadromous Fish</u>

<u>Smalltooth sawfish (U.S. DPS)</u>, *Pristis pectinate*, and designated critical habitat

<u>Gulf sturgeon</u>, *Acipenser oxyrinchus desotoi*, and designated critical habitat

<u>Scalloped hammerhead (Central and Southwest Atlantic DPS)</u>, *Sphyrna lewini*

<u>Atlantic sturgeon (South Atlantic DPS)</u>, *Acipenser oxyrinchus oxyrinchus*

<u>Atlantic sturgeon (Carolina DPS)</u>, *Acipenser oxyrinchus oxyrinchus*

<u>Shortnose sturgeon</u>, *Acipenser brevirostrum*

<u>Nassau grouper</u>, *Epinephelus striatus*

The action may affect, but is not likely to adversely affect (directly or indirectly), marine and anadromous fishes listed above, including smalltooth sawfish and Gulf sturgeon designated critical habitat.

The distribution range of all listed anadromous and marine fish species overlaps the *Green Zone*; therefore, these species could be exposed to dispersants and chemically dispersed oil. However, effects would most likely be confined to the approximate footprint of the treated area and generally limited to a few hours post dispersant application (discussed in Section 2.1.H). The preferred prey of the scalloped hammerhead shark (fish, cephalopods, crustaceans, and rays) are able to metabolize and excrete hydrocarbon compounds indicating little risk for their bioaccumulation and biomagnification (discussed in Section 2.1.G). The preferred prey of all other species is primary benthic fauna that are not likely to be impacted to any degree from surface application of dispersants in the *Green Zone*, where water depths are greater than 10 m. Any impacts would be limited to entrained prey within the top few meters of the water column, likely representing a small fraction of the available food source for anadromous and marine fish. In addition, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by dispersant use. Thus, it is not likely that the use of dispersants in the *Green Zone* would adversely affect any of the listed anadromous and marine fish species.

5.6.A(4) <u>Corals</u>

<u>Elkhorn coral</u>, *Acropora palmata*, and designated critical habitat

<u>Staghorn coral</u>, *Acropora cervicornis*, and designated critical habitat

<u>Rough cactus coral</u>, *Mycetophyllia ferox*

<u>Mountainous star coral</u>, *Orbicella faveolta*

<u>Lobed star coral</u>, *Orbicella annularis*

<u>Pillar coral</u>, *Dendrogyra cylindrus*

<u>Boulder star coral</u>, *Orbicella franksi*

The action may affect, but is not likely to adversely affect (directly or indirectly), corals listed above, including Elkhorn and Staghorn coral designated critical habitat.

The distribution range of all coral species overlaps the *Green Zone*; therefore, these species could be exposed to dispersants and chemically dispersed oil. However, since most of these species are found in nearshore shallow waters, only early life stages (larvae and eggs) entrained within the top few meters of the water column, within the approximate footprint of the treated slick, could be exposed to dispersants or chemically dispersed oil. Based on laboratory toxicity tests, exposures are likely to be below effect levels in areas adjacent to the treated area (discussed in Section 2.1.G). Furthermore, dispersants and chemically dispersed oil may adversely affect only a small fraction of the early life stages produced during the spawning season that might be in the upper water column at the time of any particular incident. In addition, there is little risk of effects from exposure to dispersants or chemically dispersed oil in nearshore waters because of the dilution that would take place as the chemically dispersed oil in the water column moves towards shore (Section 2.1.H). Similarly, prey of corals are not likely to be adversely impacted because the concentration of dispersants and chemically dispersed oil would be substantially diluted to below effects. In addition, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by dispersant use. Consequently, effects of chemically dispersed oil to corals would be most likely confined to the approximate footprint of the treated area and generally limited to a few hours post dispersant application. In addition, the use of dispersants could reduce the volume and extent of spilled oil entering shallow water habitats (e.g., [15, 265, 323, 324]). Thus, it is not likely that the use of dispersants in the *Green Zone* would adversely affect any of the listed coral species.

Critical habitat for elkhorn and staghorn coral does not overlap the *Green Zone*. Consequently, any effects of chemically dispersed oil to PCEs would be most likely confined to the outermost edge of the critical habitat (outside the *Green Zone*), and limited to a few hours post dispersant application due to dilution in the offshore water column. In addition, the use of dispersants could reduce the volume and extent of spilled oil entering this critical habitat (e.g., [15, 265, 323, 324]). Thus, it is not likely that the use of dispersants in the *Green Zone* would adversely affect the critical habitat of Elkhorn and Staghorn corals.

5.6.A(5) Seagrass

Johnson's seagrass, *Halophila johnsonii*, and designated critical habitat

The action may affect, but is not likely to adversely affect (directly or indirectly), Johnson's seagrass, including its designated critical habitat.

The distribution range of Johnson's seagrass does not substantially overlap the *Green Zone*. Since most of this species is found in nearshore shallow waters, exposures are only likely within the approximate footprint of the treated slick. In addition, there is little risk of effects from exposure to dispersants or chemically dispersed oil in nearshore waters because of the dilution that would take place as the chemically dispersed oil in the water column moves towards shore (Section 2.1.H). Furthermore, any indirect impacts on water quality are expected to be short lived and transitory. Consequently, effects of chemically dispersed oil to Johnson's seagrass would be most likely confined to the approximate footprint of the treated area and generally limited to a few hours post dispersant application. In addition, the use of dispersants could reduce the volume and extent of spilled oil entering shallow water habitats [15, 265, 323, 324]. Thus, it is not likely that the use of dispersants in the *Green Zone* would adversely affect Johnson's seagrass.

5.6.A(6) Summary

A summary of final determinations on the use of dispersants in the *Green Zone* on species and designated critical habitat under the jurisdiction of the NMFS is presented in Table 5-11 and Table 5-12, respectively.

Table 5-11. Summary of final determination on the impacts of the Proposed Federal Action to species under the jurisdiction NMFS.

Species	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
Marine Mammals									
Sperm Whale	X	X	X	X	X	X	X	X	X
North Atlantic Right Whale				X	X	X	X	X	X
Humpback Whale	X	X	X	X	X	X	X	X	X
Fin Whale	X	X	X	X	X	X	X	X	X
Sei Whale	X	X	X	X	X	X	X	X	X
Brydes Whale	X	X	X	X	X	X	X	X	X
Sea Turtles									
Kemp's ridley Sea Turtle	X	X	X	X	X	X	X	X	X
Green Sea Turtle	X	X	X	X	X	X	X	X	X
Loggerhead Sea Turtle	X	X	X	X	X	X	X	X	X
Leatherback Sea Turtle	X	X	X	X	X	X	X	X	X
Hawksbill Sea Turtle	X	X	X	X	X	X	X	X	X
Anadromous and Marine Fish									
Smalltooth sawfish	X	X	X	X	X	X	X	X	X
Gulf Sturgeon		X	X						
Scalloped Hammerhead	X	X	X	X	X	X	X	X	X
Atlantic Sturgeon Carolina DPS							X	X	X
Atlantic Sturgeon South Atlantic DPS					X	X	X	X	X
Shortnose Sturgeon					X	X	X	X	X
Nassau Grouper				X	X	X	X	X	X
Corals									
Elkhorn Coral				X	X				
Staghorn Coral,				X	X				
Rough Cactus Coral			X	X	X	X			
Mountainous Star Coral			X	X	X	X			
Lobed Star Coral			X	X	X	X			
Pillar Coral			X	X	X	X			
Boulder Star Coral			X	X	X	X			
Seagrass									
Johnson's Seagrass					X				
Determination	No affect		May affect, not likely to adversely affect		May affect, likely to adversely affect				

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Table 5-12. Summary of final determination on the impacts of the Proposed Federal Action to designated critical habitat under the jurisdiction NMFS.

Critical Habitat	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
North Atlantic Right Whale									
Southeast U.S.					X	X	X	X	
Southeast U.S.					X	X	X	X	X
Loggerhead Sea Turtle									
N-01 (Migrating) N-02 (Winter)									X
N-17 (Nearshore Productive, Breeding, Migratory, *Sargassum*)					X	X			
N-18 (Nearshore Productive, Migratory)					X	X			
N-19 (Nearshore Productive, Breeding, Migratory)				X	X				
S-01, S-02 (*Sargassum*)	X	X	X	X	X	X	X	X	X
Elkhorn and Staghorn Coral									
Acropora Area 1 (Florida)				X	X				
Determination	No affect		May affect, not likely to adversely affect			May affect, likely to adversely affect			

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5.6.B. Determination of the Proposed Federal Action on Species and Designated Critical Habitat under the Jurisdiction of the U.S. Fish and Wildlife Service

Based on the information provided by the USFWS there are no designated critical habitat in the *Green Zone*. Therefore, determinations below address only listed species.

5.6.B(1) Marine Mammals

West Indian Manatee, *Trichechus manatus*

The action may affect, but is not likely to adversely affect (directly or indirectly) the West Indian Manatee.

Most West Indian manatees occur in shallow nearshore waters, and only a rare number of individuals may be found in areas more than 3 nm offshore. Because West Indian manatees rarely swim out as far as the *Green Zone*, a few individuals may be at a small risk of being subject to overspray of dispersants. There is also risk that chemically dispersed oil from the *Green Zone* would move, at diluted concentrations, into manatee habitat via alongshore currents. However, studies indicate no effects from exposures to dispersants and chemically dispersed oil at concentrations expected to occur in nearshore waters (discussed in Section 2.1.G and Section 2.1.H). Dispersants could reduce the adverse effects of oil spills that originate outside the distribution range of the manatee by reducing the volume and extent of spilled oil entering their habitat (e.g., [15, 265, 323, 324])., and by reducing impacts associated with nearshore oil spill response efforts. The manatee feed on nearshore vegetation, which are not likely to be exposed to dispersants or chemically dispersed oil at concentrations above effects levels because concentrations are expected to decline rapidly in both space and time, and be substantially diluted when reaching nearshore waters. Thus, it is not likely that the use of dispersants in the *Green Zone* would adversely affect the West Indian manatee.

5.6.B(2) Anadromous Fish

5.6.B(2)(a) Marine and anadromous fish

Gulf sturgeon, *Acipenser oxyrinchus desotoi*

The action may affect, but is not likely to adversely affect (directly or indirectly), Gulf sturgeon.

The distribution range of Gulf sturgeon may overlap the *Green Zone*; therefore, this species could be exposed to dispersants and chemically dispersed oil. However, effects would most likely be confined to the approximate footprint of the treated area and limited to a few hours post dispersant application (discussed in Section 2.1.H). The preferred prey of this species is primary benthic fauna that are not likely to be impacted to any degree. Any impacts would be limited to entrained prey within the top few meters of the water column, likely representing a small fraction of the available food source. In addition, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by dispersant use. Thus, it is not likely that the use of dispersants in the *Green Zone* would adversely affect the Gulf sturgeon.

5.6.B(3) Birds

Red Knot, *Calidris canutus rufa*

The action may affect, but is not likely to adversely affect (directly or indirectly) the red knot.

The red knot occupies nearshore and intertidal coastal habitats, thus it would not be directly affected by the use of dispersants and chemically dispersed oil in the *Green Zone*. For short periods of time during migration, there is a small risk of red knot occurring in the *Green Zone* when this species could be subject to overspray of dispersants. However, this risk is likely minimal. The prey items for red knot occur mostly in the intertidal zone, where concentrations of dispersants and chemically dispersed oil would be substantially diluted to below effects levels when reaching nearshore waters (discussed in Section 2.1.G and Section 2.1.H). Thus it is not likely that the use of dispersants in the *Green Zone* would adversely affect this species. Successful dispersion of oil in the *Green Zone* may reduce the amount of oil that could strand on red knot habitat. In addition, the use of dispersants could reduce the volume and extent of spilled oil entering nearshore habitats (e.g., [15, 265, 323, 324]). Reducing the amount of oil stranding onto nearshore coastal habitats would reduce impacts associated with shoreline oil spill response in areas important for their overwintering. Thus, it is not likely that the use of dispersants in the *Green Zone* would adversely affect the red knot.

Roseate tern, *Sterna dougalli*

The action may affect, but is not likely to adversely affect (directly or indirectly) the roseate tern.

The roseate tern shallow water habitats, thus it would not be directly affected by the use of dispersants and chemically dispersed oil in the *Green Zone*. For short periods of time during migration, there is a small risk of roseate tern occurring in the *Green Zone* when this species could be subject to overspray of dispersants. However, this risk is likely minimal. The prey items for roseate tern occur mostly in shallow areas (≤2.1 mi [7 km] from shore, water depths less than 16.5 ft. [5 m]), and in shallow nearshore habitats, where concentrations of dispersants and chemically dispersed oil would be substantially diluted to below effects levels when reaching nearshore waters (discussed in Section 2.1.G and Section 2.1.H). Thus it is not likely that the use of dispersants in the *Green Zone* would adversely affect this species. Successful dispersion of oil in the *Green Zone* may reduce the amount of oil that could strand on roseate tern habitat. In addition, the use of dispersants could reduce the volume and extent of spilled oil entering nearshore habitats (e.g., [15, 265, 323, 324]). Reducing the amount of oil stranding onto nearshore coastal habitats would reduce impacts associated with shoreline oil spill response in areas important for their overwintering. Thus, it is not likely that the use of dispersants in the *Green Zone* would adversely affect the roseate tern.

A summary of final determinations on the use of dispersants in the *Green Zone* on species under the jurisdiction of the USFWS is presented in Table 5-13.

Table 5-13. Summary of final determination on the impacts of the Proposed Federal Action to species under the jurisdiction USFWS.

Species	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
Marine mammals									
West Indian Manatee	X	X	X	X	X	X	X	X	X
Anadromous Fish									
Gulf Sturgeon		X	X						
Birds									
Red Knot	X	X	X	X	X	X	X	X	X
Roseate Tern				X	X				
Determination	No affect		May affect, not likely to adversely affect			May affect, likely to adversely affect			

5.6.C. Determination of the Proposed Federal Action on Essential Fish Habitat and Essential Fish Habitat-Habitat Areas of Particular Concern

SAFMC: **Water Column, *Sargassum*, Coral Reefs and Coral Communities, Deepwater Coral, Live/Hard Bottom, Marine Soft Bottom, Seagrasses, Oyster Reefs, Artificial Reefs, Habitat Areas of Particular Concern**

GMFMC: **Pelagic (Water Column), Shelf Edge/Slope, Coral Reefs, Submerged Aquatic Vegetation (including seagrasses and benthic algae), Hard Bottom, Soft Bottom, Oyster Reefs, Drift Algae [*Sargassum*, pelagic *Sargassum* community], Habitat Areas of Particular Concern**

NMFS: **Habitat Areas of Particular Concern (Highly Migratory Species).**

5.6.C(1) Determination

The action may adversely affect EFH or EFH-HAPC.

5.6.C(2) Summary

Among all EFH, the habitat more likely to experience temporary impacts on water quality is the Water Column EFH. However, any direct effects are anticipated to be minor and temporary (discussed in Section 2.1.G and Section 2.1.H). Similarly, *Sargassum* (managed by SAFMC and GMFMC) may be temporarily and directly exposed to dispersants and chemically dispersed oil if entrained within the water mass of the treated oil slick. However, the use of dispersants is expected to reduce direct effects of oil spills on organisms founds on the water surface (e.g., [15]), including *Sargassum*. In addition, and as noted previously (see Section 2.1.G and Section 2.1.H), dispersants enhance the partitioning of oil into the water column followed by the rapid dilution of oil levels to below those associated with adverse effects. Consequently any direct effects are anticipated to be minor and temporary. Any direct effects of dispersants and chemically dispersed oil on other EFH and EFH-HAPC managed by the SAFMC and the GMFMC are expected to impact only a relatively small fraction of the each EFH and EFH-HAPC, with effects likely being short-lived and transitory. Consequently, effects of chemically dispersed oil to EFH and EFH-HAPC would be most likely confined to the approximate footprint of the treated area and limited to a few hours post dispersant application. Thus, it is not likely that the use of dispersants in the *Green Zone* would adversely affect any of the EFH and EFH-HAPC.

Different from the determination associated with Endangered Species Act consultations, any affect to the quality or quantity of EFH is considered an adverse affect. As stated above, the adverse affect is expected to be “temporary”, will “impact only a relatively small fraction”, “short-lived”, and “transitory”. As such, our determination is that the proposed action will have minimal adverse affects on EFH and EFH-HAPC. In addition to the resonance of all protocols outlined in the RRT 4 Dispersant Use Preauthorization Plan, this determination also highlights the importance of the conservation measures found in Appendix IV, which have been identified during the construct of this biological assessment, and are intended to further reduce or eliminate the minimal adverse impacts expected to EFH or EFH-HAPC should dispersant operations in the Green Zone be used.

A summary of final determinations on the use of dispersants in the *Green Zone* on EFH and EFH-HAPC managed by the SAFMC, GMFMC and NMFS is presented in Table 5-14.

Table 5-14. Summary of final determination on the impacts of the Proposed Federal Action to EFH managed by the SAFMC and the GMFMC.

Essential Fish Habitat	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
South Atlantic Fisheries Management Council									
Essential Fish Habitat of the SAFMC									
Water Column				X	X	X	X	X	X
Sargassum				X	X	X	X	X	X
Coral Reefs and Coral Communities				X	X	X	X	X	X
Deepwater Coral				X	X	X	X	X	X
Live/Hard Bottom				X	X	X	X	X	X
Marine Soft Bottom				X	X	X	X	X	X
Seagrasses				X	X	X	X	X	X
Oyster Reefs				X	X	X	X	X	X
Artificial Reefs				X	X	X	X	X	X
EFH – Habitat Areas of Particular Concern of the SAFMC									
All areas within the EEZ that contain *Sargassum* population				X	X	X	X	X	X
Documented sites of spawning aggregations in NC, SC, GA, and FL described in the Habitat Plan; other spawning areas identified in the future; habitats identified for submerged aquatic vegetation				X	X	X	X	X	X
The Point									X
The Ten Fathom Ledge							X		X
Big Rock									X
Charleston Bump							X		
Seagrass Habitat; oyster shell habitat; pelagic and benthic *Sargassum*				X	X	X	X	X	X
Hoyt Hills							X		X
Hermatypic coral habitats and reefs				X	X	X			

Essential Fish Habitat	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
Manganese outroppings on the Blake Plateau				X	X	X	X	X	X
Council designated Artificial Reef Special Management Areas (SMZs).				X	X	X	X	X	X
Sandy shoals of Capes Lookout, Cape Fear, and Cape Hatteras from shore to the ends of the respective shoals, but shoreward of the Gulf Stream							X		X
Hurl Rocks							X		
The Point off Jupiter Inlet					X				
The Hump off Islamorada, Florida				X					
The Marathon Hump off Marathon, Florida				X					
The “Wall” off of the Florida Keys				X					
Pelagic *Sargassum*				X	X	X	X	X	X
Big Rock									X
Gray’s Reef National Marine Sanctuary								X	
Offshore (530 meter; 15-90 feet) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks					X	X			
Georgetown Hole							X		
Oculina Bank					X	X		X	
Satellite Oculina Bank HAPC #1					X	X		X	
Satellite Oculina Bank HAPC #2					X	X		X	
Gulf of Mexico Fisheries Management Council									
Essential Fish Habitat of the GMFMC									
Pelagic (Water Column)		X	X	X					
Shelf Edge/Slope		X	X	X					
Coral Reefs		X	X	X					
Submerged Aquatic Vegetation (including seagrasses and benthic algae)		X	X	X					
Hard Bottom		X	X	X					
Soft Bottom		X	X	X					
Oyster Reefs		X	X	X					
Drift Algae (*Sargassum*, pelagic *Sargassum* community)		X	X	X					
EFH – Habitat Areas of Particular Concern of the GMFMC									
Florida Middle Grounds			X	X					
Tortugas South				X					
Madison-Swanson Marine Reserve			X	X					
Pulley Ridge			X	X					
National Marine Fisheries Service									
Essential Fish Habitat of the NMFS									
Same as EFH of the SAFMC and GMFMC									
EFH – Habitat Areas of Particular Concern of the NMFS									
Gulf of Mexico (Highly Migratory Species)		X	X	X					

Determination	No affect	May Adversely Affect	Will Adversely Affect

Chapter 6. Effects of Preauthorized In-Situ Burn Operations on Listed Species, Critical Habitats, and Essential Fish Habitats

Section 6.1. Effects of the Action

In this section, potential effects of the Proposed Federal Action are discussed for each individual listed and proposed species under the ESA, and designated critical habitat, as well as for EFH. For the purpose of this Biological Assessment, direct and indirect effects of the Proposed Federal Action within the *Green Zone* are considered, and defined as follows:

> *Direct effects* are explicitly defined as those caused by the Proposed Federal Action and occur at the same time and place as the Action; and
>
> *Indirect effects* are explicitly defined as those caused by the Action and are later in time, but are reasonably certain to occur[60].

Effects are assumed to occur when there is a clear pathway of exposure, when a Proposed Federal Action has been undertaken, and when the receptors or critical habitats are physically present (see Figure 5-1).

A complete exposure pathway to in-situ burning (including combustion byproducts) and burn residues can only occur when all of the following elements are present (modified from [271, 272]):

1. An oil spill incident requiring in-situ burning resulting in exposure to the combustion byproducts and burn residues;
2. Media (i.e., water, air, or sediment) must be present for the combustion byproducts and burn residues to travel;
3. Listed species, designated critical habitat or EFH must be present and come into direct contact with the combustion byproducts and burn residues; and
4. A pathway of exposure leading to direct contact the body (i.e., ingestion, inhalation, and dermal contact and absorption)

As discussed in Section 2.2.D, potential exposure to air-breathing marine species is likely concentrated within the immediate vicinity and downwind of the burn area, but there is little information on smoke exposure levels and durations to air-breathing marine animals (e.g., cetaceans, birds, sea turtles) within these areas. However, best management practices during *in-situ* burning are in place to minimize impacts to wildlife, especially threatened and endangered species, listed critical habitats, and EFH (Appendix IV). For example, specific wildlife measures (e.g., an on-site survey prior to the burn, burn relocation to an area where listed species are not present, employment of hazing techniques) (Appendix IV) are implemented to minimize direct impacts from in-situ burning. As a result, potential exposure to air-breathing aquatic species is likely concentrated to the immediate vicinity of the treated area, with impacts from ingestion of burn residues comparable to those resulting from the ingestion of untreated oil and residues (discussed in Section 2.2.D).

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[60] 50 CFR 402.02

As defined above, indirect effects of the Proposed Federal Action on listed species, critical habitat, and EFH are those that are caused by the action and are later in time, but still reasonably certain to occur. Scientific data documenting such indirect effects are limited and, consequently, indirect effects are difficult to assess. However, indirect effects that could occur include sublethal effects of burn residues that could result in delayed effects to listed species (e.g., reduced feeding in sea turtles and marine birds). Indirect effects also include effects on other species that are ecologically connected to the listed species (e.g., prey, competitors, predators), and that could affect individuals or the entire population of the listed species (e.g., reduced energy for growth, development, and reproduction).

For the purpose of this *Biological Assessment* direct and indirect effects from in-situ burning and burn residues are determined based on appropriate scientific information. Due to similarities in life history, behavior and physiology, species are grouped by taxa in the discussion of effects, but determinations are made on individual species. Similar analyses are included for EFH. The agencies' determination on the potential effect for each species and designated critical habitat, and EFH is listed in summary tables in Section 6.6. Only species, critical habitat, or EFH known to be present within the *Green Zone* are included in the following sections, or when located within the immediate vicinity of the *Green Zone*.

Section 6.2. Effects on Species and Designated Critical Habitat under the Jurisdiction of the National Marine Fisheries Service

There are only a few published studies on the direct effects of *in-situ* burning and burn residues on aquatic organisms (Section 2.2.D), but based on limited information, burn residues appear to have little to no acute toxicity to several invertebrates and fish species. This information serves as surrogate information for assessing potential effects to marine and anadromous fish. Aside from anecdotal accounts of tar ball ingestion by sea turtles following oil spills [265], there is little to no information of impacts to cetaceans and sea turtles. These two groups could be temporarily exposed to combustion products if they move to the surface to breathe within the immediate vicinity and downwind from a burn. However, any exposure to detrimental levels are anticipated to be short as the combustion byproducts quickly dissipates as it is carried away by winds (discussed in Section 2.2.D). Sea turtles could also be exposed at the water surfaces or while feeding to viscous and dense residues with the tendency to form tar balls (see Section 2.2.D and citations therein).

6.2.A. Marine Mammals

There are six listed species of marine mammals that could be affected by *in-situ* burning in the *Green Zone*. There is little to no information on the impacts to marine mammals from exposure to burn residues (discussed in Section 2.2.D). Best management practices during *in*-situ burning are in place to ensure that marine mammals spotted at the water surface are not accidentally burned during these operations (see also Appendix IV). It is important to recognize that the likelihood of exposure and effects to *in-situ* burning and burn residues are species specific, and depend on their distribution patterns and movements, habitat utilization, feeding behavior, and degree of slick/sheen avoidance.

6.2.A(1) Toothed whales

Sperm whale, *Physeter macrocephalus*

6.2.A(1)(a) Direct Effects

The distribution range of the sperm whale encompasses all areas within the *Green Zone* (Section 3.1.A(1)). As whales encounter surface oil, the primary pathways of exposure to burn residues include surface contact, ingestion, inhalation of combustion products, and contamination of prey.

Detrimental effects of exposure to *in*-situ burn residues on the skin of whales are not likely because the dermal shield is considered to be a highly effective barrier to the toxic compounds found in oil [89]. Comparable to the effects from exposure to volatile compounds from oil, for toothed whales, inhalation of combustion products originating from a freshly burned oil slick at the surface may pose the greatest risk [89, 90]. However, adverse direct effects may be more likely to result from chronic exposures to volatile compounds (e.g., [96]), which are unlikely given the dissipation of combustion byproducts as these are carried away by winds. However, there are no empirical data on the potential effects of *in-situ* burning and burn residues to toothed whales. Sperm whales feed on squid taken at depths of 500-1,000 m [NMFS 275]. Because of the prey types and foraging methods, and preferential feeding in deep waters, toothed whales are not likely to directly ingest burn residues during feeding.

6.2.A(1)(b) Indirect Effects

Toothed whales feed at depth or on mobile prey unlikely exposed to burn residues (i.e., squid, sharks, skates, etc.). In addition, toothed whales are not expected to scavenge on oil burn-tainted fish tissues [89]. Because hydrocarbons do not biomagnify up the food chain (as discussed in Section 2.1.G(4)(g)) (e.g., [140]), toothed whales are unlikely to be exposed to significant hydrocarbon burn residues via their food. In summary, indirect effects on toothed whales from *in-situ* burning in the *Green Zone* are not likely.

6.2.A(2) Baleen whales

North Atlantic right whale, *Eubalaena glacialis*, and designated critical habitat

Humpback whale, *Megaptera novaeangliae*

Fin whale, *Balaenoptera physalus*

Sei whale, *Balaenoptera borealis*

Brydes whale, *Balaenoptera adeni*

6.2.A(2)(a) Direct Effects

The distribution range of baleen whales encompasses all areas within the *Green Zone* (Sections 3.1.A(2) through 3.1.A(6)). Field observations suggest that cetaceans typically make no attempt to avoid surface oil and generally behave in a normal manner when exposed to oil on the water surface [89, 91, 94, 273, 276-278]. As baleen whales encounter surface oil, the primary pathways of exposure to *in-situ* burn residues would include surface contact, fouling of baleen, ingestion, inhalation of combustion products, and contamination of prey.

Detrimental effects of exposure to *in*-situ burn residues on the skin of whales are not likely because the dermal shield is considered to be a highly effective barrier to the toxic compounds found in oil [89]. Comparable to the effects from exposure to volatile compounds from oil, for baleen whales, inhalation of combustion products originating from a freshly burned oil slick at the surface may pose the greatest risk [89, 90]. However, adverse direct effects may be more likely to result from chronic exposures to volatile compounds (e.g., [96]), which are unlikely given the dissipation of combustion byproducts as these are carried away by winds. However, there are no empirical data on the potential effects of *in-situ* burning and burn residues to baleen whales. Fouling of the baleen plates with oil residues while feeding at or near the surface of the ocean could present a potential risk to the feeding capabilities of baleen whales (see Section 2.2.D), but these effects are likely to be short term. In addition, only a small fraction of the total treated oil (1-10%) is anticipated to remain in the water as burn residue (Section 2.2.D), suggesting that the likelihood of physical contact is small. Ingestion of burn residues, either directly or through the intake of contaminated food, is a potential exposure route in cetaceans. Baleen whales could uptake burn residues while feeding at or near the water surface. Geraci [89] estimated that an adult whale would have to consume approximately 150 gallons of oil to induce deleterious effects. Goldbogen et al. [279] calculated that fin whales engulf 71 m^3 of water when lunge feeding and 83 lunges per day would be needed to meet their energetic demand based on average krill concentration of 15 kg/m^3. If whales were feeding in the water column that contained 1 mg/L TPH, about 0.22 gal of burn residues would be filtered per lunge, and about 18 gal per day. It is therefore unlikely that whales could ingest enough burn oil residues in the water column to cause deleterious effects. Furthermore, the distribution of their prefer prey is not limited to the top few meters of the water column and can be found at depths as great as 200 m [280, 281, 325], indicating that exposure to whales would be limited only to their surface-feeding period. Another route of exposure to burn residues by baleen whales is via ingestion of contaminated food either filtered from the water column or bottom sediments. Geraci [89] calculated that more than 10% by weight of the 1,600 kg of food consumed by a 40-ton fin whale would have to be burn residue to reach a dose of 150 gallons of oil, which is not considered likely.

6.2.A(2)(b) Indirect Effects

Baleen whale prey items (e.g., plankton, euphausiids [krill], small schooling fish, and squid) may be exposed to burn residues while in the top of the water column, but not likely at concentrations associated with acute toxicity (Section 2.2.D). In addition, only a small fraction of the total treated oil (1-10%) is anticipated to remain in the water as burn residue (Section 2.2.D), suggesting that the likelihood of physical contact is small. Furthermore, as discussed in Section 2.1.G(4)(g), most aquatic organisms are able to metabolize and excrete oil-related compounds indicating little risk of bioaccumulation and biomagnification of burn residues. While *in-situ* burning and burn residues may have minor impacts on prey of listed baleen whales, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by *in-situ* burning.

6.2.A(2)(c) Critical Habitat

NMFS designated critical habitat for the North Atlantic right whale along the Southeastern U.S. (Sections 3.1.A(2)(a) through 3.1.A(2)(b)) encompassing the entire *Green Zone*. The Primary

Constituent Element[61] used by NOAA to define this critical habitat is the local habitat features (i.e., proximity to shore, water depth and temperature, calm surface conditions, protection from wave action during calving, and other essential calving features) of nearshore waters of the continental shelf off Florida and Georgia. *In-situ* burning may have transitory and short-lived effects on water quality, but are unlikely to alter any of the PCEs. In addition, best management practices during *in-situ* burning are in place to minimize impacts to critical habitats (Appendix IV).

6.2.A(2)(d) Summary

The direct and indirect effects from exposure to *in-situ* burning and burn residues on listed and proposed marine mammals and designated critical habitat for the North Atlantic right whale from *in-situ* burning in the *Green Zone* are summarized in Table 6-1. Note that specific studies on the potential direct effects of *in-situ* burning to listed marine mammals and designated critical habitat are not available, and assessments are based on their behavior and distribution.

Table 6-1. Summary of the direct and indirect effects of the Proposed Federal Action to listed marine mammals.

Listed Species Common Name, Scientific name	Direct Effects[a] In-situ burning and burn residues	Indirect Effects[b] In-situ burning and burn residue
Sperm whale, *Physeter macrocephalus*	Exposure to combustion products is possible, but likely for a short amount of time. Unlikely effects from ingestion as sperm whales feed at depths over large areas during foraging episodes.	Unlikely as concentrations of burn residues in the water are expected to be below effects levels.
North Atlantic right whale, *Eubalaena glacialis* **Humpback whale, *Megaptera novaeangliae*** **Fin whale, *Balaenoptera physalus*** **Sei whale, *Balaenoptera borealis*** **Brydes whale, *Balaenoptera adeni***	Exposure to combustion products is possible, but likely for a short amount of time. Unlikely effects from ingestion as the amount of oil potentially ingested during feeding is below the levels thought to be deleterious.	Unlikely as concentrations of burn residues in the water are expected to be below effects levels.
Critical Habitat for the North Atlantic right whale, *E. glacialis*	Unlikely to have impacts on PCEs.	None

[61] Primary Constituent Elements (PCEs) represent the environmental conditions or habitat attributes that are essential for persistence of a management species. The Endangered Species Act requires protection of PCEs to promote recovery and sustainability of a protected species and/or distinct population, but provides no specific guidance for determining boundaries of protected areas.

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species.

6.2.B. Sea Turtles

There are five listed species of sea turtles that could be affected by *in-situ* burning in the *Green Zone*. There is little to no information on the impacts to sea turtles from exposure to burn residues (discussed in Section 2.2.D). Best management practices during *in-situ* burning are in place to ensure that sea turtles spotted at the water surface are not accidentally burned during these operations (see also Appendix IV). It is important to recognize that the likelihood of exposure and effects to *in-situ* burning and burn residues are species specific, and depend on their distribution patterns and movements, habitat utilization, feeding behavior, and degree of slick/sheen avoidance.

6.2.B(1) Sea turtles

Kemp's ridley sea turtle, *Lepidochelys kempii*

Green sea turtle, *Chelonia mydas*

Loggerhead sea turtle (Northwest Atlantic DPS[62]), *Caretta caretta*, and designated critical habitat

Leatherback sea turtle, *Dermochelys coriacea*

Hawksbill sea turtle, *Eretmochelys imbricate*

6.2.B(1)(a) Direct Effects

The range of these sea turtles extends offshore of the Southeast and Gulf of Mexico coasts (Sections 3.1.B(1) through 3.1.B(5)). They spend a large amount of time on the water surface where they could be exposed to *in-situ* burning and burn residues. Inhalation of combustion products originating from a freshly burned oil slick at the surface may pose the greatest risk to all listed sea turtles. However, adverse direct effects may be more likely to result from chronic exposures, which are unlikely given the dissipation of combustion byproducts as these are carried away by winds. Kemp's ridley, green, loggerhead and hawksbill sea turtles are mostly benthic feeders and are not likely to be exposed to burn residues during feeding, but only when they come to the surface to breathe or rest between dives, as described for marine mammals [89, 90]. In contrast, leatherback sea turtles feed on soft-bodied animals (e.g., jellyfish, sea nettles and salps, and pyrosomes) within the water column and at the water surface particularly in the summer. All sea turtles may be exposed to viscous and dense residues with the tendency to form tar balls, with effects comparable to those of tar balls from unburned oil. However, only a small fraction of the total treated oil (1-10%) is anticipated to remain in the water as burn residue (Section 2.2.D), suggesting that the likelihood of physical contact is small. With the exception of Kemp's ridley sea turtles, all other species of sea turtles found within the *Green Zone* nest on beaches along the southern U.S. and Gulf of Mexico, though nesting is minor for leatherback sea turtles, and rare for hawksbill. However, *in-situ* burning does not pose a threat to nesting

[62] Northwest Atlantic Ocean distinct population segment (DPS).

beaches. In contrast, hatchlings and juveniles from all five sea turtle species may be found within the *Green Zone*, and could therefore be exposed to *in-situ* burning and burn residues. Although there are currently no specific data on the potential effects of *in*-situ burning on sea turtles, any effects from exposure to burned oil residues would be most likely be confined to the approximate footprint of the treated area.

6.2.B(1)(b) Indirect Effects

Kemp's ridley, green, loggerhead and hawksbill sea turtles feed primarily on benthic prey that are unlikely to be adversely impacted by burn residues in the water column. Although burn residues may sink, only a small fraction of the total treated oil (1-10%) is anticipated to form burn residue (Section 2.2.D), suggesting that the likelihood of physical contact of the benthos is small. The aggregations of jellyfish, sea nettles, and salps that are the preferred prey of leatherback sea turtles are often aggregated near the water surface where they may be exposed to burn residues, but not likely at concentrations associated with acute toxicity (Section 2.2.D). Any impacts are likely limited to a small area relative to the potential distribution of prey. Furthermore, as discussed in Section 2.2, most aquatic organisms are able to metabolize and excrete oil-related compounds indicating little risk of bioaccumulation and biomagnification of burn residues. While *in-situ* burning and burn residues may have minor impacts on prey of listed sea turtles, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by *in-situ* burning.

6.2.B(1)(c) Critical Habitat

NMFS designated critical habitat for the loggerhead sea turtle along the U.S. coast (Sections 3.1.B(3)(a) through 3.1.B(3)(b)), with five critical habitats (i.e., migratory, winter, nearshore reproductive, breeding and *Sargassum*) overlapping the *Green Zone*. The PCE used by NMFS to define this critical habitat is the local habitat features (i.e., access, transit, egression, waters free of obstructions, proximity to shore, water depth and temperature). *In-situ* burning and burn residues may have transitory and short-lived effects on water quality, but are unlikely to alter any of the PCEs. The only PCE that directly addresses prey (i.e., support adequate prey abundance and cover) applies to *Sargassum* as a critical habitat. It is unlikely that *in-situ* burning would occur in areas with large aggregations of *Sargassum*. In addition, and as discussed previously, the effects of *in-situ* burning to prey of loggerhead sea turtles would be most likely confined to the approximate footprint of the burning oil and limited to a few hours post oil burning. In addition, best management practices during *in-situ* burning are in place to minimize impacts to critical habitats (Appendix IV).

6.2.B(1)(d) Summary

The direct and indirect effects from exposure to *in-situ* burning and burn residues on listed sea turtles and critical habitat for the loggerhead sea turtle from *in-situ* burning in the *Green Zone* are summarized in Table 6-2. Note that specific studies on the potential direct effects of *in-situ* burning to listed sea turtles and designated cr itical habitat are not available, and assessments are based on their behavior and distribution.

Table 6-2. Summary of the direct and indirect effects of the Proposed Federal Action to listed sea turtles

Listed Species Common Name, Scientific name	Direct Effects[a] In-situ burning and burn residues	Indirect Effects[b] In-situ burning and burn residue
Kemp's ridley sea turtle, *Lepidochelys kempii* **Green sea turtle, *Chelonia mydas*** **Loggerhead sea turtle[1], *Caretta caretta*** **Hawksbill sea turtle, *Eretmochelys imbricate***	Exposure to combustion products is possible, but likely for a short amount of time. Unlikely effects from ingestion because the amount of oil potentially ingested during feeding is below the levels thought to be deleterious. Fouling from ingestion of tar balls is possible, but unlikely because of the small volume of burn residues.	Unlikely as concentrations of burn residues in the water are expected to be below effects levels. In addition, unlikely as these sea turtles feed primarily on benthic prey as the likelihood of physical contact of the benthos is small.
Leatherback sea turtle, *Dermochelys coriacea*	Exposure to combustion products is possible, but likely for a short amount of time. Unlikely effects from ingestion because the amount of oil potentially ingested during feeding is below the levels thought to be deleterious. Fouling from ingestion of tar balls is possible, but unlikely because of the small volume of burn residues.	Unlikely as concentrations of burn residues in the water are expected to be below effects levels.
Critical Habitat for the Loggerhead sea turtle, *C. caretta*	Unlikely to have impacts on PCEs.	None

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin). This includes direct exposure to designated critical habitat for the Leatherback sea turtle; [b] Likely indirect effects would include effects on the primary prey species. This includes direct exposure to resources within the designated critical habitat for the leatherback sea turtle; [1] Northwest Atlantic DPS.

6.2.C. Marine and Anadromous Fish

There are six listed species of marine and anadromous fish that could be affected by *in-situ* burning in the *Green Zone*. There is little to no information on the impacts to fish from exposure to *in-situ* burning and burn residues. It is important to recognize that the likelihood of exposure and effects to *in-situ* burning are species specific, and depend on their distribution patterns and movements, habitat utilization, and degree of slick/sheen avoidance.

6.2.C(1) Marine and anadromous fish

Smalltooth sawfish (U.S. DPS), *Pristis pectinate*, and designated critical habitat

Gulf sturgeon, *Acipenser oxyrinchus desotoi*, and designated critical habitat

Scalloped hammerhead (Central and Southwest Atlantic DPS), *Sphyrna lewini*

Atlantic sturgeon (South Atlantic DPS), *Acipenser oxyrinchus*

Atlantic sturgeon (Carolina DPS), *Acipenser oxyrinchus*

Shortnose sturgeon, *Acipenser brevirostrum*

Nassau grouper, *Epinephelus striatus*

6.2.C(1)(a) Direct Effects

The range of the listed or proposed fishes extends along the entire Southeast and Gulf of Mexico U.S. coast (3.1.C(1) through 3.1.C(7)) and in some cases it overlaps the *Green Zone*. Juvenile and adult fish could come in contact with both burn residues in the water column in the immediate area around *in-situ* burning operations. Limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea, with little evidence of acute toxicity of burn residues to aquatic species. In addition, only a small fraction of the total treated oil (1-10%) is anticipated to remain in the water as burn residue (Section 2.2.D), suggesting that the likelihood of physical contact is small. Juvenile and adult fish in the open water conditions of the *Green Zone* are mobile and able to avoid or move away from *in-situ* burning operations, resulting in temporary exposures. Consequently, effects of *in-situ* burning to marine and anadromous fish would be most likely confined to the approximate footprint of the treated area and limited to a few hours post *in-situ* burning.

6.2.C(1)(b) Indirect Effects

Plankton and fish serve as prey for some of the listed fish species, though most of these species (except for scalloped hammerhead) are primarily benthic feeders. Although burn residues may sink, only a small fraction of the total treated oil (1-10%) is anticipated to form burn residue (Section 2.2.D), suggesting that the likelihood of physical contact of the benthos is small. Limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea, with little evidence of acute toxicity of burn residues to aquatic species. While *in-situ* burning and burn residues may have minor impacts on prey of listed marine and anadromous fish, the impacted area is likely small relative to the potential distribution of prey and, thus, it is unlikely that the entire area where prey may be found would be impacted by *in-situ* burning.

6.2.C(1)(c) Summary

The direct and indirect effects from exposure to *in-situ* burning and burn residues on listed marine and anadromous fish and designate critical habitat for smalltooth sawfish and the Gulf sturgeon from *in-situ* burning in the *Green Zone* are summarized in Table 6-3. Note that specific studies on the potential direct effects of *in-situ* burning and burn residues to listed marine and anadromous fish, and critical habitat are not available, and assessments are based on their behavior and distribution.

Table 6-3. Summary of the direct and indirect effects of the Proposed Federal Action to listed fish.

Listed Species Common Name, Scientific name	Direct Effects[a] In-situ burning and burn residues	Indirect Effects[b] In-situ burning and burn residue
Smalltooth sawfish[1], *Pristis pectinate* **Gulf sturgeon, *Acipenser oxyrinchus desotoi*** **Scalloped hammerhead[2], *Sphyrna lewini*** **Atlantic sturgeon[3], *Acipenser oxyrinchus oxyrinchus*** **Atlantic sturgeon[4], *Acipenser oxyrinchus oxyrinchus*** **Shortnose sturgeon, *Acipenser brevirostrum*** **Nassau grouper, *Epinephelus striatus***	Unlikely as concentrations of burn residues in the water are expected to be below effects levels and confined to the approximate footprint of the *in-situ* burning area.	Unlikely as concentrations of burn residues in the water are expected to be below effects levels.

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species. [1] U.S. DPS; [2] Central and Southwest Atlantic DPS; [3] Carolina DPS; [4] South Atlantic DPS.

6.2.D. Corals

There are seven listed species of corals that could be affected by *in-situ* burning in the *Green Zone*. There is little to no information on the impacts to corals from exposure to *in-situ* burning and burn residues. Response actions have the potential to affect the early life stages of listed corals and live coral colonies should a preauthorized *in-situ* burning be used to address a surface slick in the area where spawning is occurring. It is important to recognize that the likelihood of exposure and effects to *in-situ* burning are life-stage specific and depend on their distribution patterns and habitat utilization.

6.2.D(1) Corals

Elkhorn coral, *Acropora palmata*, and designated critical habitat

Staghorn coral, *Acropora cervicornis*, and designated critical habitat

Rough cactus coral, *Mycetophyllia ferox*

Mountainous star coral, *Orbicella faveolta*

Lobed star coral, *Orbicella annularis*

Pillar coral, *Dendrogyra cylindrus*

<u>Boulder star coral</u>, *Orbicella franksi*

6.2.D(1)(a) Direct Effects

The range of the listed corals extends along the southernmost point of the Florida coast and may overlap with the *Green Zone* (Sections 3.1.D(1) through 3.1.D(7)). Early life stages of the listed coral species could come in contact with burn residues in the water column in the immediate area around *in-situ* burning operations. However, only a small fraction of the total treated oil (1-10%) is anticipated to remain in the water as burn residue (Section 2.2.D), suggesting that the likelihood of physical contact is small. Limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea, with little evidence of acute toxicity of burn residues to aquatic species. However, early life stages of coral may be more sensitive than species used in toxicity testing. Early life stages may not be able to avoid or move away from areas with burn residues, resulting in temporary exposures. Although sinking burn residues are only a small fraction of the total treated oil (1-10%), burn residue have the potential to foul coral colonies at the bottom of the water column. However, effects of *in-situ* burning to corals would be most likely confined to the approximate footprint of the treated area.

6.2.D(1)(b) Indirect Effects

Plankton serve as prey for these coral species. Limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea, with little evidence of acute toxicity of burn residues to aquatic species. Although unlikely, *in-situ* burning and burn residues may have minor impacts on prey of listed corals, but the impacted area is likely small relative to the potential distribution of prey. It is unlikely that the entire area where prey may be found would be impacted by *in-situ* burning.

6.2.D(1)(c) Critical Habitat

NMFS designated critical habitat for elkhorn and staghorn corals on (3.1.D(1)(a) through 3.1.D(1)(b)). The PCEs used by NMFS to define this critical habitat in nearshore and marine waters include: suitable and available substrate to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. However, since these designated critical habitats do not overlap the *Green Zone*, *in-situ* burning is unlikely to impact any PCEs. Furthermore, limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea. Consequently, effects of *in-situ* burning to PCEs for elkhorn and staghorn corals would be most likely confined to the outermost edge of the critical habitat (outside the *Green Zone*) and limited to a few hours post *in-situ* burning due to dilution in the offshore water column. In addition, best management practices during *in-situ* burning are in place to minimize impacts to critical habitats (Appendix IV).

6.2.D(1)(d) Summary

The direct and indirect effects from exposure to *in-situ* burning and burn residues on listed corals and designated critical habitat for elkhorn and Staghorn corals from *in-situ* burning in the *Green Zone* are summarized in Table 6-4. Note that specific studies on the potential direct effects of *in-*

situ burning and burn residues to listed corals are not available, and assessments are based on their behavior and distribution.

Table 6-4. Summary of the direct and indirect effects of the Proposed Federal Action to listed corals.

Listed Species Common Name, Scientific name	Direct Effects[a] In-situ burning and burn residues	Indirect Effects[b] In-situ burning and burn residue
Elkhorn coral, *Acropora palmate* **Staghorn coral, *Acropora cervicornis*** **Rough cactus coral, *Mycetophyllia ferox*** **Mountainous star coral, *Orbicella faveolta*** **Lobed star coral, *Orbicella annularis*** **Pillar coral, *Dendrogyra cylindrus*** **Boulder star coral, *Orbicella franksi***	Unlikely as concentrations of burn residues in the water are expected to be below effects levels and confined to the approximate footprint of the *in-situ* burning area. Fouling of coral colonies from sinking oil is possible, but likely impacting a small area.	Unlikely as concentrations of burn residues in the water are expected to be below effects levels.
Critical Habitat for elkhorn coral, *A. palmata* and Staghorn coral, *A. cervicornis*,	Unlikely to have impacts on PCEs.	None

[a] Likely direct effects would include exposure via ingestion (digestion), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species.

6.2.E. Seagrass

There is one seagrass listed that could be affected by *in-situ* burning in the *Green Zone*. There is little to no information on the impacts to *in-situ* burning and burn residues on Johnson's seagrass. Response actions have the potential to affect seagrasses should a preauthorized *in-situ* burning be used to address a surface slick in the area where the Johnson's seagrass occurs. It is important to recognize that the likelihood of exposure and effects to *in-situ* burning are life-stage specific, and depend on their distribution patterns and habitat utilization.

6.2.E(1) Seagrass

Johnson's seagrass, *Halophila johnsonii*, and designated critical habitat

6.2.E(1)(a) Direct Effects

The range of Johnson's seagrass extends along sections of the Southeast Florida coast and it is mostly limited to shallow waters (≤5 m depth) (Section 3.1.E(1)), thus it is likely outside the *Green Zone*. Deeper patches Johnson's seagrass could come in contact with burn residues in the water column and sinking burn residues in the immediate area around *in-situ* burning operations. Limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea, with little evidence of acute toxicity of burn residues to aquatic species. Although sinking burn residues are only a small fraction of the total treated oil (1-10%), burn residue have the potential to Johnson's seagrass beds at the bottom of the water column. However, effects of *in-situ* burning to Johnson's seagrass would be most likely confined to the approximate footprint of the treated area.

6.2.E(1)(b) Indirect Effects

Impacts to water quality that temporarily reduce light penetration in the water column could have minor impacts on photosynthetic efficiency. Limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea. These studies may serve as surrogates for the potential impacts of *in-situ* burning on water quality. However, it is expected that these impacts would be short lived and transitory.

6.2.E(1)(c) Summary

The direct and indirect effects from exposure to *in-situ* burning and burn residues on listed seagrass and designated critical habitat from *in-situ* burning in the *Green Zone* are summarized in Table 6-5. Note that specific studies on the potential direct effects of *in-situ* burning and burn residues to listed corals are not available, and assessments are based on their behavior and distribution.

Table 6-5. Summary of the direct and indirect effects of the Proposed Federal Action to listed seagrass.

Listed Species Common Name, Scientific name	Direct Effects[a] *In-situ* burning and burn residues	Indirect Effects[b] *In-situ* burning and burn residue
Johnson's seagrass, *Halophila johnsonii*	Unlikely as concentrations of burn residues in the water are expected to be below effects levels and confined to the approximate footprint of the *in-situ* burning area. Fouling of seagrass beds from sinking oil is possible, but likely impacting a small area.	Unlikely as concentrations of burn residues in the water are expected to be below effects levels.

[a] Likely direct effects would include exposure via dermal contact and absorption (skin); [b] Likely indirect effects would include effects on photosynthetic efficiency.

Section 6.3. Effects on Species and Designated Critical Habitat under the Jurisdiction of the U.S. Fish and Wildlife Service

There is one marine mammal listed that could be affected by *in-situ* burning in the *Green Zone*. Based on the information provided by the USFWS, there are no designated critical habitat in the *Green Zone*. Therefore discussions below focus only listed species.

6.3.A. Marine Mammals

There is one marine mammal listed that could be affected by *in-situ* burning in the *Green Zone*. There is little to no information on the impacts to marine mammals from exposure to *in-situ* burning and burn residues. Response actions have the potential to affect the West Indian manatee should a preauthorized *in-situ* burning be used to address a surface slick in the area where the West Indian manatee occurs. It is important to recognize that the likelihood of exposure and effects to *in-situ* burning are life-stage specific, and depend on their distribution patterns and habitat utilization.

West Indian Manatee, *Trichechus manatus*

6.3.A(1)(a) Direct Effects

The West Indies manatee is unlikely to be present in waters more than 3 nm off the coast (Section 3.2.A(1)) and thus would have a low likelihood of being exposed during *in-situ* burning, at the *in-situ* burning point or through a traveling combustion byproducts.

There is no documented information on the effects of *in-situ* burning on the West Indies manatee. Comparable to the effects from exposure to volatile compounds from oil, for West Indies manatee, inhalation of combustion products originating from a freshly burned oil slick at the surface may pose the greatest risk [89, 90]. However, given the dissipation of combustion byproducts as these are carried away by winds, it is unlikely that inhalation poses a risk to West Indies manatee. In addition, it is unlikely that burn residues would reach water masses occupied by this species.

6.3.A(1)(b) Indirect Effects

The West Indies manatee feeds on nearshore plants (hyacinths, hydrilla, seagrass, etc.). Only a small fraction of the total treated oil (1-10%) is anticipated to form burn residue (Section 2.2.D), suggesting that the physical contact of the nearshore benthic vegetation is unlikely. Consequently, it is unlikely that the prey species of the West Indies manatee would be adversely affected by burn residues from *in-situ* burning in the *Green Zone*.

6.3.A(1)(c) Summary

The direct and indirect effects from exposure to *in-situ* burning and burn residues on West Indies manatee from *in-situ* burning in the *Green Zone* are summarized in Table 6-6. Note that specific studies on the potential direct effects of *in-situ* burning and burn residues to this species are not available, and assessments are based on their behavior and distribution.

Table 6-6. Summary of the direct and indirect effects of the Proposed Federal Action to listed marine mammals.

Listed Species Common Name, Scientific name	Direct Effects[a] *In-situ* burning and burn residues	Indirect Effects[b] *In-situ* burning and burn residue
West Indian Manatee, *Trichechus manatus*	Unlikely exposure to combustion products. Unlikely that burn residues would reach water masses occupied by this species located inland of the *Green Zone*.	None

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species.

6.3.B. Anadromous Fish

There one listed species of anadromous fish that could be affected by *in-situ* burning in the *Green Zone*. There is little to no information on the impacts to fish from exposure to *in-situ* burning and burn residues. It is important to recognize that the likelihood of exposure and effects to *in-situ* burning depends on the distribution patterns and movements and habitat utilization of this species.

6.3.B(1) Marine and anadromous fish

Gulf sturgeon, *Acipenser oxyrinchus desotoi*

6.3.B(1)(a) Direct Effects

The range of the Gulf sturgeon extends along the entire Gulf of Mexico coast (Section 3.2.B(1)) and may overlap the *Green Zone*. Adult sturgeon could come in contact with burn residues in the water column in the immediate area around *in-situ* burning operations. Limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea, with little evidence of acute toxicity of burn residues to aquatic species. Adult fish in the open water of the *Green Zone* are mobile and able to avoid or move away from *in-situ* burning operations, resulting in temporary exposures at most. Consequently, effects of *in-situ* burning to the Gulf sturgeon would be most likely confined to the approximate footprint of the treated area and limited to a few hours post *in-situ* burning.

6.3.B(1)(b) Indirect Effects

The Gulf sturgeon is a benthic feeder and its prey are unlikely to be affected by *in-situ* burning and burn residues (see Section 2.2.D). Although burn residues may sink, only a small fraction of the total treated oil (1-10%) is anticipated to form burn residue (Section 2.2.D), suggesting that the likelihood of physical contact of the benthos is small. In addition, impacts are likely limited to a small area relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by *in-situ* burning.

6.3.B(1)(c) Summary

The direct and indirect effects from exposure to *in-situ* burning and burn residues on the Gulf sturgeon from *in-situ* burning in the *Green Zone* are summarized in Table 6-7. Note that specific studies on the potential direct effects of *in-situ* burning and burn residues to the Gulf sturgeon are not available, and assessments are based on their behavior and distribution.

Table 6-7. Summary of the direct and indirect effects of the Proposed Federal Action to listed fish.

Listed Species Common Name, Scientific name	Direct Effects[a] *In-situ* burning and burn residues	Indirect Effects[b] *In-situ* burning and burn residue
Gulf sturgeon, *Acipenser oxyrinchus desotoi*	Unlikely as concentrations of burn residues in the water are expected to be below effects levels and confined to the approximate footprint of the *in-situ* burning area.	Unlikely as concentrations of burn residues in the water are expected to be below effects levels.

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species.

6.3.C. Birds

There are two listed bird species that could be affected by *in-situ* burning in the *Green Zone*. There is little to no information on the impacts to birds from exposure to *in-situ* burning and burn residues. Best management practices during *in-situ* burning are in place to ensure that birds spotted at or near the water surface are not accidentally burned during these operations (Appendix IV). It is important to recognize that the likelihood of exposure and effects to *in-situ* burning are species specific, and depend on their distribution patterns and movements, habitat utilization, feeding behavior, and degree of slick/sheen avoidance. For a direct exposure to burn residues to occur, listed birds would have to be present in the same location of *in-situ* burn operations.

Red Knot, *Calidris canutus rufa*

Roseate tern, *Sterna dougalli*

6.3.C(1)(a) Direct Effects

The red knot does not use the offshore marine environment to any degree, relying primarily on coastal environments (Section 3.2.C(1)).

The roseate tern could occur on occasion as far offshore as the *Green Zone*, but this is uncommon as their foraging area concentrates in areas less than 2.1 mi (7 km) from shore, at water depths less than 16.5 ft. (5 m), and in shallow bays, tidal inlets and channels, tide-rips and sandbars (Section 3.2.C(2)). Birds may transit during their migration period over the *Green Zone* and could be directly exposed to combustion byproducts in the event of *in-situ* burning operations in this area, though the risk is likely minimal. The red knot feeds inland of the *Green Zone* and is not likely to be exposed to burn residues in the water column.

6.3.C(1)(b) Indirect Effects

The red knot feeds on small clams, mussels, snails, and other invertebrates found in wet sand of the intertidal zone and beaches. Prey found on these areas are unlikely to be exposed to burn residues. Limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea, with little evidence of acute toxicity of burn residues to aquatic species. In addition, only a small fraction of the total treated oil (1-10%) is anticipated to form burn residue (Section 2.2.D), suggesting that the physical contact of the nearshore benthic habitats is unlikely. Consequently, it is unlikely that the red knot would be indirectly affected by *in-situ* burning in the *Green Zone*.

The roseate tern feeds on small schooling marine fish in shallow waters. Prey found on these areas are unlikely to be exposed to burn residues. Limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea, with little evidence of acute toxicity of burn residues to aquatic species. Furthermore, as discussed in Section 2.2, most aquatic organisms, and particularly fish, are able to metabolize and excrete oil-related compounds indicating little risk for their bioaccumulation and biomagnification. Consequently, it is unlikely that roseate terns would be indirectly affected by in-situ burning and burn residues from in-situ burning in *Green Zone*.

6.3.C(1)(c) Summary

The direct and indirect effects from exposure to *in-situ* burning combustion byproducts and burn residues on the red knot and the roseate tern from *in-situ* burning in the *Green Zone* are summarized in Table 6-8. Note that specific studies on the potential direct effects of *in-situ* burning and burn residues to the red knot and the roseate tern are not available, and assessments are based on their behavior and distribution.

Table 6-8. Summary of the direct and indirect effects of the Proposed Federal Action to listed birds.

Listed Species Common Name, Scientific name	Direct Effects[a] *In-situ* burning and burn residues	Indirect Effects[b] *In-situ* burning and burn residue
Red Knot, *Calidris canutus rufa*	Unlikely exposure to burn residues and combustion byproducts during migration. Unlikely that burn residues would reach water masses occupied by this species.	None
Roseate tern, *Sterna dougalli*	Unlikely exposure to burn residues and combustion byproducts during migration. Unlikely that burn residues would reach water masses occupied by this species.	None

[a] Likely direct effects would include exposure via ingestion (digestion), inhalation (respiratory), dermal contact and absorption (skin); [b] Likely indirect effects would include effects on the primary prey species.

Section 6.4. Essential Fish Habitat

Under the Magnuson-Stevens Fishery Conservation and Management Act, consultations with NMFS are required on Federal Actions that may result in adverse effects to Essential Fish Habitat (EFH). As stated in Chapter 4, EFH in the South Atlantic region is managed by the South Atlantic Fisheries Management Council (SAFMC), while EFH in the Gulf of Mexico is managed by the Gulf of Mexico Fishery Management Council (GMFMC). Evaluations on the potential effects of *in-situ* burning within the *Green Zone* to each EFH by Management Council are described here, noting that best management practices during *in-situ* burning are in place to minimize impacts to EFH (Appendix IV). For the purpose of this *Biological Assessment* direct and indirect effects from *in-situ* burning and burn residues are determined based on appropriate scientific information. Due to their spatial distribution and distribution within the water column, all EFH by Management Council are discussed concurrently, but determinations are made on individual EFHs. Only EFH known to be present within the *Green Zone* are included in the following sections.

6.4.A. Essential Fish Habitat Managed by the South Atlantic Fishery Management Council

6.4.A(1) Direct Effects

Although based on limited information, the known impacts from exposure to *in-situ* burning and burn residues are generally reported based on impacts to species (Section 2.2.D), and not commonly on habitats or ecosystems. While there may be concerns on the impacts to water quality from increase contaminant loading with *in-situ* burning, limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons under unburned and burned crude oil slicks in the open sea. Although unlikely, the EFH managed by the SAFMC that may be more likely to experience temporary impacts on water quality is the water column

EFH. There may also be concerns regarding fouling of benthic habitats. However, only a small fraction of the total treated oil (1-10%) is anticipated to remain in the water as burn residue and sink (Section 2.2.D), suggesting that the likelihood of physical contact of the benthic habitats is small. As a result, EFH managed by the SAFMC that may be more likely to experience impacts from sinking oil residues include Coral Reefs and Coral Communities, Live/Hard Bottom, Marine Soft Bottom, Seagrasses, Oyster Reefs, Artificial Reefs, and some Habitats of Particular Concern (i.e., coral, coral reef and live/hard bottom) located within the *Green Zone*. However, impacts are likely limited to the immediate footprint of burning operations likely comprising a small fraction of the entire EFH. EFH in deeper waters or mostly concentrated in nearshore environments, and in some instances outside the *Green Zone* (i.e., Coral Reefs and Coral Communities, Deepwater Coral, Live/Hard Bottom, Marine Soft Bottom, Seagrasses, Oyster Reefs, Artificial Reefs, as well as most Habitats of Particular Concern [i.e., shrimp, red drum, snapper grouper complex, spiny lobster, coastal migratory pelagics, coral, coral reef and live/hard bottom, dolphin wahoo, *Oculina* bank]) may not be directly exposed to *in-situ* burning and burn residues. EFH that may overlap physically with offshore oil spills (i.e., *Sargassum*) and potentially impacted by *in-situ* burning would likely comprise a small fraction of the entire EFH. In addition, it is unlikely that *in-situ* burning would occur in areas with large aggregations of *Sargassum*. One of the primary direct impacts of oil spills on vegetated habitats (see Section 2.1.G(4)(f)) is smothering of plant surfaces causing suffocation, with sublethal impacts ranging from alteration of enzyme systems, reduced photosynthesis and respiration, among others. Consequently any direct effects from *in-situ* burning and burn residues on EFH managed by the SAFMC are anticipated to be minor, short-lived, and transitory, and likely limited to a relatively small fraction of each EFH.

6.4.A(2) Indirect Effects

There are no known indirect effects of *in-situ* burning and burn residues on EFH managed by the SAFMC.

6.4.A(3) Summary

The direct and indirect effects from exposure to *in-situ* burning and burn residues on EFH managed by the SAFMC from *in-situ* burning in the *Green Zone* are summarized in Table 6-9. Note that specific studies on the potential direct effects of *in-situ* burning and burn residues to specific EFHs are not available, and assessments are based on their distribution.

Table 6-9. Summary of the direct and indirect effects of the Proposed Federal Action to EFH managed by the SAFMC.

Listed Species Common Name, Scientific name	Direct Effects[a] *In-situ* burning and burn residues	Indirect Effects[b] *In-situ* burning and burn residue
Water Column	Unlikely as the concentration of burn residues are not high enough to impact water quality. Any, impacts are likely limited to a small fraction of the entire EFH.	None
Coral Reefs and Coral Communities, Deepwater Coral, Live/Hard Bottom, Marine Soft Bottom, Seagrasses, Oyster Reefs, Artificial Reefs	Physical contact of EFH within the *Green Zone* with sinking burn residues is possible, but any impacts are likely limited to a small fraction of the entire EFH.	None
Sargassum	Unlikely to be directly impacted by *in-situ* burning operations. Any impacts are likely limited to a small fraction of the entire EFH.	None
Habitat Areas of Particular Concern	Physical contact of EFH within the *Green Zone* with sinking burn residues is possible, but any impacts are likely limited to a small fraction of the entire EFH.	None

[a] Likely direct effects would include exposure via physical contact; [b] None known.

6.4.B. Essential Fish Habitat Managed by the Gulf of Mexico Fishery Management Council

6.4.B(1) Direct Effects

The known impacts from exposure to *in-situ* burning and burn residues are generally reported based on impacts to species (Section 2.2.D), and not commonly on habitats or ecosystems. While there may be concerns on the impacts to water quality from increase contaminant loading with *in-situ* burning limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons under unburned and burned crude oil slicks in the open sea. As a result EFH managed by the GMFMC that may be more likely to experience temporary impacts on water quality is the Pelagic (water column) EFH. There may also be concerns regarding fouling of benthic habitats. However, only a small fraction of the total treated oil (1-10%) is anticipated to remain in the water as burn residue and sink (Section 2.2.D), suggesting that the likelihood of physical contact of the benthic habitats is small.

As a result, EFH managed by the GMFMC that may be more likely to experience impacts from sinking oil residues include Coral Reefs, Submerged Aquatic Vegetation (including seagrasses and benthic algae), Hard Bottom, Soft Bottom, as well Habitats of Particular Concern located within the *Green Zone*. However, impacts are likely limited to the immediate footprint of burning operations and likely comprising a small fraction of the entire EFH. EFH in deeper waters or mostly concentrated in nearshore environments, and in some instances outside the *Green Zone* (i.e., Shelf Edge/Slope, Coral Reefs, Submerged Aquatic Vegetation [including seagrasses and benthic algae], Hard Bottom, Soft Bottom, Oyster Reefs, as well Habitats of Particular Concern) may not be directly exposed to *in-situ* burning and burn residues. EFH that may overlap physically with offshore oil spills (i.e., *Sargassum*) and potentially impacted by *in-situ* burning would likely comprise a small fraction of the entire EFH. In addition, it is unlikely that *in-situ* burning would occur in areas with large aggregations of *Sargassum*. One of the primary direct impacts of oil spills on vegetated habitats (see Section 2.1.G(4)(f)) is smothering of plant surfaces causing suffocation, with sublethal impacts ranging from alteration of enzyme systems, reduced photosynthesis and respiration, among others. Consequently any direct effects from *in-situ* burning and burn residues on EFH managed by the GMFMC are anticipated to be minor, short-lived and transitory, and likely limited to a relatively small fraction of the each EFH.

6.4.B(2) Indirect Effects

There are no known indirect effects of *in-situ* burning and burn residues on EFH managed by the GMFMC.

6.4.B(3) Summary

The direct and indirect effects from exposure to *in-situ* burning and burn residues on EFH managed by the GMFMC from *in-situ* burning in the *Green Zone* are summarized in Table 6-10. Note that specific studies on the potential direct effects of *in-situ* burning and burn residues to specific EFHs are not available, and assessments are based on their distribution.

Table 6-10. Summary of the direct and indirect effects of the Proposed Federal Action to EFH managed by the GMFMC.

Listed Species Common Name, Scientific name	Direct Effects[a] *In-situ* burning and burn residues	Indirect Effects[b] *In-situ* burning and burn residue
Pelagic (Water Column)	Unlikely as the concentration of burn residues are not high enough to impact water quality. Any, impacts are likely limited to a small fraction of the entire EFH.	None
Shelf Edge/Slope Coral Reefs, Submerged Aquatic Vegetation (including seagrasses and benthic algae) Hard Bottom, Soft Bottom, Oyster Reefs	Physical contact of EFH within the *Green Zone* with sinking burn residues is possible, but any impacts are likely limited to a small fraction of the entire EFH.	None
Drift Algae (*Sargassum*, pelagic *Sargassum* community)	Unlikely to be directly impacted by *in-situ* burning operations. Any impacts are likely limited to a small fraction of the entire EFH.	None

Habitat Areas of Particular Concern	Physical contact of EFH within the *Green Zone* with sinking burn residues is possible, but any impacts are likely limited to a small fraction of the entire EFH.	None

[a] Likely direct effects would include exposure via physical contact; [b] None known.

6.4.C. Essential Fish Habitats and Habitats of Particular Concern under the management of the National Marine Fisheries Service

6.4.C(1) Direct Effects

The known impacts from exposure to *in-situ* burning and burn residues are generally reported based on impacts to species (Section 2.2.D), and not commonly on habitats or ecosystems. While there may be concerns on the impacts to water quality from increase contaminant loading with *in-situ* burning limited studies (see Section 2.2.D) have documented comparable concentrations of petroleum hydrocarbons between unburned and burned crude oil slicks in the open sea. As a result EFH-HAPC managed by the NMFS may experience temporary impacts on water quality, but these would be short in nature (Section 2.2.D) and unlikely to have long-lasting negative impacts. There may also be concerns regarding fouling of benthic habitats. Consequently any direct effects from *in-situ* burning and burn residues on EFH-HAPC managed by the NMFS are anticipated to be minor, short-lived and transitory, and likely limited to a relatively small fraction of the EFH-HAPC.

6.4.C(2) Indirect Effects

There are no know indirect effects of *in-situ* burning and burn residues on EFH-HAPC managed by the NMFS.

6.4.C(3) Summary

The direct and indirect effects from exposure to *in-situ* burning and burn residues on EFH-HAPC managed by the NMFS from *in-situ* burning in the *Green Zone* are summarized in Table 6-11. Note that specific studies on the potential direct effects of *in-situ* burning and burn residues to specific EFH-HAPCs are not available, and assessments are based on their distribution.

Table 6-11. Summary of the direct and indirect effects of the Proposed Federal Action to EFH-HAPC managed by the NMFS.

Listed Species Common Name, Scientific name	Direct Effects[a] *In-situ* burning and burn residues	Indirect Effects[b] *In-situ* burning and burn residue
Habitat Areas of Particular Concern	Physical contact of EFH-HAPC within the *Green Zone* with sinking burn residues is possible, but any impacts are likely limited to a small fraction of the entire EFH-HAPC.	None

[a] Likely direct effects would include exposure via physical contact; [b] None known.

Section 6.5. Cumulative Effects

Cumulative effects under the ESA are defined in 50 CFR 402.02 as effects that are reasonably certain to occur in the *Green Zone* as a result of future state, tribal, local or private actions, not involving Federal activities. For the purpose of this *Biological Assessment*, only non-federal activities that are reasonably certain to occur in the foreseeable future are included in this section. Future Federal Actions that are unrelated to the proposed action are not considered in this section because they require separate consultations pursuant to Section 7 of the ESA. Non-federal actions that are reasonably that are reasonably certain to occur in the foreseeable future include those discussed in Chapter 4. In addition, global trends that are expected to contribute to cumulative effects on species, critical habitat and EFH within the *Green Zone* include global climate change, marine debris, invasive species (see Chapter 4), and other processes that directly or indirectly affect food availability, induce shifts in species distribution, or cause direct impacts on species and habitats. The potential impacts arising from these activities were discussed in 5.4.C. Relevant sections applicable to this section of the *Biological Assessment* include: changes in food availability (Section 5.5.A), water and environmental quality (Section 5.5.B), behavioral and physical disturbance (Section 5.5.C), and direct impacts (Section 5.5.D).

6.5.A. Cumulative Effects on Species, Critical Habitats, and Essential Fish Habitat

6.5.A(1) Cumulative Effects on Marine Mammals

Marine mammals continue to be negatively impacted by ship strikes, entanglement with fishing gear, marine debris, increase noise in the marine environment, changes in prey availability, and impacts from changes in environmental quality, among other threats. In-situ burning operations may result in the exposure of marine mammals to burn residues. This could cumulatively add stressors to the current threats on listed and proposed marine mammal species discussed in this *Biological Assessment*. However, the localized use of *in-situ* burning to treat offshore oil spills is anticipated to have minimal and temporary effects on marine mammals. In addition, and similar to the use of dispersants, *in-situ* burning is expected to reduce direct effects of oil spills on marine mammals (e.g., [15, 265, 323, 324], and therefore, the *in-situ* burning operations would not contribute to the cumulative effects on marine mammals in the region.

The PCEs used by NMFS to define the critical habitat of the North Atlantic right whale is the local habitat features (i.e., proximity to shore, water depth and temperature, calm surface conditions, protection from wave action during calving, and other essential calving features). Exposure to *in-situ* burning and burn residues could cumulatively add stressors to the PCEs. However, due to the localized use of *in-situ* burning to treat offshore oil spills, these effects are anticipated to be discountable and insignificant for the critical habitat.

6.5.A(2) Cumulative Effects on Sea Turtles

Sea turtles continue to be negatively impacted by illegal harvesting of eggs from nesting grounds, degradation and loss of nesting habitat, illegal harvesting of adults, entanglement with fishing gear and marine debris, vessel strikes, and incidental capture by fisheries, among other threats. In-situ burning operations may result in the exposure of sea turtles to burn residues. This could cumulatively add stressors to the current threats on listed sea turtles discussed in this *Biological Assessment*. However, the localized use of *in-situ* burning to treat offshore oil spills is anticipated to have minimal and temporary effects on sea turtles. In addition, and similar to the use of dispersants, *in-situ* burning is expected to reduce direct effects of oil spills on sea turtles and their nesting beaches (e.g., [15, 265, 323, 324], and therefore, the *in-situ* burning operations would not contribute to the cumulative effects on sea turtles in the region.

The PCEs used by NMFS to define the five critical habitats of the loggerhead sea turtle is the local habitat features (i.e., access, transit, egression, waters free of obstructions, proximity to shore, water depth and temperature). Exposure to *in-situ* burning and burn residues could cumulatively add stressors to the PCEs, but these effects are anticipated to be discountable and insignificant for the critical habitat. The only PCE that is directly related to prey (i.e., support adequate prey abundance and cover) applies to *Sargassum* as a critical habitat. Exposure to *in-situ* burning and burn residues could cumulatively add stressors to this PCE, although it is unlikely that *in-situ* burning would occur in areas with large aggregations of *Sargassum*. In addition, and similar to the use of dispersants, *in-situ* burning is expected to reduce direct effects of oil spills on organisms founds on the water surface (e.g., [15], including *Sargassum*. Furthermore, due to the localized use of *in-situ* burning to treat offshore oil spills, these effects are anticipated to be discountable and insignificant for *Sargassum*.

6.5.A(3) Cumulative Effects on Marine and Anadromous Fish

Marine and anadromous fish continue to be negatively impacted by bycatch in fisheries, historical overfishing and illegal harvesting, degradation and loss of rearing habitat, and shifts in habitat resulting from climate change, among other threats. In-situ burning may result in the exposure of marine and anadromous fish to burn residues. This could cumulatively add stressors to the current threats on listed and proposed marine and anadromous fish species discussed in this *Biological Assessment*. However, the localized use of *in-situ* burning to treat offshore oil spills is anticipated to have minimal and temporary effects on marine and anadromous fish. Therefore, the preauthorized use of burn residues would not contribute to the cumulative effects on marine and anadromous fish in the region.

The PCEs used by NMFS to define the critical habitat of the smalltooth sawfish and the Gulf sturgeon include: a migratory corridor between estuarine and marine habitats, water quality ensuring adequate dissolved oxygen levels and low levels of contaminants, and food resources for sub-adults and adults (e.g., benthic invertebrates and fish). However, since these designated critical habitats do not overlap the *Green Zone*, *in-situ* burning is unlikely to impact any PCEs. Any exposures burn residues could cumulatively add stressors to the PCEs. However, due to the localized used of burn residues to treat offshore oil spills, these effects are anticipated to be discountable and insignificant for the critical habitat.

6.5.A(4) Cumulative Effects on Corals

Corals continue to be negatively impacted by habitat degradation and loss, eutrophication and sedimentation, bleaching, diseases, physical damage from natural and anthropogenic sources, and ocean acidification, among other threats. In-situ burning may result in the exposure of corals to burn residues. This could cumulatively add stressors to the current threats on listed and proposed corals species discussed in this *Biological Assessment*. However, localized *in-situ* burning to treat offshore oil spills is anticipated to have minimal and temporary effects on corals. In addition, and similar to the use of dispersants, *in-situ* burning is expected to reduce direct effects of oil spills on corals (e.g., [54, 324]), and therefore, the preauthorized use of *in-situ* burning would not contribute to the cumulative effects on corals in the region.

The PCEs used by NMFS to define the critical habitat of elkhorn and staghorn corals include suitable and available substrate to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. However, since these designated critical habitats do not overlap the *Green Zone*, *in-situ* burning is unlikely to impact any PCEs. Any exposures to burn residues could cumulatively add stressors to the PCEs. However, due localized *in-situ* burning to treat offshore oil spills, these effects are anticipated to be discountable and insignificant for the critical habitat.

6.5.A(5) Cumulative Effects on Seagrass

Johnson's seagrass continue to be negatively impacted by habitat degradation and loss, eutrophication, and sedimentation, among other threats. In-situ burning may result in the exposure of corals to residues. This could cumulatively add stressors to the current threats on Johnson's seagrass. However, localized *in-situ* burning to treat offshore oil spills is anticipated to have minimal and temporary effects on Johnson's seagrass. In addition, and similar to the use of dispersants, *in-situ* burning is expected to reduce direct effects of oil spills on shallow water and nearshore habitats (e.g., [15, 265, 323, 324] including Johnson's seagrass, and therefore, localized *in-situ* burning would not contribute to the cumulative effects on Johnson's seagrass in the region.

The PCEs used by NOAA to define the critical habitat of Johnson's seagrass include water quality, salinity levels, water transparency, and stable, unconsolidated sediments that are free from physical disturbance. However, since the designated critical habitat does not overlap the *Green Zone*, *in-situ* burning is unlikely to impact any PCEs. Any exposures to burn residues could cumulatively add stressors to the PCEs. However, localized *in-situ* burning to treat offshore oil spills, these effects are anticipated to be discountable and insignificant for the critical habitat.

6.5.A(6) Cumulative Effects on Birds

The red knot continues to be negatively impacted by loss of nesting habitat (outside of the U.S.), human disturbances, coastal development of beaches and other nearshore habitats, predation, and reduced food sources, among other threats. Similarly, the roseate tern continues to be threaded by human disturbance of nesting habitats, habitat degradation, among other threats. In addition, and similar to the use of dispersants, *in-situ* burning to treat oil spills in offshore waters is expected to reduce the amount of oil that may strand on intertidal habitats and shoreline habitats (e.g., [15, 265, 323, 324] where these species overwinters and feeds, *in-situ* burning will not contribute to the cumulative effects on the red knot and roseate tern in the region.

6.5.A(7) Cumulative Effects on Essential Fish Habitat and Essential Fish Habitat-Habitat Areas of Particular Concern

Essential Fish Habitat (EFH) and Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPC) continues to be negatively impacted by habitat degradation and loss (i.e., inadequate fishing practices, localized pollution, reduced water quality). In-situ burning may result in the exposure of some EFHs and EFH-HAPCs to burn residues. This could cumulatively add stressors to the current threats on EFH and EFH-HAPC discussed in this *Biological Assessment*. However, localized *in-situ* burning to treat offshore oil spills is anticipated to have minimal and temporary effects on EFH and EFH-HAPC. In addition, *in-situ* burning is expected to reduce direct effects of oil spills on EFH and EFH-HAPC, and therefore, *in-situ* burning would not contribute to the cumulative effects on EFH and EFH-HAPC in the region.

Section 6.6. Determination of Action

This section presents the summary of the determinations of adverse effects on ESA-listed species and designated critical habitat, and EFH from implementation of *in-situ* burning during an oil spill in offshore waters. Final determinations were based on:

1. A synthesis of limited toxicological and effects information of *in-situ* burning and burn residues on closely related animal groups (Section 2.2.D);
2. Species-specific information of their presence and potential geographic distribution in relation to the *Green Zone* (Chapter 4);
3. Assessments on the likelihood of potential direct and indirect effects based on relevant information (1 and 2 above) (Section 6.1), and driven by information on:
4. The potential temporal and spatial overlap between species, designated critical habitat and EFH, and *in-situ* burn operations, and based on limited information from previous field studies (Section 2.2.D);
5. An understanding of potential mitigation strategies that are in place to minimize impacts to wildlife, especially threatened and endangered species, listed critical habitats, and EFH (Appendix IV).
6. Effects determinations are summarized in Table 6-11, Table 6-12, Table 6-13 and Table 6-14, with determinations further specified by RRTIV's Areas of Operation.

6.6.A. Determination of the Proposed Federal Action on Species and Designated Critical Habitat under the Jurisdiction of the National Marine Fisheries Service

6.6.A(1) Marine Mammals

6.6.A(1)(a) Toothed whales

Sperm whale, *Physeter macrocephalus*

The action may affect, but is not likely to adversely affect (directly or indirectly), sperm whales.

The distribution range of sperm whales overlaps the *Green Zone*; therefore, this species could be exposed to combustion byproducts and burn residues. Sperm whales exposed combustion products in the water column or at the surface might experience irritation of the eyes and mucous membranes. All of these effects would be transitory and spatially limited. Furthermore, because of their prey types and foraging strategy, sperm whales are not likely to directly ingest burn residues during feeding. Burn residues in the water column is not likely to adversely affect the food supply of sperm whales as they feed at depth or on mobile prey. In addition, their preferred prey (fish) are able to metabolize and excrete hydrocarbons leading only to a small risk for oil bioaccumulation and biomagnification (discussed in Section 2.1.G(4)(g)). In addition, *in-situ* burning at the water surface could reduce the adverse effects of oil spills by reducing exposure to toxic volatile fractions [104, 105], and by reducing dermal exposure to whole oil [15, 265, 323, 324]. Any effects would be transitory and spatially limited. Thus it is not likely that *in-situ* burning in the *Green Zone* would adversely affect these species.

6.6.A(1)(b) Baleen whales

North Atlantic right whale, *Eubalaena glacialis*, and designated critical habitat

Humpback whale, *Megaptera novaeangliae*

Fin whale, *Balaenoptera physalus*

Sei whale, *Balaenoptera borealis*

Brydes whale, *Balaenoptera adeni*

The action may affect, but is not likely to adversely affect (directly or indirectly), baleen whales listed above, including North Atlantic right whale designated critical habitat.

The distribution range of baleen whales overlaps the *Green Zone*; therefore, this species could be exposed to combustion byproducts and burn residues. Baleen whales exposed combustion products in the water column or at the surface might experience irritation of the eyes and mucous membranes and fouling of the baleen plates. All of these effects would be transitory and spatially limited. It is not likely that baleen whales could ingest enough burn residues in the water column to cause deleterious effects (discussed in Section 2.2.D). Although unlikely, effects of burn residues to prey of baleen whales would be most likely confined to the footprint of the treated area and limited to a few hours post *in-situ* burning operations. In addition, many of their prey (e.g., small fish) are able to metabolize and excrete hydrocarbons leading to only a small risk of bioaccumulation and biomagnification (discussed in Section 2.1.G(4)(g)). Furthermore, *in-situ* burning at the water surface could reduce the adverse effects of oil spills by reducing exposure to toxic volatile fractions [104, 105], and by reducing dermal exposure to whole oil [15, 265, 323, 324]. Thus it is not likely that *in-situ* burning in the *Green Zone* would adversely affect these species.

It is unlikely that the entire critical habitat of the North Atlantic right whale within the *Green Zone* would be impacted by *in-situ* burning. Thus it is not likely that *in-situ* burning in the *Green Zone* would adversely affect the critical habitat of the North Atlantic right whale.

6.6.A(2) Sea Turtles

Kemp's ridley sea turtle, *Lepidochelys kempii*

Green sea turtle, *Chelonia mydas*

Loggerhead sea turtle, *Caretta caretta*, and designated critical habitat

Leatherback sea turtle, *Dermochelys coriacea*

Hawksbill sea turtle, *Eretmochelys imbricate*

The action may affect, but is not likely to adversely affect (directly or indirectly), sea turtles listed above, including loggerhead sea turtle designated critical habitat.

With the exception of Kemp's ridley sea turtles, nesting of all other species of sea turtles occurs along the coast bordering the *Green Zone*; therefore, burn residues pose threats to newly hatched turtles. In-situ burning could reduce the adverse effects of oil spills that originate outside nesting areas by reducing the volume and extent of spilled oil entering this habitat (e.g., [265]), and by reducing impacts associated with nearshore oil spill response efforts. Sea turtles encountering combustion products generated through *in-situ* burning operations might experience irritation of eyes and mucous membranes, but any effects are likely to be temporary (discussed in Section 2.2.D). Kemp's ridley, green, loggerhead and hawksbill sea turtles feed primarily on benthic prey that are not likely to be impacted to a great degree by sinking burn residues. While *in-situ* burning and burn residues in the *Green Zone* may have minor impacts on prey of leatherback sea turtles, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by *in-situ* burning. Furthermore, *in-situ* burning at the water surface could reduce the adverse effects of oil spills by reducing exposure to toxic volatile fractions [104, 105], and by reducing dermal exposure to whole oil (e.g., [15, 265, 323, 324], and possible ingestion of tar balls. Thus, owing in large part to their widespread distribution, it is not likely that *in-situ* burning in the *Green Zone* would adversely affect any of the listed sea turtle species.

As discussed previously, the effects of *in-situ* burning and burn residues to prey of loggerhead sea turtles associated with *Sargassum* would be most likely confined to the approximate footprint of the treated area, although it is unlikely that *in-situ* burning would occur in areas with large aggregations of *Sargassum*. Thus, it is not likely that *in-situ* burning in the *Green Zone* would adversely affect the critical habitat of the loggerhead sea turtle.

6.6.A(3) Marine and Anadromous Fish

Smalltooth sawfish (U.S. DPS), *Pristis pectinate*, and designated critical habitat

Gulf sturgeon, *Acipenser oxyrinchus desotoi*, and designated critical habitat

Scalloped hammerhead (Central and Southwest Atlantic DPS), *Sphyrna lewini*

Atlantic sturgeon (South Atlantic DPS), *Acipenser oxyrinchus oxyrinchus*

Atlantic sturgeon (Carolina DPS), *Acipenser oxyrinchus oxyrinchus*

Shortnose sturgeon, *Acipenser brevirostrum*

Nassau grouper, *Epinephelus striatus*

The action may affect, but is not likely to adversely affect (directly or indirectly), marine and anadromous fishes listed above, including smalltooth sawfish and Gulf sturgeon designated critical habitat.

The distribution range of all listed anadromous and marine fish species overlaps the *Green Zone*; therefore, these species could be exposed to burn residues. However, effects would most likely be confined to the approximate footprint of the treated area and limited to a few hours post *in-situ* burning. The preferred prey of the scalloped hammerhead shark (fish, cephalopods, crustaceans, and rays) are able to metabolize and excrete hydrocarbon compounds indicating little risk for their bioaccumulation and biomagnification (discussed in Section 2.1.G(4)(g)). The preferred prey of all other species is primary benthic fauna, which are not likely to be affected by sinking burn residues generated through *in-situ* burning operations in the *Green Zone*. In addition, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by *in-situ* burning. Thus, it is not likely that *in-situ* burning in the *Green Zone* would adversely affect any of the listed anadromous and marine fish species.

6.6.A(4) Corals

Elkhorn coral, *Acropora palmata*, and designated critical habitat

Staghorn coral, *Acropora cervicornis*, and designated critical habitat

Rough cactus coral, *Mycetophyllia ferox*

Mountainous star coral, *Orbicella faveolta*

Lobed star coral, *Orbicella annularis*

Pillar coral, *Dendrogyra cylindrus*

Boulder star coral, *Orbicella franksi*

The action may affect, but is not likely to adversely affect (directly or indirectly), corals listed above, including Elkhorn and Staghorn coral designated critical habitat.

The distribution range of all coral species overlaps the *Green Zone*; therefore, these species could be exposed to burn residues. However, since most of these species are found in nearshore shallow waters, only early life stages (larvae and eggs) entrained within the top few meters of the water column, within the approximate footprint of the treated slick, could be exposed to burn residues. Based on limited laboratory toxicity tests there is little evidence of acute toxicity of burn residues to aquatic species (Section 2.2.D). In addition, there is little risk of effects from exposure to burn residues in nearshore waters. Corals could also be affected by sinking burn residue with the potential of fouling living coral colonies, but given that only a small fraction of the total treated oil may sink, physical fouling may be limited. Similarly, prey of corals are not likely to be adversely impacted as there is little evidence of acute toxicity of burn residues to aquatic species. In addition, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by *in-situ* burning. Consequently, effects of *in-situ* burning to corals would be most likely confined to the approximate footprint of the treated area. In addition, *in-situ* burning could reduce the volume and extent of spilled oil entering shallow water habitats (e.g., [15, 265, 323, 324]). Thus, it is not likely that *in-situ* burning in the *Green Zone* would adversely affect any of the listed coral species.

Critical habitat for elkhorn and staghorn coral does not overlap the *Green Zone*. Consequently, any effects of *in-situ* burning to PCEs would be most likely confined to the outermost edge of the critical habitat (outside the *Green Zone*), and limited to a few hours post *in-situ* burning due to dilution in the offshore water column. In addition, *in-situ* burning could reduce the volume and extent of spilled oil entering this critical habitat (e.g., [15, 265, 323, 324]). Thus, it is not likely that *in-situ* burning in the *Green Zone* would adversely affect the critical habitat of Elkhorn and Staghorn corals.

6.6.A(5) Seagrass

Johnson's seagrass, *Halophila johnsonii*, and designated critical habitat

The action may affect, but is not likely to adversely affect (directly or indirectly), Johnson's seagrass, including its designated critical habitat.

The distribution range of Johnson's seagrass does not substantially overlap the *Green Zone*. Since most of this species is found in nearshore shallow waters, exposures are only likely within the approximate footprint of the treated slick. In addition, there is little risk of effects from exposure to burn residues in nearshore waters. Furthermore, any indirect impacts on water quality are expected to be short lived and transitory. Johnson's seagrass could be affected by sinking burn residue with the potential of fouling of seagrass beds. Given that only a small fraction of the total treated oil may sink, physical fouling may be limited. Consequently, effects of *in-situ* burning to Johnson's seagrass would be most likely confined to the approximate footprint of the treated area. In addition, *in-situ* burning could reduce the volume and extent of spilled oil entering shallow water habitats (e.g., [15, 265, 323, 324]. (e.g., [15, 265, 323, 324]. Thus, it is not likely that *in-situ* burning in the *Green Zone* would adversely affect Johnson's seagrass.

6.6.A(6) Summary

A summary of final determinations on *in-situ* burning in the *Green Zone* on species and designated critical habitat under the jurisdiction of the NMFS is presented in Table 6-11 and Table 6-12, respectively.

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Table 6-12. Summary of final determination on the impacts of the Proposed Federal Action to species under the jurisdiction NMFS.

Species	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
Marine Mammals									
Sperm Whale	X	X	X	X	X	X	X	X	X
North Atlantic Right Whale				X	X	X	X	X	X
Humpback Whale	X	X	X	X	X	X	X	X	X
Fin Whale	X	X	X	X	X	X	X	X	X
Sei Whale	X	X	X	X	X	X	X	X	X
Brydes Whale	X	X	X	X	X	X	X	X	X
Sea Turtles									
Kemp's ridley Sea Turtle	X	X	X	X	X	X	X	X	X
Green Sea Turtle	X	X	X	X	X	X	X	X	X
Loggerhead Sea Turtle	X	X	X	X	X	X	X	X	X
Leatherback Sea Turtle	X	X	X	X	X	X	X	X	X
Hawksbill Sea Turtle	X	X	X	X	X	X	X	X	X
Anadromous and Marine Fish									
Smalltooth sawfish	X	X	X	X	X	X	X	X	X
Gulf Sturgeon		X	X						
Scalloped Hammerhead	X	X	X	X	X	X	X	X	X
Atlantic Sturgeon Carolina DPS							X	X	X
Atlantic Sturgeon South Atlantic DPS					X	X	X	X	X
Shortnose Sturgeon					X	X	X	X	X
Nassau Grouper				X	X	X	X	X	X
Corals									
Elkhorn Coral				X	X				
Staghorn Coral,				X	X				
Rough Cactus Coral			X	X	X	X			
Mountainous Star Coral			X	X	X	X			
Lobed Star Coral			X	X	X	X			
Pillar Coral			X	X	X	X			
Boulder Star Coral			X	X	X	X			
Seagrass									
Johnson's Seagrass					X				
Determination	No affect		May affect, not likely to adversely affect		May affect, likely to adversely affect				

Table 6-13. Summary of final determination on the impacts of the Proposed Federal Action to designated critical habitat under the jurisdiction NMFS.

Critical Habitat	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
North Atlantic Right Whale									
Southeast U.S.					X	X	X	X	
Southeast U.S.					X	X	X	X	X
Loggerhead Sea Turtle									
N-01 (Migrating), N-02 (Winter)									X
N-17 (Nearshore Productive, Breeding, Migratory, *Sargassum*)					X	X			

Critical Habitat	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
N-18 (Nearshore Productive, Migratory)					X	X			
N-19 (Nearshore Productive, Breeding, Migratory)				X	X				
S-01, S-02 (*Sargassum*)	X	X	X	X	X	X	X	X	X
Determination	No affect		May affect, not likely to adversely affect			May affect, likely to adversely affect			

6.6.B. Determination of the Proposed Federal Action on Species and Designated Critical Habitat under the Jurisdiction of the U.S. Fish and Wildlife Service

Based on the information provided by the USFWS there is no designated critical habitat in the *Green Zone*. Therefore, determinations below address only listed species.

6.6.B(1) Marine Mammals

West Indian Manatee, *Trichechus manatus*

The action may affect, but is not likely to adversely affect (directly or indirectly) the West Indian Manatee.

Most West Indian manatees occur in shallow nearshore waters, and only a rare number of individuals may be found in areas more than 3 nm offshore. Because West Indian manatees rarely swim out as far as the *Green Zone*, a few individuals may be at a small risk of being exposed to *in-situ* burning. In-situ burning could reduce the adverse effects of oil spills that originate outside the distribution range of the manatee by reducing the volume and extent of spilled oil entering their habitat (e.g., [15, 265, 323, 324], and by reducing impacts associated with nearshore oil spill response efforts. The manatee feed on nearshore vegetation, which are not likely to be exposed to burn residues. Thus, it is not likely that *in-situ* burning in the *Green Zone* would adversely affect the West Indian manatee.

6.6.B(2) Anadromous Fish

6.6.B(2)(a) Marine and anadromous fish

Gulf sturgeon, *Acipenser oxyrinchus desotoi*

The action may affect, but is not likely to adversely affect (directly or indirectly), Gulf sturgeon.

The distribution range of Gulf sturgeon may overlap the *Green Zone*; therefore, this species could be exposed to burn residues. Although unlikely, any effects would most likely be confined to the approximate footprint of the treated area. The preferred prey of this species is primary benthic fauna, which are not likely to be affected by sinking burn residues. Any impacts would likely be limited to small fraction of the available food source. In addition, the impacted area is likely small relative to the potential distribution of prey, and thus, it is unlikely that the entire area where prey may be found would be impacted by *in-situ* burning. Thus, it is not likely that *in-situ* burning in the *Green Zone* would adversely affect the Gulf sturgeon.

6.6.B(3) Birds

Red Knot, *Calidris canutus rufa*

The action may affect, but is not likely to adversely affect (directly or indirectly) the red knot.

The red knot occupies nearshore and intertidal coastal habitats, thus it would not be directly affected by the use of *in-situ* burning and burn residues in the *Green Zone*. For short periods of time during migration, there is a small risk of red knot occurring in the *Green Zone* when this species could be affected by combustion byproducts generated during *in-situ* burning operations. However, this risk is likely minimal. The prey items for red knot occur mostly in the intertidal zone, and are unlikely to be impacted by burn residues in the water column or sinking burn residues. -*situ* burning could reduce the volume and extent of spilled oil entering nearshore habitats (e.g., [15, 265, 323, 324]. However, this risk is likely minimal. The prey items for roseate tern occur mostly in shallow areas, and in shallow nearshore habitats, and are unlikely to be impacted by burn residues in the water column or sinking burn residues. Thus it is not likely that *in-situ* burning in the *Green Zone* would adversely affect this species. In addition, *in-situ* burning could reduce the volume and extent of spilled oil entering nearshore habitats (e.g., [15, 265, 323, 324]. Reducing the amount of oil stranding onto nearshore coastal habitats would reduce impacts associated with shoreline oil spill response in areas important for their overwintering. Thus, it is not likely that *in-situ* burning in the *Green Zone* would adversely affect the red knot.

Roseate tern, *Sterna dougalli*

The action may affect, but is not likely to adversely affect (directly or indirectly) the roseate tern.

The roseate tern shallow water habitats, thus it would not be directly affected by the use of *in-situ* burning and burn residues in the *Green Zone*. For short periods of time during migration, there is a small risk of roseate tern occurring in the *Green Zone* when this species could be subject to *in-situ* burning. Thus it is not likely that *in-situ* burning in the *Green Zone* would adversely affect this species. In addition, in reducing the amount of oil stranding onto nearshore coastal habitats would reduce impacts associated with shoreline oil spill response in areas important for their overwintering. Thus, it is not likely that *in-situ* burning in the *Green Zone* would adversely affect the roseate tern.

6.6.B(4) Summary

A summary of final determinations on *in-situ* burning in the *Green Zone* on species under the jurisdiction of the USFWS is presented in Table 6-13.

Table 6-14. Summary of final determination on the impacts of the Proposed Federal Action to species under the jurisdiction USFWS.

Species	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC

Marine mammals									
West Indian Manatee	X	X	X	X	X	X	X	X	X
Anadromous Fish									
Gulf Sturgeon		X	X						
Birds									
Red Knot	X	X	X	X	X	X	X	X	X
Roseate Tern				X	X				
Determination	No affect		May affect, not likely to adversely affect			May affect, likely to adversely affect			

6.6.C. Determination of the Proposed Federal Action on Essential Fish Habitat – Habitat Areas of Particular Concern

6.6.C(1) Essential Fish Habitat

SAFMC: **Water Column, *Sargassum*, Coral Reefs and Coral Communities, Deepwater Coral, Live/Hard Bottom, Marine Soft Bottom, Seagrasses, Oyster Reefs, Artificial Reefs, Habitats Areas of Particular Concern**

GMFMC: **Pelagic (Water Column), Shelf Edge/Slope, Coral Reefs, Submerged Aquatic Vegetation (including seagrasses and benthic algae), Hard Bottom, Soft Bottom, Oyster Reefs, Drift Algae [*Sargassum*, pelagic *Sargassum* community], Habitat Areas of Particular Concern**

NMFS: **Habitat Area of Particular Concern (Highly Migratory Species).**

6.6.C(2) Determination

The action may adversely affect EFH or EFH-HAPC.

6.6.C(3) Summary

Among all EFH, the habitat more likely to experience temporary impacts on water quality is the Water Column EFH. However, any direct effects are anticipated to be minor and temporary. Similarly, *Sargassum* (managed by SAFMC and GMFMC) may be temporarily and directly exposed to *in-situ* burning and burn residues, but it is unlikely that *in-situ* burning would occur in areas with large aggregations of *Sargassum*. In-situ burning is expected to reduce direct effects of oil spills on organisms found on the water surface, including *Sargassum*. Consequently any direct effects are anticipated to be minor and temporary. Any direct effects of *in-situ* burning and burn residues on other EFH and EFH-HAPC managed by the SAFMC, GMFMC and NMFS are expected to impact only a relatively small fraction of the each EFH and EFH-HAPC, with effects likely being short-lived and transitory. Consequently, effects of *in-situ* burning to EFH and EFH-HAPC would be most likely confined to the approximate footprint of the treated area and limited to a few hours post *in-situ* burning.

Different from the determination associated with the Endangered Species Act, any affect to the quality or quantity of EFH is considered an adverse affect. As stated above, the adverse affect is expected to be “temporary”, will “impact only a relatively small fraction”, “short-lived”, and "transitory". As such, our determination is that the proposed action will have minimal adverse affects on EFH and EFH-HAPC. In addition to the resonance of all protocols outlined in the In-Situ Burn Preauthorization Plan, this determination also highlights the importance of the conservation measures found in Appendix IV, which are intended to further reduce or eliminate the minimal adverse impacts expected to EFH or EFH-HAPC should in-situ burn operations in the Green Zone be used.

A summary of final determinations on *in-situ* burning in the *Green Zone* on EFH and EFH-HAPC managed by the SAFMC, GMFMC and NMFS is presented in Table 6-13.

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Table 6-15. Summary of final determination on the impacts of the Proposed Federal Action to EFH managed by the SAFMC and the GMFMC.

Essential Fish Habitat	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
South Atlantic Fisheries Management Council									
Essential Fish Habitat of the SAFMC									
Water Column				X	X	X	X	X	X
Sargassum				X	X	X	X	X	X
Coral Reefs and Coral Communities				X	X	X	X	X	X
Deepwater Coral				X	X	X	X	X	X
Live/Hard Bottom				X	X	X	X	X	X
Marine Soft Bottom				X	X	X	X	X	X
Seagrasses				X	X	X	X	X	X
Oyster Reefs				X	X	X	X	X	X
Artificial Reefs				X	X	X	X	X	X
EFH – Habitat Areas of Particular Concern of the SAFMC									
All areas within the EEZ that contain *Sargassum* population				X	X	X	X	X	X
Documented sites of spawning aggregations in NC, SC, GA, and FL described in the Habitat Plan; other spawning areas identified in the future; habitats identified for submerged aquatic vegetation				X	X	X	X	X	X
The Point									X
The Ten Fathom Ledge							X		X
Big Rock									X
Charleston Bump							X		
Seagrass Habitat; oyster shell habitat; pelagic and benthic *Sargassum*				X	X	X	X	X	X
Hoyt Hills							X		X
Hermatypic coral habitats and reefs				X	X	X			
Manganese outroppings on the Blake Plateau				X	X	X	X	X	X
Council designated Artificial Reef Special Management Areas (SMZs).				X	X	X	X	X	X
Sandy shoals of Capes Lookout, Cape Fear, and Cape Hatteras from shore to the ends of the respective shoals, but shoreward of the Gulf Stream							X		X
Hurl Rocks							X		
The Point off Jupiter Inlet					X				
The Hump off Islamorada, Florida				X					
The Marathon Hump off Marathon, Florida				X					
The "Wall" off of the Florida Keys				X					
Pelagic *Sargassum*				X	X	X	X	X	X
Big Rock									X
Gray's Reef National Marine Sanctuary								X	
Offshore (530 meter; 15-90 feet) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks					X	X			
Georgetown Hole							X		
Oculina Bank					X	X		X	
Satellite Oculina Bank HAPC #1					X	X		X	
Satellite Oculina Bank HAPC #2					X	X		X	

Essential Fish Habitat	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
Gulf of Mexico Fisheries Management Council									
Essential Fish Habitat of the GMFMC									
Pelagic (Water Column)		X	X	X					
Shelf Edge/Slope		X	X	X					
Coral Reefs		X	X	X					
Submerged Aquatic Vegetation (including seagrasses and benthic algae)		X	X	X					
Hard Bottom		X	X	X					
Soft Bottom		X	X	X					
Oyster Reefs		X	X	X					
Drift Algae (*Sargassum*, pelagic *Sargassum* community)		X	X	X					
EFH – Habitat Areas of Particular Concern of the GMFMC									
Florida Middle Grounds			X	X					
Tortugas South				X					
Madison-Swanson Marine Reserve			X	X					
Pulley Ridge			X	X					
National Marine Fisheries Service									
Essential Fish Habitat of the NMFS									
Same as EFH of the SAFMC and GMFMC									
EFH – Habitat Areas of Particular Concern of the NMFS									
Gulf of Mexico (Highly Migratory Species)		X	X	X					
Determination	**No affect**		**May Adversely Affect**			**Will Adversely Affect**			

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Appendix I. Literature Cited

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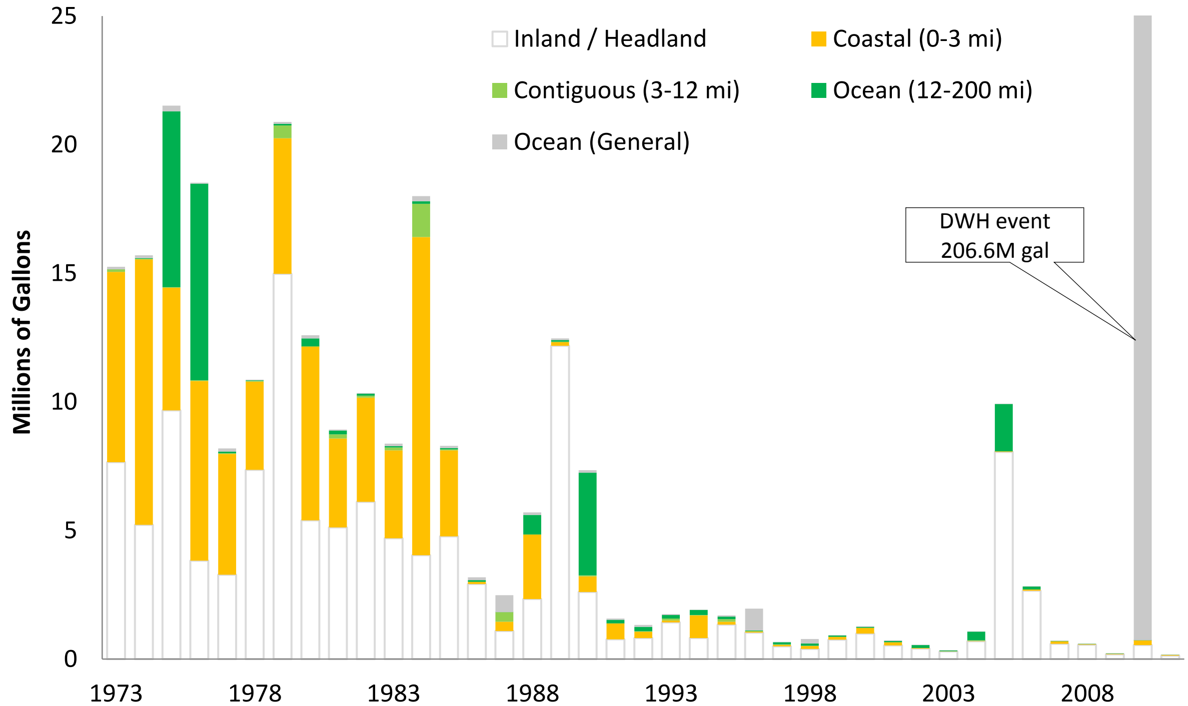
Appendix II. Oil Spill Trends Based on Historical Data

Discharges of oil within the marine environment of Federal Region 4 are generally related to incidents involving ships and commodity transportation. A transportation incident within the proposed *Green Zone* and discharging large quantities of oil likely to benefit from dispersant use would involve a tanker ship or a deep draft tank barge. The largest Worst Case Discharge (WCD) volume for a potential incident would involve an offshore production facility. Based on the information outlined in this Section, scenarios have been developed (Table II-) which illustrate dispersant use likely discharge volumes, locations, and oil types.

III. A. History of Spill Events

Cumulative discharge incidents of oil in the U.S. have decreased in both volume and frequency over the past 40 years according to the U.S. Coast Guard 2012 Spill/Release Compendium [326] (see Figure II-and Figure II-2). The trend of cumulative oil discharged in Figure II-, most notably from incidents along Coastal, Contiguous, and Ocean zones, follows closely the intrastate crude oil traffic activities displayed in Figure 4-6. However the frequency of incidents in Figure II-2 does not follow this pattern as it shows a significant increase to more than 1,000 discharge incidents per year within both the Coastal and Ocean zones from 1991 to 2001 followed by a decrease to less than 500 per year after 2002.

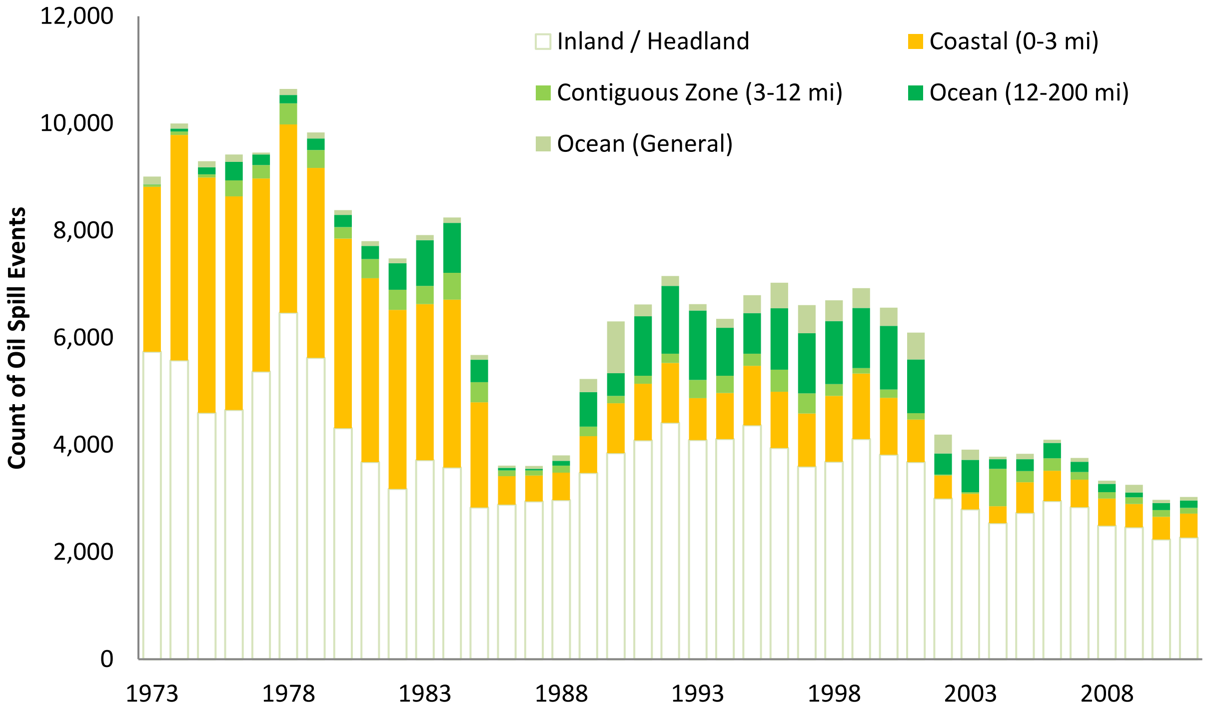
Figure II-1. Cumulative Actual Volume (in million gallons) for Oil Spill Events in the U.S. from 1973 to 2011 [326]



Although the frequency of discharge incidents in the Ocean zone increased from 1991 to 2001 (Figure II-2), the cumulative volume of oil discharged in these areas did not increase over this time period (Figure II-) suggesting improved reporting practices for incidents in this area. Overall, over the past 40 years the frequency of spill incidents has decreased by an order of magnitude in the Coastal (nearshore, 0-3 miles) zone and decreased more moderately within the Contiguous and Ocean zones (Figure II-2). The cumulative volume of oil discharged in the

Coastal zone, however, decreased far more significantly (by two orders of magnitude) (Figure II-) during this same time period, suggesting improved engineering and programmatic controls to reduce the volume discharged during an event.

Figure II-2. Count of Oil Spill Events by Receiving Water in the U.S. from 1973 to 2011 [326]



Oil discharge incidents in and around Federal Region 4 over the last 40 years follow the same pattern as those tabulated for the entire U.S. (Figure II-3 and Figure II-). The frequency of incidents during 1991 to 2000 did not decrease from values in the 1970s and 1980s (most notably in USCG District 8) but decreased by approximately 50% thereafter (Figure II-3). However the cumulative volume of oil discharged decreased dramatically over this same period (Figure II-). This trend suggests improved reporting and discharge control practices, possibly related to regulatory changes from the Oil Pollution Act of 1990 (33 U.S.C. 2701-2761) which amended the Clean Water Act (33 U.S.C. 1251-1387) to address preventing and responding to oil pollution incidents.

Figure II-3. Count of Oil Spill Events by USCG District from 1973 to 2011 [326]

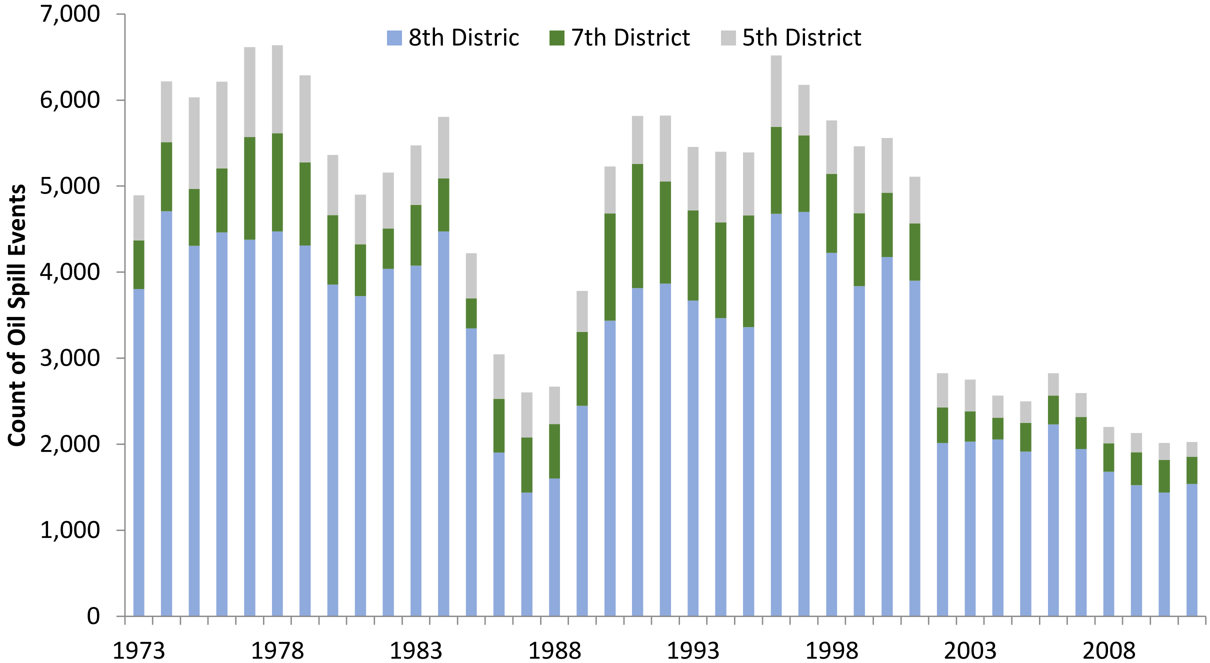
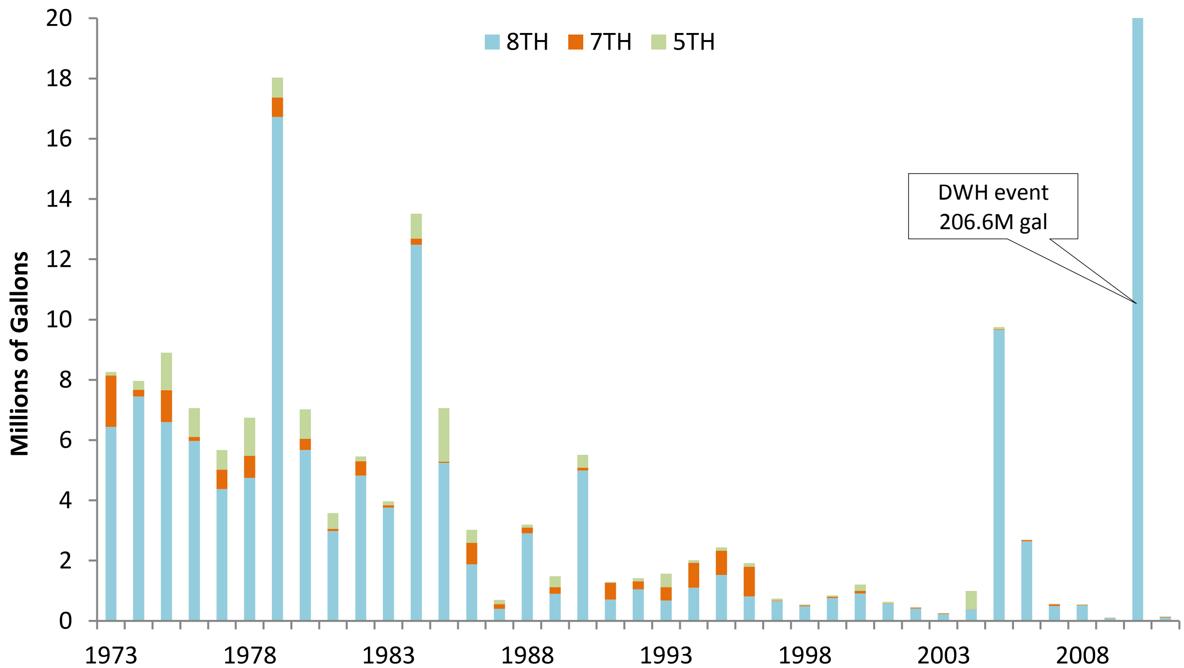


Figure II-4. Cumulative Actual Volume of Oil Spills (in million gallons) for Oil Spill Events in USCG Districts 5, 7, and 8 from 1973 to 2011 [326]



Small discharge incidents below 100 gallons dominate most reported spill events (Table II-), where for every discharge between 100 to 10,000 gallons there are approximately twenty small events, and for every discharge over 10,000 gallons there are approximately one thousand small events. However, the greatest volume of oil discharged results from large incidents; one or two events of over 10,000 gallons can result in more oil discharged than the cumulative total of all other incidents within a USCG District for that year (Table II-). Moreover, the potential discharge volume (oil not yet released to water) during large incidents is significantly greater than all other incidents combined by an order of magnitude or more (Table II-).

In and around Federal Region 4, discharge incidents most frequently involve crude oil or diesel fuel (Table II-) with approximately 400-500 incidents per year from 2002-2015 between USCG Districts 5, 7, and 8 (incidents involving unidentified oil occurred with comparable frequency from 2002 to 2007 in the USCG MISLE database but lower overall numbers for “unknown” oils after 2007 may indicated improved identification practices). The next most frequent oils discharged include hydraulic and lubricating oils.

III. B. Types of Oil Spilled in Gulf and South Atlantic

The cumulative volume of oil discharged in and around Federal Region 4 also mostly involves crude oil or diesel fuel (Table II-); however, annual discharge volumes of crude oil are generally lower than those of diesel fuel and occur with greater variability. The high value of nearly 385,000 gallons discharged to water in 2005 is primarily related a single shipping incident from the *M/V ATHOS I* in the Delaware River (USCG District 5) [327]. As illustrated in the previous section, the occurrence of large discharge incidents is infrequent but can result in a greater volume of oil discharged than several hundred or several thousand smaller incidents.

Cold air and water temperatures will affect the dispersability of oil [234]; however, there appears to be no trend in available data over the last ten years of any variation between oil discharge incidents of any size occurring in warm weather months versus cold weather months (Figure II-11).

Table II-1. Annual Total Count of Oil Spill Events in USCG Districts 5, 7 and 8 Sorted by Spill Size [328]

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
USCG District 5															
Events <100 gal	279	385	254	229	248	235	192	196	207	159	192	204	153	147	**3,080**
Events 100-1,000 gal	14	21	20	13	13	14	10	8	13	13	6	13	5	6	**169**
Events 1,000-10,000 gal	2	3	2	1	3	2	6	2	2	5	1	3	1	2	**35**
Events >10,000 gal	1	0	0	1	0	0	0	0	0	0	0	0	0	0	**2**
USCG District 7															
Events <100 gal	332	332	251	287	301	349	316	336	402	275	346	368	412	312	**4,619**
Events 100-1,000 gal	17	14	10	12	16	13	12	12	13	13	10	12	15	5	**174**
Events 1,000-10,000 gal	4	3	4	5	1	1	0	6	1	1	2	2	2	0	**32**
Events >10,000 gal	1	0	0	0	1	0	0	0	0	0	0	0	0	0	**2**
USCG District 8															
Events <100 gal	1,656	1,736	1,744	1,783	1,904	1,776	1,557	1,430	1,327	1,381	1,367	1,366	1,240	1,016	**21,283**
Events 100-1,000 gal	76	74	76	55	103	67	51	55	57	55	49	40	37	29	**824**
Events 1,000-10,000 gal	9	14	11	20	21	13	4	7	13	6	11	16	9	4	**158**
Events >10,000 gal	4	0	1	1	5	2	0	2	2	0	0	1	2	0	**20**
Total Events <100 gal	**2,267**	**2,453**	**2,249**	**2,299**	**2,453**	**2,360**	**2,065**	**1,962**	**1,936**	**1,815**	**1,905**	**1,938**	**1,805**	**1,475**	**28,982**
Total Events 100-1,000 gal	**107**	**109**	**106**	**80**	**132**	**94**	**73**	**75**	**83**	**81**	**65**	**65**	**57**	**40**	**1,167**
Total Events 1,000-10,000 gal	**15**	**20**	**17**	**26**	**25**	**16**	**10**	**15**	**16**	**12**	**14**	**21**	**12**	**6**	**225**
Total Events >10,000 gal	**6**	**0**	**1**	**2**	**6**	**2**	**0**	**2**	**2**	**0**	**0**	**1**	**2**	**0**	**24**

Figure II-5. U.S. South Atlantic Oil Discharges to Water within the RRT4 Dispersant Use Plan *Yellow Zone* from 2002 to 2015; Icons Indicate Actual Spill Volume [328]

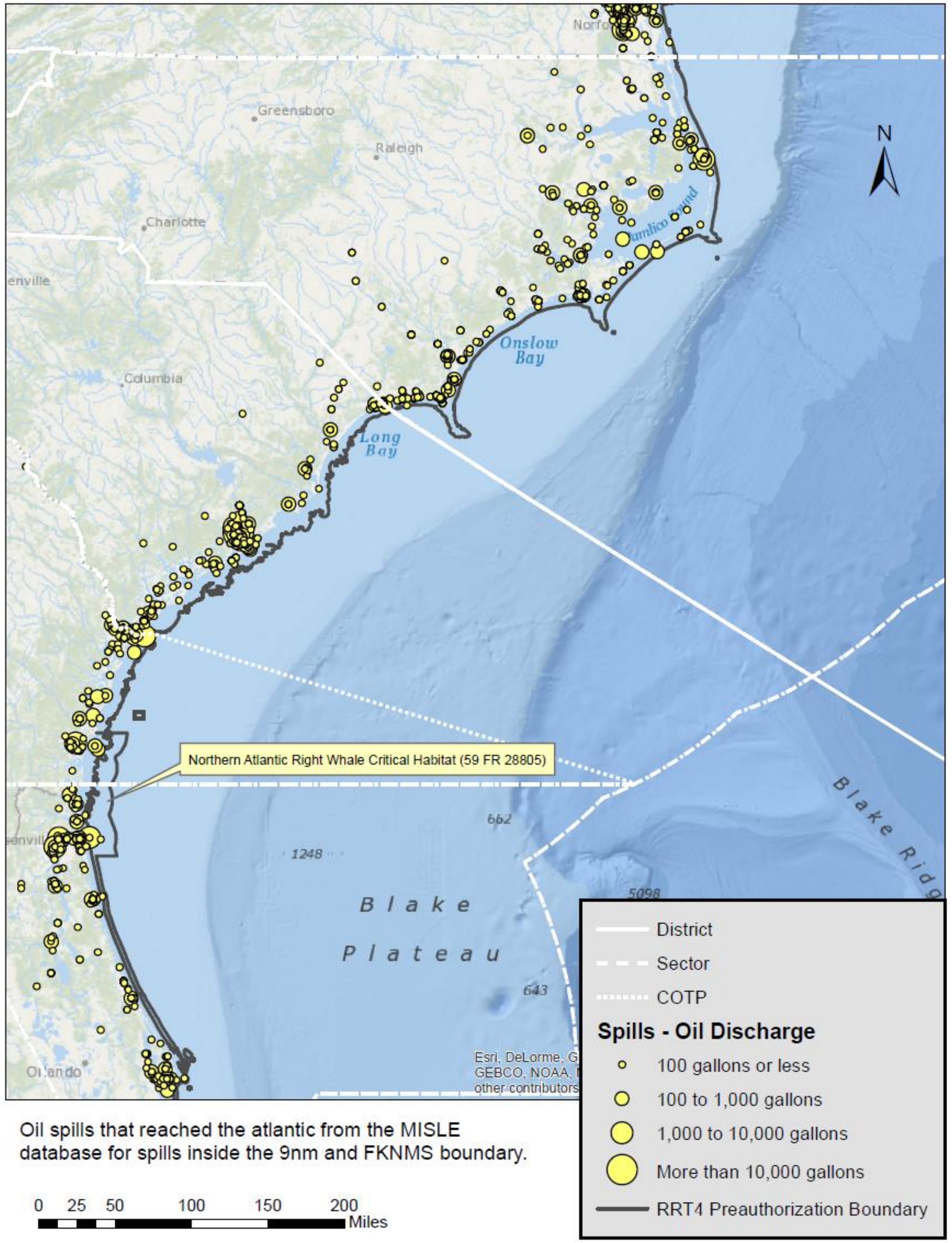


Figure II-6. U.S. South Atlantic Oil Discharges to Water within the RRT4 Dispersant Use Plan *Green Zone* from 2002 to 2015; Icons Indicate Actual Spill Volume [328]

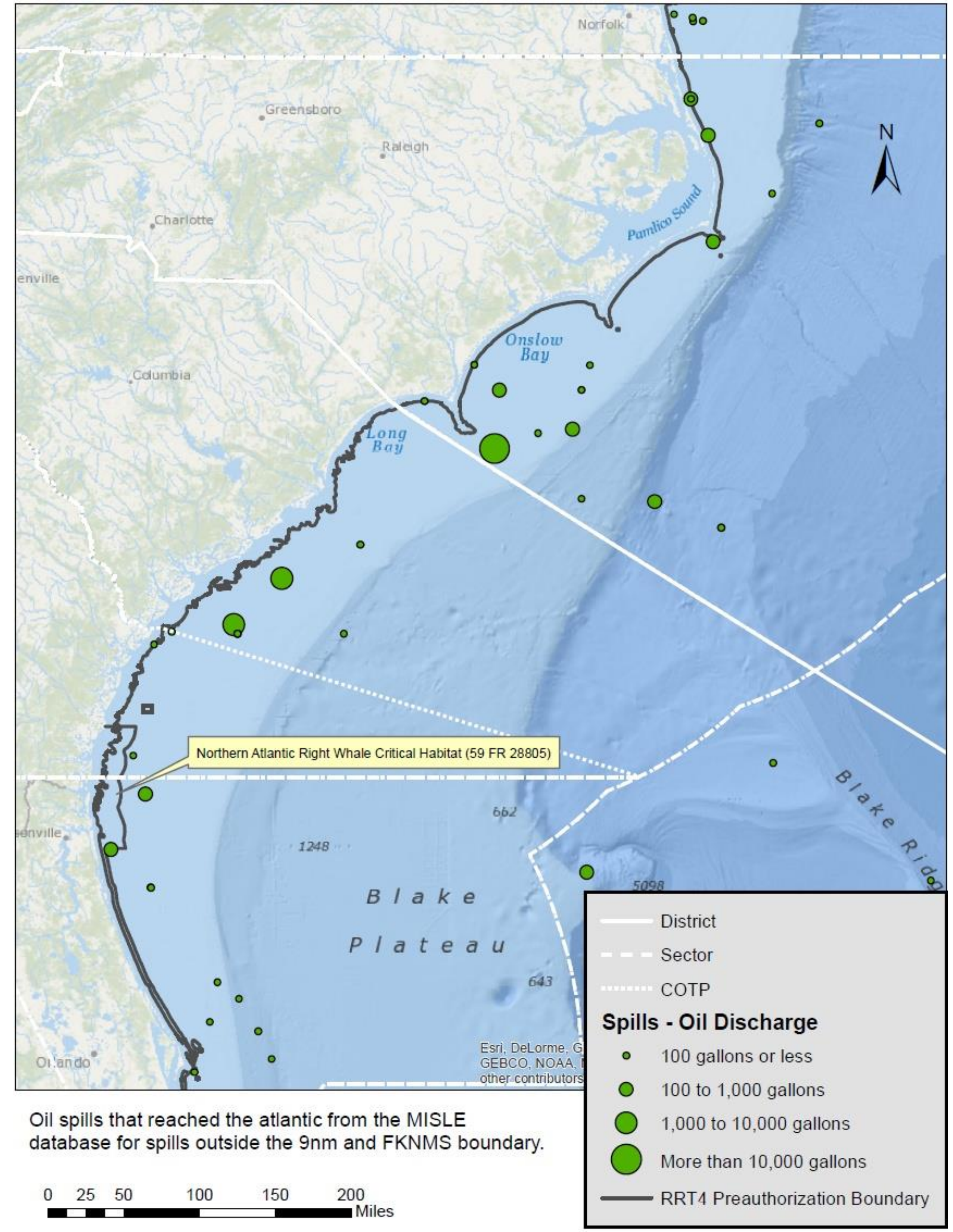


Figure II-7. South Florida Oil Discharges to Water within the RRT4 Dispersant Use Plan *Yellow Zone* from 2002 to 2015; Icons Indicate Actual Spill Volume [328]

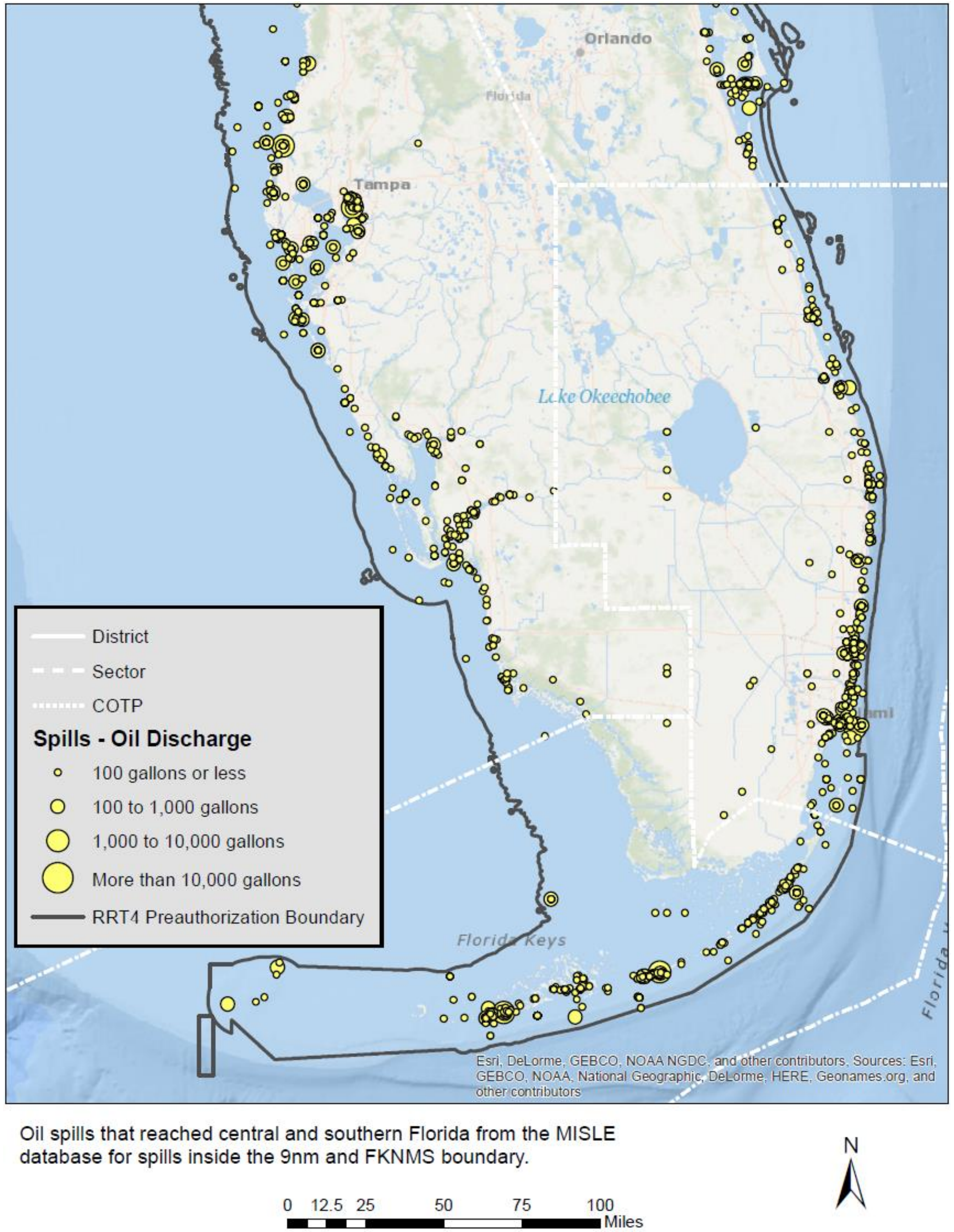


Figure II-8. South Florida Oil Discharges to Water within the RRT4 Dispersant Use Plan *Green Zone* from 2002 to 2015; Icons Indicate Actual Spill Volume [328]

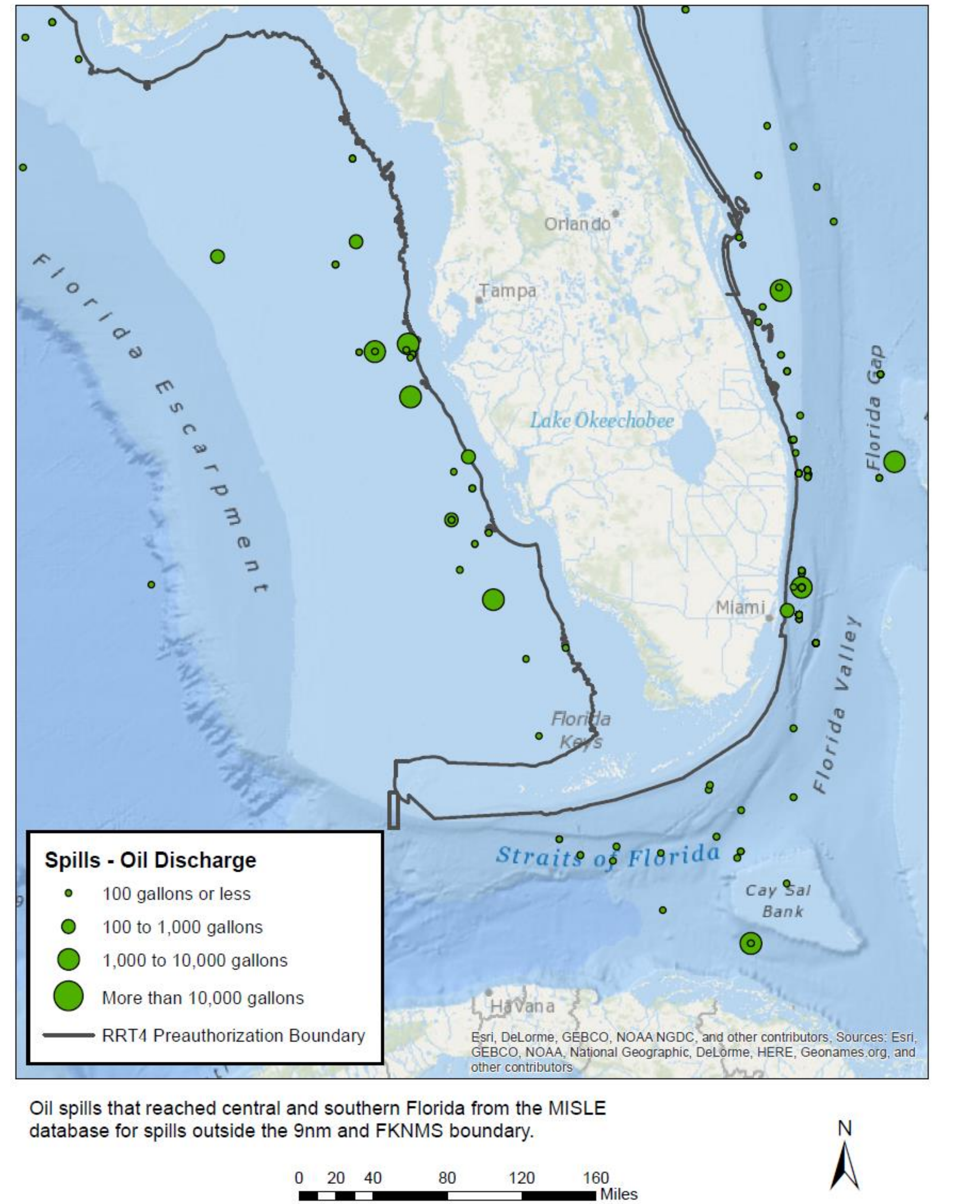
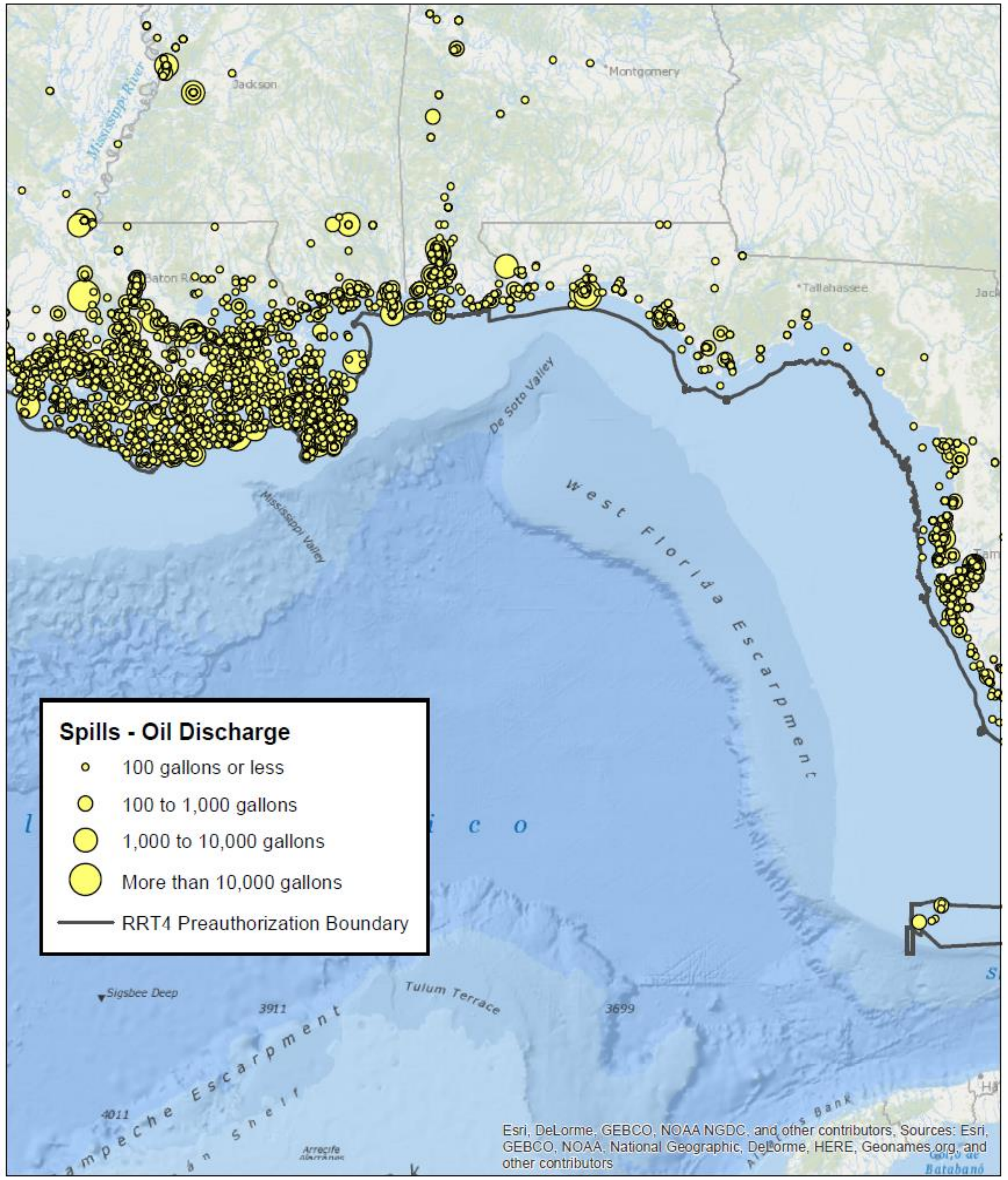


Figure II-9. Gulf of Mexico Oil Discharges to Water within the RRT4 Dispersant Use Plan *Yellow Zone* from 2002 to 2015; Icons Indicate Actual Spill Volume [328]

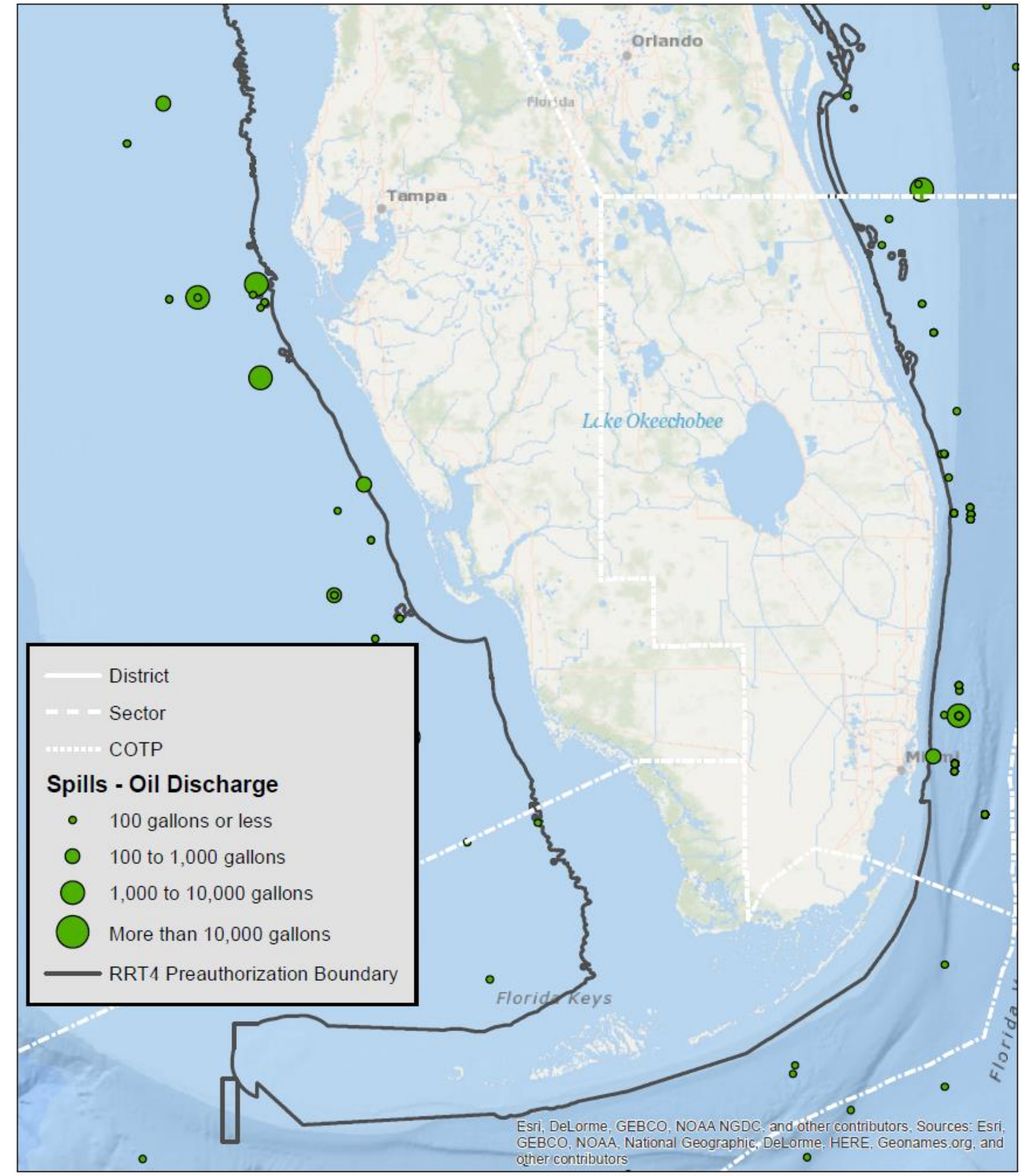


Oil spills that reached the Gulf water in northern Florida from the MISLE database for spills inside the 3nm and 9nm boundary.

0 30 60 120 180 240 Miles

N

Figure II-10. Gulf of Mexico Oil Discharges to Water within the RRT4 Dispersant Use Plan *Green Zone* from 2002 to 2015; Icons Indicate Actual Spill Volume [328]



Oil spills that reached central and southern Florida from the MISLE database for spills outside the 9nm and FKNMS boundary.

0 12.5 25 50 75 100 Miles

N

Table II-2. Cumulative Actual Volume (in 1000 Gallons) for Oil Spill Events in USCG Districts 5, 7 and 8 Sorted by Spill Size [328]

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
USCG District 5															
Events <100 gal	2	3	2	3	2	2	2	2	1	1	1	2	1	1	**24**
Events 100-1,000 gal	5	5	5	3	4	4	2	3	3	3	2	4	1	1	**45**
Events 1,000-10,000 gal	2	12	6	1	13	2	13	9	2	9	1	5	1	5	**81**
Events >10,000 gal	10	0	0	263	0	0	0	0	0	0	0	0	0	0	**273**
USCG District 7															
Events <100 gal	3	2	2	2	2	3	3	3	3	2	2	2	2	2	**34**
Events 100-1,000 gal	5	3	3	3	4	3	3	4	3	2	3	3	4	1	**44**
Events 1,000-10,000 gal	6	9	9	15	1	4	0	20	7	5	9	8	3	0	**96**
Events >10,000 gal	13	0	0	0	15	0	0	0	0	0	0	0	0	0	**28**
USCG District 8															
Events <100 gal	10	11	10	11	13	11	10	8	7	8	6	7	7	5	**124**
Events 100-1,000 gal	20	18	22	17	28	17	15	15	15	13	13	9	12	7	**220**
Events 1,000-10,000 gal	14	41	28	55	49	40	12	8	34	16	23	44	28	9	**402**
Events >10,000 gal	246	0	20	110	347	60	0	29	28	0	0	19	58	0	**918**
Total Events <100 gal	**15**	**16**	**14**	**16**	**17**	**16**	**14**	**12**	**11**	**11**	**10**	**11**	**9**	**8**	**182**
Total Events 100-1,000 gal	**30**	**26**	**29**	**23**	**36**	**24**	**20**	**22**	**20**	**19**	**17**	**16**	**17**	**10**	**309**
Total Events 1,000-10,000 gal	**23**	**62**	**43**	**70**	**63**	**46**	**25**	**37**	**43**	**30**	**33**	**58**	**32**	**14**	**579**
Total Events >10,000 gal	**269**	**0**	**20**	**373**	**362**	**60**	**0**	**29**	**28**	**0**	**0**	**19**	**58**	**0**	**1,218**

Table II-3. Cumulative Potential Volume (in 1000 Gallons) for Oil Spill Events in USCG Districts 5, 7 and 8 Sorted by Spill Size [328]

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
USCG District 5															
Events <100 gal	3	4	2	3	3	2	2	2	2	1	2	2	1	2	**30**
Events 100-1,000 gal	15	14	16	8	9	13	9	8	9	8	9	11	5	10	**144**
Events 1,000-10,000 gal	49	113	87	33	55	67	33	48	15	38	10	20	28	17	**615**
Events >10,000 gal	155	667	2,889	12,045	658	3,186	1,965	4,389	110	3,661	88	75	54	305	**30,245**
USCG District 7															
Events <100 gal	3	3	3	3	3	3	3	3	3	3	3	3	3	2	**40**
Events 100-1,000 gal	14	13	12	11	8	10	10	12	14	8	15	15	13	11	**169**
Events 1,000-10,000 gal	56	35	24	41	51	26	25	53	48	27	37	19	37	27	**506**
Events >10,000 gal	2,803	209	688	268	101	0	63	481	254	99	747	79	2,021	3,698	**11,512**
USCG District 8															
Events <100 gal	10	10	9	9	10	12	10	9	9	10	9	8	9	6	**129**
Events 100-1,000 gal	33	24	29	30	42	46	55	53	44	50	44	37	40	29	**554**
Events 1,000-10,000 gal	105	210	215	201	187	224	303	365	291	303	221	312	363	199	**3,499**
Events >10,000 gal	6,644	4,432	18,315	4,145	6,553	5,230	11,541	14,241	11,388	6,052	33,992	12,098	28,372	3,993	**166,999**
Total Events <100 gal	**15**	**16**	**14**	**15**	**16**	**17**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**10**	**199**
Total Events 100-1,000 gal	**62**	**51**	**57**	**50**	**59**	**69**	**74**	**73**	**67**	**66**	**68**	**63**	**58**	**50**	**867**
Total Events 1,000-10,000 gal	**210**	**359**	**326**	**275**	**293**	**317**	**361**	**466**	**354**	**368**	**268**	**352**	**428**	**243**	**4,619**
Total Events >10,000 gal	**9,603**	**5,308**	**21,892**	**16,458**	**7,311**	**8,417**	**13,569**	**19,111**	**11,752**	**9,813**	**34,828**	**12,252**	**30,447**	**7,996**	**208,756**

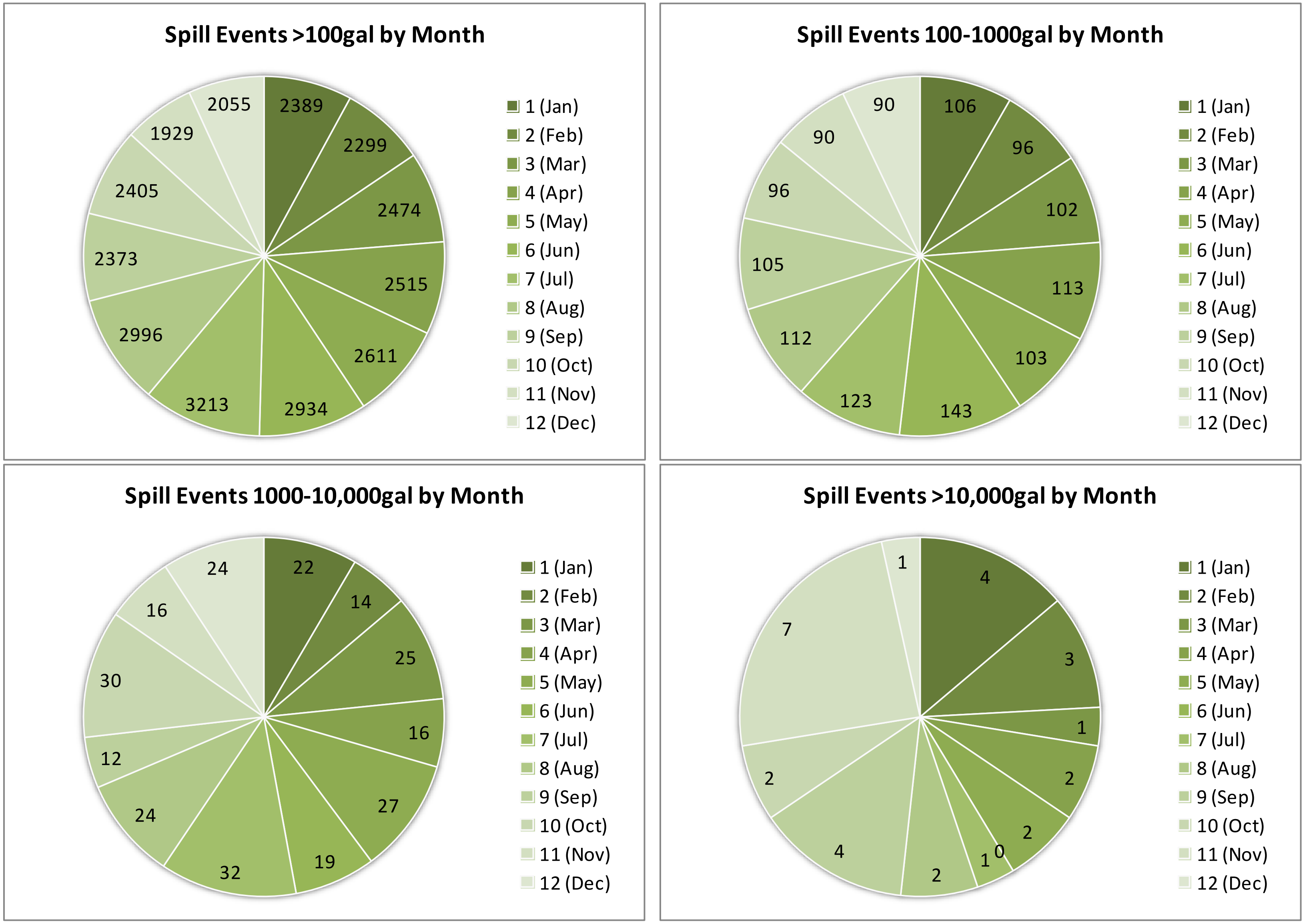
Table II-4. Annual Total Count of Oil Spill Events in USCG Districts 5, 7 and 8 for Top 20 Oil Types According to Total Spill Events from 2002 to 2015 [328]

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
Oil: Crude	647	532	515	492	523	535	552	518	477	551	535	534	522	321	**7,254**
Oil: Diesel	529	549	495	503	523	619	506	468	495	410	465	466	451	426	**6,905**
Unknown material, Oil or Oil-like	496	689	498	509	608	363	247	268	323	198	173	220	193	178	**4,963**
Hydraulic fluid or oil	111	114	132	119	181	155	189	160	152	185	214	195	198	155	**2,260**
Other oil, oil with no CHRIS Code	201	186	184	208	179	158	120	150	114	153	171	140	103	81	**2,148**
Oil, misc: Lubricating	119	111	103	125	122	141	107	109	83	91	116	95	86	103	**1,511**
Oil, fuel: No. 2-D	125	154	122	155	141	115	79	67	47	23	21	15	17	14	**1,095**
Gasoline: Automotive (Unleaded)	51	71	56	66	77	76	64	65	117	72	81	93	63	70	**1,022**
Oil, misc: Motor	43	66	61	45	74	82	77	71	61	61	64	76	59	52	**892**
Bilge slops	57	54	48	54	51	53	30	24	40	37	26	45	39	29	**587**
Oil, waste/lubricants	58	43	37	20	21	41	38	20	25	16	13	33	31	25	**421**
Gasoline: Casinghead	21	26	55	45	48	59	31	41	15	17	18	11	4	13	**404**
Oil, fuel: No. 6	35	24	43	26	13	25	30	24	41	27	32	21	23	16	**380**
Gasoline: Automotive (4.23g Pb/gal)	44	38	17	18	22	17	17	9	5	2	5	6	11	4	**215**
Oil, fuel: No. 2	13	31	13	12	12	7	14	13	9	17	11	17	19	10	**198**
Natural gas condensate	3	8	4	9	3	12	16	16	15	22	13	21	14	10	**166**
Oil, misc: Residual	1		3	5	3	9	8	14	13	10	22	13	22	16	**139**
Oil, fuel: No. 1-D	4	5	6	8	17	8	5	15	7	15	7	7	4	4	**112**
Oil, misc: Mineral	9	8	6	5	8	5	5	4	6	6	3	3	11	5	**84**
Oil, edible: Vegetable	2	8	3	2	1	9	5	2	1	3	4	3	8	2	**53**
Gas oil: Miscellaneous	9	6		5	1	1	2	4	6	2	3	3	9	2	**53**

Table II-5. Annual Cumulative Volume (in 1000 Gallons) of Actual Oil Discharged in USCG Districts 5, 7 and 8 for Top 20 Oil Types According to Total Oil Spilled from 2002 to 2015 [328]

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
Oil: Diesel	54.55	56.68	67.11	41.35	84.39	51.85	26.28	30.65	43.59	20.70	34.12	61.77	85.85	18.67	**677.57**
Oil: Crude	9.56	7.14	5.47	384.59	56.40	58.36	9.07	9.83	30.68	16.60	6.88	13.08	17.41	4.28	**629.34**
Unknown material, Oil or Oil-like	80.89	26.25	10.52	28.71	95.30	6.87	1.85	2.75	2.63	2.59	1.58	4.21	1.90	0.72	**266.77**
Asphalt	0.61	0.02	0.08	0.96	220.14		0.50	0.01	0.00	0.15	0.00	0.01	0.05	0.05	**222.58**
Gasoline: Automotive (Unleaded)	125.86	0.53	0.43	0.80	1.17	0.75	1.01	8.93	1.38	0.64	0.46	1.50	0.25	0.74	**144.46**
Other oil, oil with no CHRIS Code	41.50	11.42	1.20	11.91	3.06	1.69	0.84	2.89	2.99	2.88	0.62	4.36	0.77	0.52	**86.65**
Oil, fuel: No. 2-D	7.17	11.32	11.34	13.19	12.25	3.02	1.83	4.71	11.69	2.27	1.86	0.28	3.94	0.20	**85.06**
Oil, fuel: No. 2	0.59	9.59	0.21	7.00	0.35	0.45	2.10	19.57	0.23	3.52	1.64	2.30	0.96	0.02	**48.51**
Oil, waste/lubricants	2.52	4.49	0.24	0.16	0.48	11.95	13.99	5.51	2.03	5.28	0.48	0.21	0.16	0.29	**47.79**
Oil, fuel: No. 6	13.03	6.52	0.55	0.87	1.58	0.32	4.34	12.83	0.43	1.76	2.86	0.45	0.49	1.35	**47.38**
Oil, misc: Lubricating	1.72	1.39	7.79	2.20	0.65	1.18	0.94	1.00	0.70	1.79	0.79	0.66	0.87	4.61	**26.29**
Hydraulic fluid or oil	0.42	0.74	0.76	1.09	1.27	2.15	0.92	0.76	1.02	1.14	2.77	1.17	1.19	0.67	**16.07**
Oil, misc: Mineral	0.03	0.09	0.03	0.03	0.05	2.24	0.46	0.01	0.04	4.86	0.01	5.00	0.06	0.06	**12.96**
Bilge slops	0.57	0.37	0.96	0.35	0.27	0.80	0.81	1.27	2.82	0.53	1.07	0.20	0.77	0.13	**10.93**
Natural gas condensate	0.01	0.03	0.01	0.02	0.00	0.28	0.46	0.05	0.08	0.09	0.59	6.70	1.75	0.07	**10.14**
Oil, misc: Motor	0.10	0.34	0.39	0.26	1.32	0.52	0.34	0.44	0.13	0.52	0.44	0.33	0.26	0.35	**5.74**
Oil, fuel: No. 1-D	0.01	0.17	0.12	0.43	0.09	0.24	0.03	1.29	1.69	0.19	0.74	0.04	0.05	0.30	**5.38**
Gasoline: Casinghead	0.26	0.20	0.19	0.05	0.19	0.28	0.10	0.09	0.05	0.11	3.26	0.02	0.02	0.07	**4.88**
Oil, edible: Vegetable	0.01	0.03	0.00	0.02	0.00	3.34	0.01	0.78	0.00	0.10	0.00	0.05	0.02	0.01	**4.37**
Petrolatum									3.80						**3.80**

Figure II-11. Monthly Total Count of Oil Spill Events Sorted by Actual Spill Size in USCG Districts 5, 7 and 8 from 2002 to 2015 [328]



III. C. Crude Oil Types in Gulf and South Atlantic

Discharge incidents involving crude oil in the Gulf of Mexico and South Atlantic are mostly likely to involve medium to heavy sour crude oil types with API gravities of 27-35 with some imported oils having API gravities <27. Oils produced in the Gulf of Mexico are generally regarded as a medium sour crude (Figure II-12). Foreign imported oils to Mississippi favor heavy sour crude by a 7:1 margin over medium crude, the next most common import (Table II-). Foreign imported oils to Alabama have favored heavy sour crude since 2011; light sweet crude (API > 35) was previously the highest imported crude oil in Alabama but has not been imported since 2012.

Figure II-12. US Offshore Crude Oil Production by Crude Type [329]

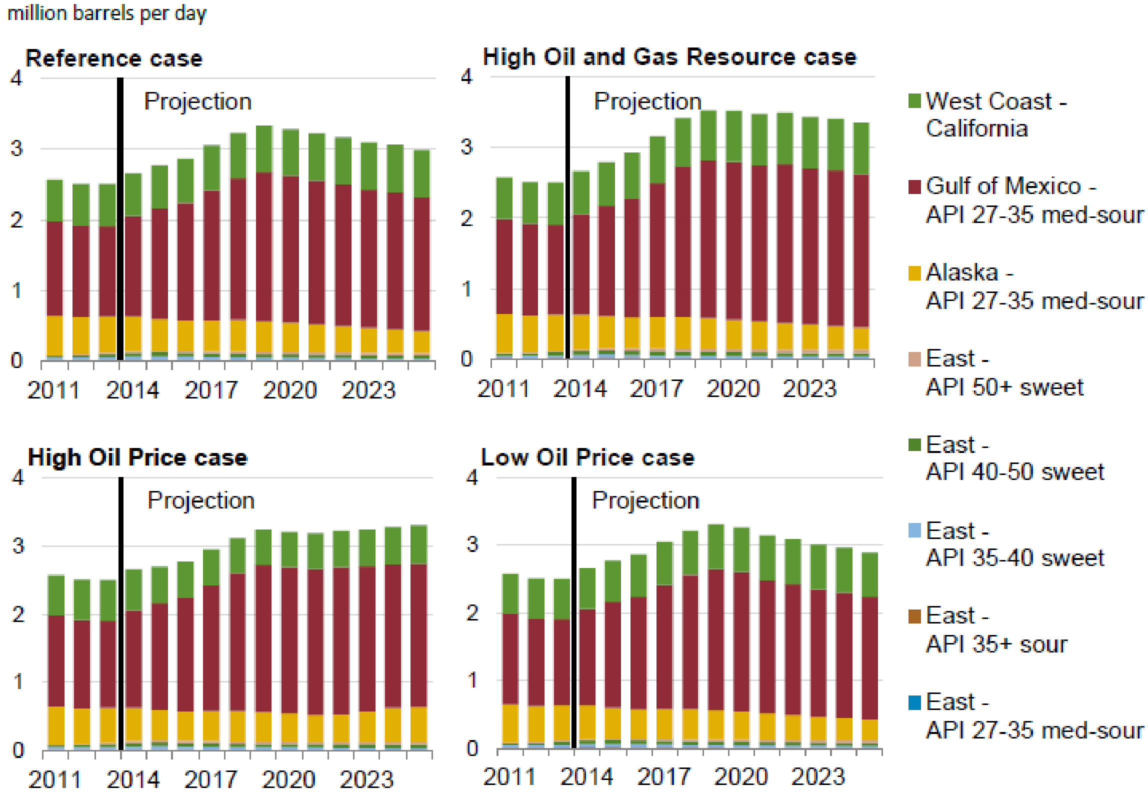


Table II-6. Crude Oil Imports to U.S. Gulf of Mexico States by State and Oil Type (in million gallons [Mgal]) [330]

	2009 (Mgal)	2010 (Mgal)	2011 (Mgal)	2012 (Mgal)	2013 (Mgal)	2014 (Mgal)
Alabama	**2,538**	**2,362**	**2,274**	**1,208**	**942**	**2,874**
Heavy Sour	289	349	961	671	703	2,715
Heavy Sweet	0	0	0	0	0	39
Light Sweet	1,470	1,292	542	137	0	0
Medium	780	721	771	399	239	120
Florida	**11**	**0**	**0**	**11**	**0**	**0**
Heavy Sour	11	0	0	11	0	0
Louisiana	**51,256**	**55,003**	**50,485**	**43,116**	**34,683**	**29,127**
Heavy Sour	17,468	17,424	16,180	14,520	12,497	12,322
Heavy Sweet	1,603	1,138	1,974	1,892	2,149	1,430
Light Sour	906	1,375	2,675	3,947	1,954	775
Light Sweet	6,871	8,753	6,213	3,695	1,008	81
Medium	24,408	26,313	23,443	19,060	17,075	14,518
Mississippi	**10,082**	**9,165**	**9,110**	**8,257**	**7,558**	**4,792**
Heavy Sour	8,222	6,991	7,300	7,034	6,871	3,976
Heavy Sweet	83	0	0	0	0	0
Light Sour	0	0	0	114	61	0
Light Sweet	569	406	858	141	4	0
Medium	1,208	1,768	952	968	623	816
Texas	**93,245**	**99,040**	**87,997**	**82,220**	**69,162**	**63,617**
Heavy Sour	39,840	42,622	41,664	40,598	38,919	41,039
Heavy Sweet	1,534	2,681	1,638	1,167	1,223	591
Light Sour	7,085	10,132	8,674	6,611	3,655	636
Light Sweet	17,397	16,880	8,245	4,750	809	206
Medium	27,388	26,725	27,775	29,094	24,556	21,145
Grand Total	**157,132**	**165,570**	**149,866**	**134,811**	**112,345**	**100,410**

Data distributed in short tons; "Mgal" calculated using average oil density of 6.8bbl/ton

There are no crude oil refineries in Federal Region 4 Atlantic states (Table 4-5); therefore, there is no significant transport of crude oil to these states. However, there are large refineries in northeast U.S. states that receive imports of foreign oil that are transported in shipping lanes near Region 4 southern states. A count of imported oils from South American countries to the U.S. northeast in Table II- shows that a majority of these oils are heavy sour crudes (Table II- is a sample that is limited strictly to countries in Central America and the South American continent; it does not consider eastern sources that may be transported through the Panama Canal).

Table II-7. Crude Oil Imports to U.S. Atlantic States from Central and South America (which Transit Offshore from Federal Region 4 Atlantic States) by Oil Type (in million gallons [Mgal]) [330]

	2009 (Mgal)	2010 (Mgal)	2011 (Mgal)	2012 (Mgal)	2013 (Mgal)	2014 (Mgal)	Total (Mgal)
Heavy Sour	1,917	1,150	847	959	757	527	6,157
Heavy Sweet	86	50	175	0	33	55	400
Light Sour	0	0	23	23	12	92	150
Light Sweet	45	68	28	40	10	2	194
Medium	204	46	21	19	69	409	768
Grand Total	**2,253**	**1,315**	**1,094**	**1,041**	**881**	**1,086**	**7,670**

Data distributed in short tons; “Mgal” calculated using average oil density of 6.8 bbl/ton

III. D. Oil Transport Vessels

Transport of waterborne commerce of oil and petroleum products is conducted with self-propelled tankers and non-self-propelled barges. Beginning January 1, 2010, single hull vessels were no longer permitted to transport oil on waters subject to jurisdiction of the United States (46 U.S.C. §3703) and by January 1, 2015, this phase out included vessels with only double bottoms or double sides. Additionally, transport of oil by barge in open water and outside of state jurisdictional waters (within the proposed dispersant preauthorization *Green Zone*) are likely to be shipped within a *deep draft*[63] double hulled tank barge which narrows the available fleet of vessels.

Of the 40,000 U.S.-flagged commercial vessels currently operating (as of 2013), less than 0.2% are self-propelled tankers while almost 12% are tank barges (Figure II-13). Of the 4,694 U.S.-flagged tank barges, 75% are certified are double-hulled and are eligible to transport oil after January 1, 2015. Overall, only 201 U.S.-flagged commercial vessels are deep draft barges (Figure II-14) and are likely to be transporting oil on open water beyond state jurisdictional waters.

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[63] The term “deep draft” is defined by US Army Corps WTLUS as a loaded vessel draft greater than 14 feet

Figure II-13. Summary Count of U.S. Flag Vessels Operating or Available by Type in 2013 [331]

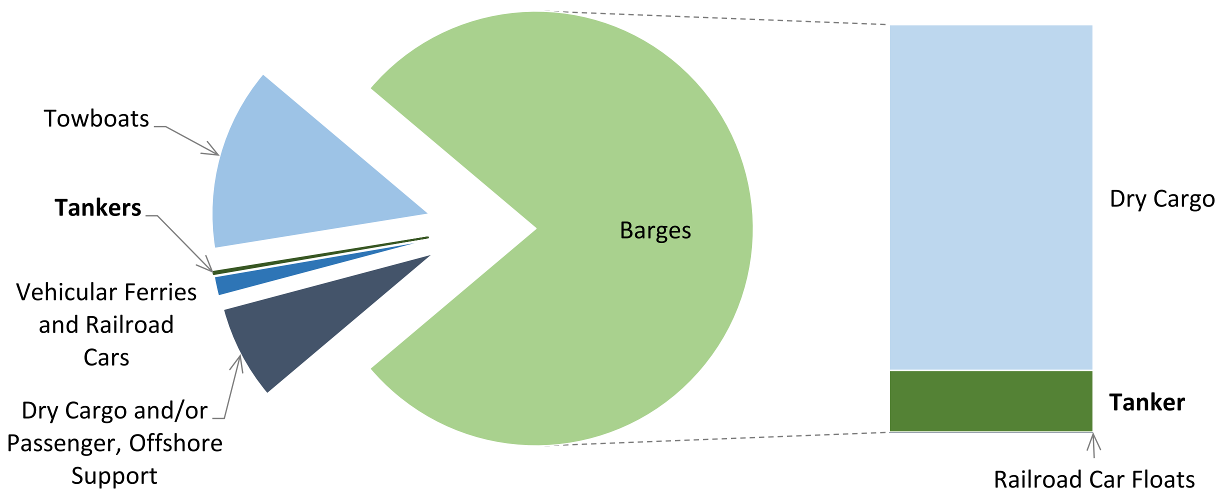
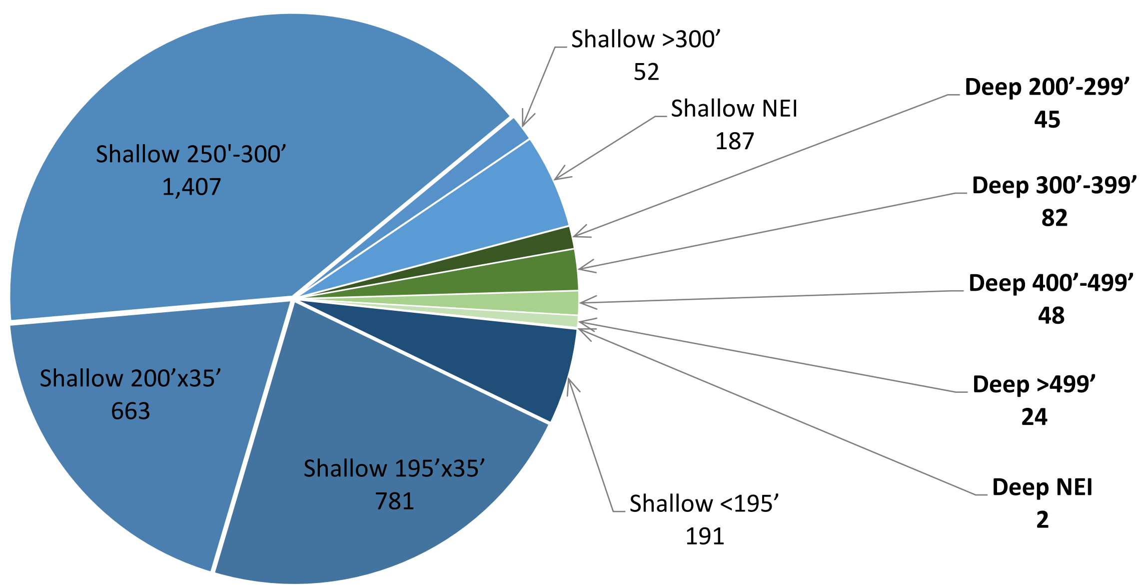


Figure II-14. Summary Count of U.S. Double-Hull Tank Barge Fleet by Size in 2013 [331]



Despite being just 5.8% of the double-hulled tank barge fleet for U.S.-flagged commercial vessels, deep draft barges account for 26% of the total double-hulled tank barge capacity (Figure II-15). This is due to the fact that deep draft double-hulled barges are significantly longer and larger than shallow draft tank barges (Figure II-16). Deep draft tank barges are not less than 200 feet in length and can be longer than 500 feet in length; nearly half of the fleet is approximately 300-399 feet in length and has an average capacity of 11,920 tons (ca. 3.4 million gallons of oil[64]).

Figure II-15. Summary Total Capacity (in Tons) of U.S. Double-Hull Tank Barge Fleet by Size in 2013 [331]

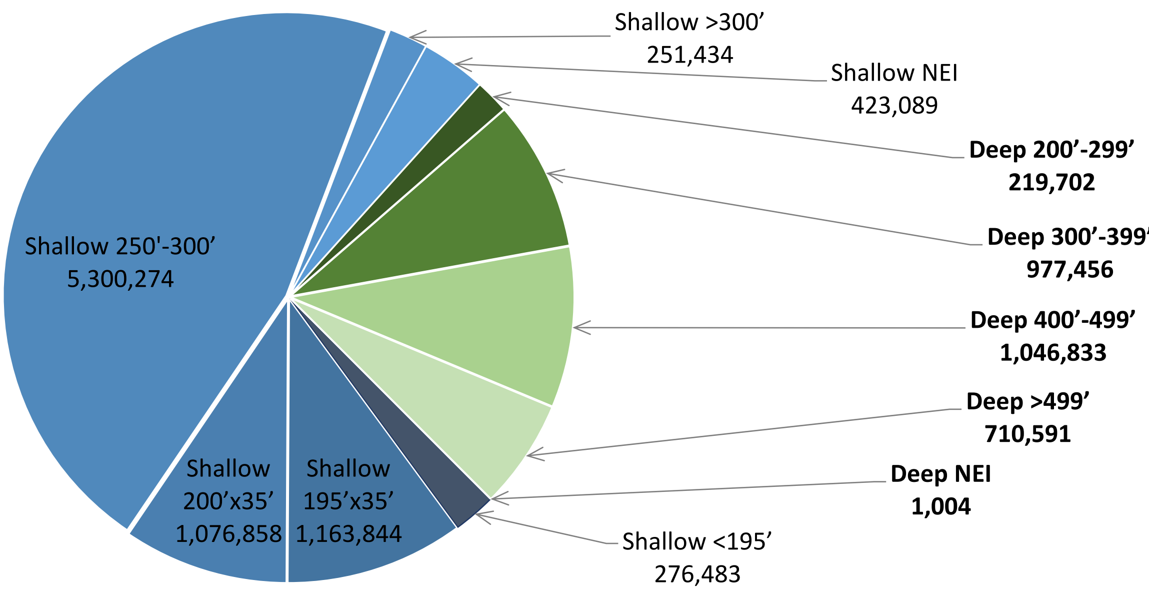
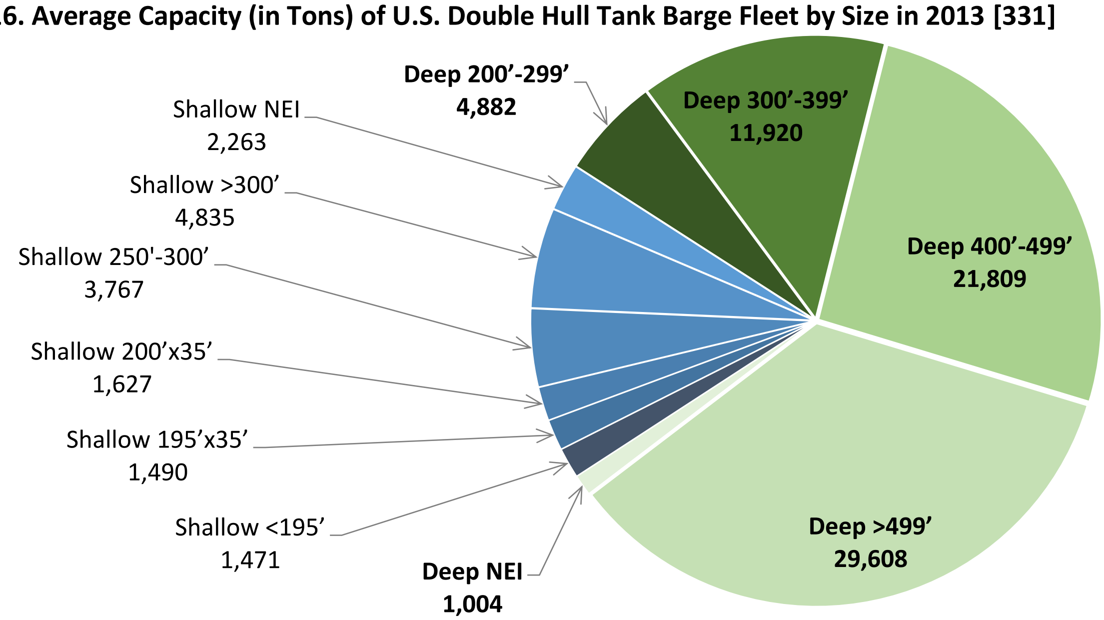


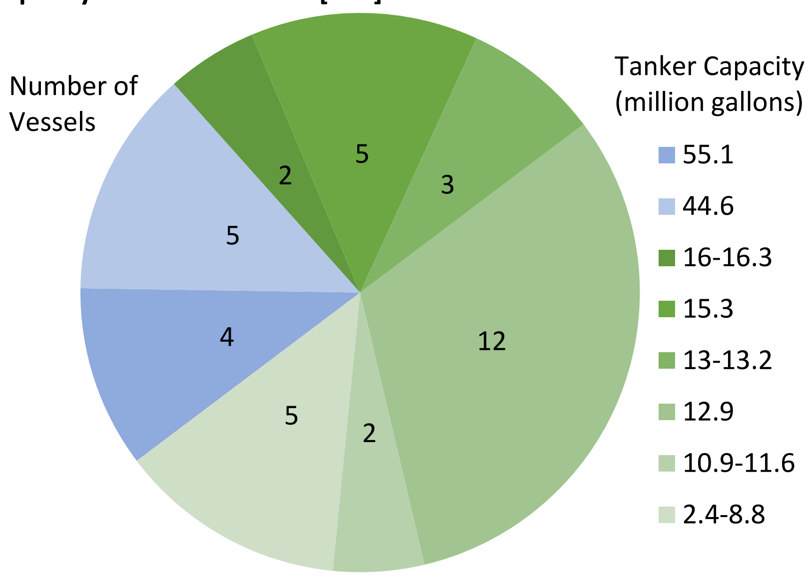
Figure II-16. Average Capacity (in Tons) of U.S. Double Hull Tank Barge Fleet by Size in 2013 [331]



[64] Calculation from short tons to gallons uses a generic average for medium crude oil of 6.8 bbl/ton

The 2013 count of U.S.-flagged commercial self-propelled petroleum tankers (Figure II-17) includes 38 vessels. The nine largest vessels (capacity range: 44.6 to 55.1 Mgal) are exclusively utilized in Pacific transportation routes and primarily used for oil produced in the State of Alaska. The most common tankers that may be seen in the Gulf and Atlantic are those of the 15.3 Mgal and 12.9 Mgal size, respectively.

Figure II-17. Summary Count of U.S. Petroleum Tankers Sorted by Capacity in Million Gallons [332]



Data distributed in short tons; "Mgal" calculated using average oil density of 6.8bbl/ton

III. E. Dispersant Use Scenarios

The conceptual design for dispersant use scenarios in Federal Region 4 is based on the types and locations of oil activity, and the type and location of vessels being used to transport that oil. Unrefined crude oil activity around Region 4 is limited primarily to Mississippi and Alabama, with some transportation occurring near the most eastern reaches of the Atlantic states. Crude oil activity for domestic offshore production consists mainly of medium sour crudes (API of 27-35) and foreign imports consists mainly of heavy sour crude (API < 27). Both medium and heavy crude oils are candidates for dispersant application though dispersibility of heavy crude oil may be have a short window of effectiveness due to increases in oil viscosity as the spilled oil weathers. Light petroleum products such as gasoline and diesel fuel are likely to evaporate and naturally disperse due to turbulence generated by wave action and currents in the event of a large discharge and are not necessarily considered candidates for dispersant use. Heavier petroleum products, such as crude oil and No. 6 fuel oil, are more likely candidates for dispersant use and the waterborne transport of fuel oil is sufficiently widespread throughout the Region to consider planning for a discharge event of this material.

A scenario involving heavy crude oil off of Mississippi was selected to reflect commerce relating to refineries in Mississippi and Alabama. A scenario involving heavy crude further offshore from North Carolina was selected to reflect oil commerce from foreign imports to refineries in the northeast United States. Scenarios involving No. 6 fuel oil were selected near Tampa Bay and Savannah and Charleston to reflect fuel oil commerce activity near the busiest locations for this material; another scenario for fuel oil was added near Key West due to the high density of fuel oil being transported around the southern end of Florida enroute to east coast harbors.

In determining the potential spill volume for scenarios in Federal Region 4, consideration was given to the Oil or Hazardous Material Pollution Prevention Regulation for Vessels Tank Vessel Response Plans (TVRP) for Oil (33 CFR §155.1010-1070) which provides a definition for Maximum Most Probable Discharge (MMPD) and Worst Case Discharge (WCD) (33 CFR §155.1020). For TVRPs, MMPD is a 2,500 bbl (105,000 gal) discharge from a vessel with a capacity greater than 25,000 bbl (1,050,000 gal) or 10% of a vessel's oil cargo for those with a capacity less than 25,000 bbl (1,050,000 gal); a WCD is a loss of a vessel's entire oil cargo under adverse weather conditions. Both tankers and deep draft barges in Federal Region 4 are capable and likely to be carrying oil cargos in excess of 1 million gallons. However, where the most common barge capacity may likely to be approximately 3.4 million gallons (Figure II-16 and Figure II-15), the most common tanker capacity may likely to be approximately 12.9 or 15.3 million gallons (Figure II-17).

Scenarios for crude oil were assumed to occur in self-propelled tanker ships and assigned a discharge volume of 1 million gallons, which is more than the MMPD but is less than the WCD. One million gallons reflects the severity of the incident and the potential spill volume. Scenarios for No. 6 fuel oil were assumed to occur in deep draft tank barges and assigned a discharge volume of 100,000 gallons which is concurrent with the MMPD value.

Dispersant Use Scenarios were evaluated using NOAA's Dispersant Mission Planner[65] (DMP2) and recently updated dispersant capability and stockpile status information updated in Section 0. Results from the evaluation are provided in Table II-. COREXIT EC9500A is the only dispersant readily available near Federal Region 4 (

Table 2-1), and MSRC appears to have the closest resources staged near the proposed scenario locations. Customary spray ratios and application rates of 1:20 (dispersant:oil) and 5 gal/acre, respectively, were used but a higher application rate of 10 gal/acre was added to consider difficult dispersant scenarios under high viscosity conditions. The maximum treated oil capability exceeded the discharge volume in two of the five scenarios, meaning that the entire discharge from those scenarios could be dispersed inside the 12-hour operational period, if deemed necessary.

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[65] http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/response-tools/dispersant-mission-planner-dmp2.html

Table II-8. Dispersant Use Scenarios Based on Possible Oil Discharge Events in Federal Region 4

Scenario Name	Water body	Source	Oil Type	Volume (gal)	Distance Offshore (miles)	Location Offshore	Platform	Deployment Location	Cascade Location	Transit Distance (nautical miles)	Spray Ratio	Application Rate (gal/acre)	Pass Length (nautical miles)	Operating Hours (not including Cascade)	Cascade Hours	Max Dispersant Delivery (gallons)	Max Treated Oil (gallons)	Max Treated Area (acres)	Immediate Dispersant Available	Cascade Dispersant Available
Gulf Large	Gulf	Tanker Ship	Heavy Weight Crude	1 Mil	15	From barrier islands between Mississippi and Alabama	C-130A	Kiln, MS	None	65	1:20	5	5	12	0	19,500	390,000	3,900	16,009-gal EC9500A in Kiln, MS	11,550-gal in Galveston, TX can arrive in <8 hrs
Gulf Large High Application												10				22,750	454,986	2,298		
Gulf Small Long Cascade	Gulf	Barge	No. 6 Fuel Oil	100,000	120	From Key West, FL	C-130A	Kiln, MS	540 mi to Key West	120	1:20	5	2	8.9	3.1	10,169 (only 9,520 available)	203,000	2,034	3,250-gal EC9500A on aircraft	990-gal in Miami, FL can arrive in <4hrs; 5,280-gal in Tampa, FL can arrive in <8hrs
Gulf Small Long Cascade High Application												10				13,000 (only 9,520 available)	259,980	1,313		
Gulf Small	Gulf	Barge	No. 6 Fuel Oil	100,000	50	From Tampa Bay	C-130A	Kiln, MS	390 mi to Tampa	75	1:20	5	2	9.4	2.6	13300 (only 9,520 available)	260,000	2,600	3,250-gal EC9500A on aircraft	5,280-gal in Tampa, FL; 990-gal in Miami, FL can arrive in <6hrs
Gulf Small High Application												10				16,250 (only 9.520 available)	324,996	1,641		
Atlantic Small	Atlantic	Barge	No. 6 Fuel Oil	100,000	50	From shore between Savannah and Charleston	Beechcraft King Air BE-90A	Salisbury, MD	450 mi to Savannah	60	1:20	5	2	8.1	3.9	2,550	51,000	510	425-gal EC9500A on aircraft	6,930-gal in Savannah
Atlantic Small High Application												10 (requires low speed)				2,975	59,514	301		
Atlantic Large	Atlantic	Tanker Ship	Heavy Weight Crude	1 Mil	140	From boundary waters of North Carolina	C-130A	Kiln, MS	820 mi Salisbury	210	1:20	5	5	8	4	9,750	195,000	1,950	3,250-gal EC9500A on aircraft	330-gal in Salisbury, MD; 9,910-gal in Chesapeake City, MD can arrive in <3hrs
Atlantic Large High Application												10				9,750	195,006	985		

Appendix III. Summary of Listed Species, Critical Habitats, and Essential Fish Habitat Considered in this Assessment

The following tables offer a summary of listed species, critical habitats, and essential fish habitat & habitat areas of particular concern used in this assessment. This table not only provides a quick reference listing of the species, their status, and critical habitats, but also conveys to users a quick reference location of such species and habitats as it relates to the local Area Committee's area of responsibility. The RRT4 welcomes all updates to these summaries, which will prompt consideration for further updates to this biological assessment, including the addition of new conservation measures.

Table III-1. Summary of Listed Species considered in this Assessment under the Jurisdiction of the National Marine Fisheries Service in the *Green Zone*

Species	Status	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
Marine Mammals									
Sperm Whale	E	X	X	X	X	X	X	X	X
North Atlantic Right Whale	E			X	X	X	X	X	X
Humpback Whale	E	X	X	X	X	X	X	X	X
Fin Whale	E	X	X	X	X	X	X	X	X
Sei Whale	E	X	X	X	X	X	X	X	X
Brydes Whale	C	X	X	X	X	X	X	X	X
Sea Turtles									
Kemp's ridley	E	X	X	X	X	X	X	X	X
Green Sea Turtle	T	X	X	X	X	X	X	X	X
Loggerhead Sea Turtle Northwest Atlantic DPS	T	X	X	X	X	X	X	X	X
Leatherback Sea Turtle	E	X	X	X	X	X	X	X	X
Hawksbill Sea Turtle	E	X	X	X	X	X	X	X	X
Fish									
Smalltooth sawfish U.S. DPS	E	X	X	X	X	X	X	X	X
Gulf Sturgeon	T	X	X						
Scalloped Hammerhead Central & Southwest DPS	E	X	X	X	X	X	X	X	X
Atlantic Sturgeon Carolina DPS	E						X	X	X
Atlantic Sturgeon South Atlantic DPS	E				X	X	X	X	X
Shortnose Sturgeon	E				X	X	X	X	X
Nassau Grouper	C			X	X	X	X	X	X
Coral									
Elkhorn Coral	T			X	X				
Staghorn Coral	T			X	X				
Rough Cactus Coral	T		X	X	X	X			
Mountainous Star Coral	T		X	X	X	X			
Lobed Star Coral	T		X	X	X	X			
Pillar Coral	T		X	X	X	X			

Species	Status	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
Boulder Star Coral	T		X	X	X	X			
Seagrass									
Johnson's Seagrass	T				X				
E – Endangered T – Threatened C – Candidate									

Table III-2. Summary of Designated Critical Habitat considered in this Assessment under the Jurisdiction of the National Marine Fisheries Service

Species	Status	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
WITHIN THE *GREEN ZONE*									
Marine Mammals									
West Indian Manatee	E	X	X	X	X	X	X	X	X
Fish									
Gulf Sturgeon	T	X	X						
Birds									
Red Knot	E	X	X	X	X	X	X	X	X
Roseate Tern	E	X	X	X	X	X	X	X	X
E – Endangered T – Threatened C – Candidate									

Table III-3. Summary of Listed Species considered in this Assessment under the Jurisdiction of the U.S. Fish and Wildlife Service

Species	Status	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
WITHIN THE *GREEN ZONE*									
Marine Mammals									
West Indian Manatee	E	X	X	X	X	X	X	X	X
Fish									
Gulf Sturgeon	T	X	X						
Birds									
Red Knot	E	X	X	X	X	X	X	X	X
Roseate Tern	E	X	X	X	X	X	X	X	X
E – Endangered T – Threatened C – Candidate									

Table III-4. Summary of Critical Habitat considered in this Assessment under the Jurisdiction of the U.S. Fish and Wildlife Service

Species	Status	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
WITHIN THE *GREEN ZONE*									
None identified.									
E – Endangered T – Threatened C – Candidate									

Table III-5. Summary of Essential Fish Habitat Areas of Particular Concern considered in this Assessment managed by the SAFMC, GMFMC, and NMFS

Essential Fish Habitat	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
South Atlantic Fisheries Management Council									
Essential Fish Habitat of the SAFMC									
Water Column				X	X	X	X	X	X
Sargassum				X	X	X	X	X	X
Coral Reefs and Coral Communities				X	X	X	X	X	X
Deepwater Coral				X	X	X	X	X	X
Live/Hard Bottom				X	X	X	X	X	X
Marine Soft Bottom				X	X	X	X	X	X
Seagrasses				X	X	X	X	X	X
Oyster Reefs				X	X	X	X	X	X
Artificial Reefs				X	X	X	X	X	X
EFH - Habitat Areas of Particular Concern of the SAFMC									
All areas within the EEZ that contain *Sargassum* population				X	X	X	X	X	X
Documented sites of spawning aggregations in NC, SC, GA, and FL described in the Habitat Plan; other spawning areas identified in the future; habitats identified for submerged aquatic vegetation				X	X	X	X	X	X
The Point									X
The Ten Fathom Ledge							X		X
Big Rock									X
Charleston Bump							X		
Seagrass Habitat; oyster shell habitat; pelagic and benthic *Sargassum*				X	X	X	X	X	X
Hoyt Hills							X		X
Hermatypic coral habitats and reefs				X	X	X			
Manganese outroppings on the Blake Plateau				X	X	X	X	X	X
Council designated Artificial Reef Special Management Areas (SMZs).				X	X	X	X	X	X
Sandy shoals of Capes Lookout, Cape Fear, and Cape Hatteras from shore to the ends of the respective shoals, but shoreward of the Gulf Stream							X		X
Hurl Rocks							X		
The Point off Jupiter Inlet					X				
The Hump off Islamorada, Florida				X					
The Marathon Hump off Marathon, Florida				X					
The “Wall” off of the Florida Keys				X					
Pelagic *Sargassum*				X	X	X	X	X	X
Big Rock									X
Gray’s Reef National Marine Sanctuary								X	

Essential Fish Habitat	All	MOB	STP	KYW	MIA	JAX	CHA	SAV	NC
Offshore (530 meter; 15-90 feet) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks					X	X			
Georgetown Hole							X		
Oculina Bank					X	X		X	
Satellite Oculina Bank HAPC #1					X	X		X	
Satellite Oculina Bank HAPC #2					X	X		X	
Gulf of Mexico Fisheries Management Council									
Essential Fish Habitat of the GMFMC									
Pelagic (Water Column)		X	X	X					
Shelf Edge/Slope		X	X	X					
Coral Reefs		X	X	X					
Submerged Aquatic Vegetation (including seagrasses and benthic algae)		X	X	X					
Hard Bottom		X	X	X					
Soft Bottom		X	X	X					
Oyster Reefs		X	X	X					
Drift Algae (*Sargassum*, pelagic *Sargassum* community)		X	X	X					
EFH – Habitat Areas of Particular Concern of the GMFMC									
Florida Middle Grounds			X	X					
Tortugas South				X					
Madison-Swanson Marine Reserve			X	X					
Pulley Ridge			X	X					
National Marine Fisheries Service									
Essential Fish Habitat of the NMFS									
***Same as EFH of the SAFMC and GMFMC.**									
EFH – Habitat Areas of Particular Concern of the NMFS									
Gulf of Mexico (Highly Migratory Species)		X	X	X					

Appendix IV. Conservation Measures

Dispersant Use Preauthorization Plan (DUPP) Protocols

The Regional Response Team 4 (RRT4) Dispersant Use Preauthorization Plan (DUPP) contains protocols which must be followed as part of the conditions for preauthorization. These requirements can be regarded as initial control measures developed in consideration of a dispersant operation. These control measures are then augmented by the conservation measures developed in consideration of the potential biological impacts.

Conservation/Protection Measures identified during the Biological Assessment

Additional recommended measures must be taken to prevent risk of any injury to wildlife, especially endangered or threatened species; critical habitat; and essential fish habitat are to be identified through the formal consultation process. The conservation measures provided in Appendix IV have been identified during the construct of this Biological Assessment, in consultation with NOAA, NMFS, USFWS, SAFMC, GMFMC, EPA, and USCG. These measures must be employed where the conditions identified by the service agency apply. These conservation measures can be added to regional & area contingency plans, operational plans, incident action plans, ICS-204s, Safe Work Practices, etc, as appropriate for the management of the incident.

Table IV-1. Conservation Measures for Resource Protection during Dispersant Use

ESA & EFH CONSERVATION MEASURES for DISPERSANT OPS	DUTY
Management of Dispersant Operations	
Regional & Area Contingency Plans Identifies dispersant operations checklists for decision making and organizational structure for dispersant operations at the field level, including reference to the RRT4 Dispersant Use Plan and the Selection Guide for Oil Spill Countermeasures.	FOSC RRT4
Scientific & Trustee Resource Management Support **Close coordination with NOAA Scientific Support Coordinator, trustees (DOC & DOI), and resource protection managers will occur in the development and implementation of incident specific dispersant operations in the "green zone".** All responses where dispersant use has been determined to be an effective strategy for the mitigation of oil spill impacts will involve the support of respective trustees at the local, state,	FOSC NOAA SSC RRT4

ESA & EFH CONSERVATION MEASURES for DISPERSANT OPS	DUTY
and federal level, and notably the assigned NOAA scientific support coordinator for the response; and will further require either a notification (within preauthorized area) or emergency consultation (not within preauthorized area) with the RRT4. When dispersant application is proposed in an area that is adjacent to or near waters less than 30 feet in depth, due consideration shall be given to the trajectory of the dispersed oil. If resources in adjacent shallow areas are at risk, consultation with the trustees must be conducted. - Within the Incident Command Post, close coordination between Planning/Environmental Unit and Operations/Dispersant Management/Team(s).	
Preauthorized Dispersants & Pre-determined Locations of Dispersant Operations Approved dispersants may be used in designated preapproved zones in the RRT4 area of operation, which includes marine waters off the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi out to the Exclusive Economic Zone boundary. The state territorial boundary is typically 3 nautical miles, with the exception of the west coast of Florida where state waters extend out to 9 nautical miles in certain areas. Designated preapproved zones in the RRT4 are termed green or *Yellow Zone*s.	FOSC NOAA SSC RRT4 RP

Vessel Operations in support of Dispersant Operations

NOAA's Vessel Strike Avoidance Measures and Reporting for Mariners.

NOAA's Vessel Strike Avoidance Measures and Reporting for Mariners (Attachment 2) should be implemented to reduce the risk associated with vessel strikes or disturbance of protected species to discountable levels.

Safe Speed.

Operate vessels at appropriate speeds to watch for and avoid collision with wildlife, and to avoid accidental groundings. Report all turtle sightings, all distressed or dead birds, sharks, rays, and marine mammals to the appropriate incident hotline.

Clarification/Rationale – Operate all vessels at speeds that minimize the likelihood of hitting any wildlife (e.g., shorebirds, seabirds, marine mammals, nesting or hatching sea turtles) or accidentally grounding the vessel. Report distressed or dead wildlife to the appropriate agency and/or hotline. Any clearly visible band or tag numbers encountered on dead or injured birds should be reported to www.reportband.gov. Only freshly oiled intact bird carcasses should be reported to the hotline. All other bird carcasses should be left in situ. Report vessel groundings to the USCG.

Shallow Water.

If operating vessels in shallow water, avoid impacts to seagrass beds, reef or colonized hard ground. This could be an issue for some nearshore clean-up efforts

ESA & EFH CONSERVATION MEASURES for DISPERSANT OPS	DUTY
Clarification/Rationale – Minimize impacts to sensitive habitats by avoiding them to the maximum extent practicable by maintaining a distance of no less than 10 feet, and traveling through established corridors	
Daytime/Nighttime Operations Operation of vessels only during daylight hours is recommended. If nighttime operations are necessary, avoid night-time activities in identified exclusion areas to allow longer periods without disturbance to wildlife and to minimize vessel damage to within optimal habitat. In areas where sea turtle nesting is known to occur, deck lighting at night should be minimized so as not to attract sea turtle hatchlings or disorient nesting females. Lighting of night operations should be shielded to avoid attracting in-water sea turtle hatchlings to the response area.	
Clarification/Rationale – Night work increases the likelihood of accidental encounters with wildlife, as well as movement into areas with ESA-listed coral colonies. Generally, adult sea turtle nesting and egg hatching occurs at night. Nesting shorebirds and seabirds are more sensitive and prone to nest abandonment when disturbed at night.	
Navigational Routes. All vessels shall operate at "no wake/idle" speed in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels shall follow deep water routes whenever possible.	
Clarification/Rationale – The intent of this conservation measure is to avoid and minimize scouring and prop-scarring of submerged aquatic vegetation and coral habitats, as well as collision with marine mammals or other aquatic life. When not feasible, vessel operators should take all precautions to avoid impacts to submerged aquatic vegetation and coral habitats.	
Operation near shorelines. Operate in idle within 50 ft of shorelines to avoid damage from wakes. Use caution in areas where sea turtles marine mammals are frequently observed. Land or stage boats to avoid crushing the shoreline vegetation.	
Clarification/Rationale – The intent of this conservation measure is to avoid and minimize adverse impacts to important shoreline habitat during cleanup operations.	
Towing, Anchoring, Spudding. For actions such as towing of vessels, anchoring, and spudding, areas shall be selected in coordination with NMFS and based on benthic surveys, in order to minimize impacts to ESA listed species and designated critical habitat.	
Anchoring.	

ESA & EFH CONSERVATION MEASURES for DISPERSANT OPS	DUTY
Anchoring of all response vessels should be in uncolonized sand bottoms only. The installation of mooring pins or other anchor systems that eliminate the use of non-floating line and minimize impacts to bottom substrate is preferred if uncolonized sand areas are not available or are not large enough to anchor the vessels. Anchor methods and anchor and spud locations should be selected in coordination with NMFS for all response vessels associated with a particular response action. **Miscellaneous.** The response area should be surveyed daily by divers to ensure proper placement of anchors, lines, and other equipment, and to remove debris and other materials to avoid damage to ESA resources, including corals, sea turtles, and designated critical habitat. Properly tie-down or secure all equipment in designated areas to prevent accidental loss of equipment into the water. Any debris that accidentally falls into the water during response actions should be retrieved immediately. In shallow waters, in order to minimize the potential for propeller wash damage to ESA resources, the use of propulsion systems and high RPMs should be avoided. If this is not possible, then areas for these operations should be selected in coordination with NMFS and based on benthic surveys of the site.	
Sea Turtles and Marine Mammals within 100 yards. If a sea turtle or marine mammal is observed, all appropriate precautions shall be implemented to ensure its protection. Precautions may include possible delay of the operation, or implementation of hazing, moving or other strategies in consultation with the appropriate resource protection manager. If practicable, vessel operations should cease if a marine mammal approaches within 100 yards of the vessel until the marine mammal moves away from the operational area of its own volition.	
Collision with Marine Mammal or Sea Turtle Any collision with and/or injury to a marine mammal or sea turtle shall be reported immediately to the NMFS Southeast Regional Office by email (takereport.nmfsser@noaa.gov), using the attached Ship Strike Reporting form (Attachment 3).	
Manatee Collision or Stranding Any collision with or stranding of a manatee should be reported to USFWS and applicable U.S. State trustee, department of wildlife or natural resources. In addition, the local authorized sea turtle and marine mammal stranding/rescue organizations should also be notified.	
Survey Flights in support of Dispersant Operations	

ESA & EFH CONSERVATION MEASURES for DISPERSANT OPS	DUTY
Pre-action On-Site Survey Flight When possible and/or advised by the Natural resource trustees, from DOI, DOC, or the affected State(s) or their associated resource management agencies or other designee they select, will provide a natural resource specialist to survey the dispersant application area(s) for presence of resources of concern, and to observe and document the results and any effects that may influence continued or modified dispersant use. At a minimum, SMART Tier 1 protocols must be implemented during any dispersant operations. The FOSC will use recommended monitoring procedures provided in Appendix H of the DUPP of this plan. When possible, natural resource trustees will provide a specialist in surveying of marine mammals/turtles and pelagic/migratory birds. On-site surveys will be discussed with appropriate federal, state, and local trustees; measures will be taken to prevent impacts to wildlife, especially threatened and endangered species, listed critical habitats, and essential fish habitats.	FOSC RP NOAA SSC
Survey Flights during Dispersant Operations Survey flights in the area of application will be conducted in accordance with the Air Operations Branch within the incident command system, and all operational guidance and site safety plan during dispersant operations.	FOSC RP
Air Operations Best Management Practices Avoid hovering or landing of aircraft near posted or known bird sites. Similarly, avoid hovering aircraft at low altitudes over known protected bird sites. Consider proximity of bird locations when selecting take-off and landing sites. Clarification/Rationale – Hovering or landing aircraft will flush adult birds from nests, leaving chicks or eggs vulnerable to the elements and predators; or may alter vital behaviors such as roosting, foraging, courtship, and nest-site selection. Operating aircraft within close proximity to birds increases the potential for aircraft strikes that kill birds and endanger aircraft and crews. Unless previously authorized, overflights to identify locations of oiled wildlife should not fly below 500 feet over Wildlife Refuges, Management Areas, bird rookeries, or National Parks without prior authorization from the land manager or Natural Resource Trustee. Unless previously authorized, all other aircraft are requested to maintain a minimum altitude of 2,000 feet above the surface of lands and waters of such areas. Federal Aviation Administration (FAA) Advisory Circular (AC 91-36C), "Visual Flight Rules (VFR) Near Noise Sensitive Areas," defines the surface as: the highest terrain within 2,000 feet laterally of the route of flight, or the uppermost rim of a canyon or valley.	FOSC RP

ESA & EFH CONSERVATION MEASURES for DISPERSANT OPS	DUTY
All aircraft flying over water are to be aware of marine mammals/sea turtles, and report sightings in accordance with the DUPP. Note: Dead wildlife spotted from aircraft should be reported to the appropriate agency and/or hotline.	
Marine Mammals and Sea Turtles	
Watch for marine mammals and sea turtles while operating vessels or aircraft involved directly or in support of dispersant operations. Record and report each sighting event, including GPS location, species (if known) and description of the encounter in accordance with DUPP.	FOSC NOAA SSC RP
0.5 NM (1,000 yard) Avoidance of Marine Mammals and Sea Turtles No approved dispersant application operations should be conducted within 0.5 nautical miles of marine mammals and sea turtles identified through aerial spotting. Avoid applications such that spray could be blown onto marine mammals or sea turtles.	FOSC NOAA SSC RP
Birds	
Watch for and avoid rafting or flocking birds while operating vessels or aircraft involved directly or in support of dispersant operations, including when conditions can cause spray to reach rafting birds. Record and report each sighting event, including GPS location, species (if known) and description of the encounter in accordance with DUPP.	FOSC US FWS RP
0.5 NM (1,000 yard) Avoidance of rafting birds No approved dispersant application operations should be conducted within 0.5 nautical miles of rafting birds.	FOSC US FWS RP
West Indian Manatee	
Awareness	FOSC

ESA & EFH CONSERVATION MEASURES for DISPERSANT OPS	DUTY
Instruct all personnel associated with vessel operations of the potential presence of manatees and the need to avoid collisions, or to the extent possible, close proximity, to manatees. All personnel are responsible for observing water-related activities for the presence of manatees. If manatees are seen within 100 yards, all appropriate precautions shall be implemented to ensure their protection.	NOAA SSC US FWS RP
Manatees within 50 feet or if contact seems likely or imminent. As a general precaution, no operation of any moving equipment within 50 feet of a manatee, or if contact seems likely or imminent. Activities will not resume until the manatee(s) has departed the project area on its own, or by direction from the appropriate resource protection manager.	FOSC NOAA SSC US FWS RP
Collisions with Manatee Any collision with and/or injury to a manatee shall be reported immediately to the appropriate resource manager in accordance with the DUPP.	FOSC NOAA SSC US FWS RP
Essential Fish Habitat	
Avoidance of Sargassum/Drift Algae When possible and practicable, avoid known or observed areas of *Sargassum*. Watch for *Sargassum*/drift algae while operating vessels or aircraft involved directly or in support of dispersant operations. Record and report each sighting event, including GPS location, species (if known) and description of the encounter in accordance with the DUPP.	FOSC NOAA SSC RP
As a standard, preauthorization for use of dispersants or chemical agents is not granted for use in, on, or over waters containing reefs; waters designated as marine reserves; mangrove areas; or waters in coastal wetlands; these cases require case-by-case consultation with prior and express concurrence of the state/commonwealth/territory and EPA, in consultation with DOC and DOI. Coastal wetlands are identified as including: Submerged algae beds (rocky or unconsolidated bottom) Submerged seagrass beds Coral reefs	FOSC NOAA SSC RP

Preauthorized *In-Situ* Burning Protocols & Protective Measures

The ISBP contains protocols which must be followed as part of the conditions for preauthorization. The protocols for preauthorized *in-situ* burning are provided in the Regional Response Team 4 (RRT4) In-Situ Burn Plan (ISBP).

The Regional Response Team 4 (RRT4) *In-Situ* Burn Plan (ISBP) contains protocols which must be followed as part of the conditions for preauthorization. These requirements can be regarded as initial control measures developed in consideration of an *in-situ* burn operation. These control measures are then augmented by the conservation measures developed in consideration of the potential biological impacts.

Conservation/Protection Measures identified during the Biological Assessment

Additional recommended measures must be taken to prevent risk of any injury to wildlife, especially endangered or threatened species; critical habitat; and essential fish habitat are to be identified through the formal consultation process. The conservation measures provided in Appendix IV have been identified during the construct of this Biological Assessment, in consultation with NOAA, NMFS, USFWS, SAFMC, GMFMC, EPA, and USCG. These measures must be employed where the conditions identified by the service agency apply. These conservation measures can be added to regional & area contingency plans, operational plans, incident action plans, ICS-204s, Safe Work Practices, etc, as appropriate for the management of the incident.

Table IV-2. Conservation Measures for Resource Protection during *In-Situ* Burn Operations

CONSERVATION MEASURE - INSITU BURN OPS	DUTY
Management of In-Situ Burning Operations	
Regional & Area Contingency Plan Identify *in-situ* burn operations checklists located within regional and area contingency plans, including RRT4 In-Situ Burn Plan for decision making and organizational structure for *in-situ* burn operations.	FOSC
Scientific & Trustee/Resource Management Support **Close coordination with NOAA Scientific Support Coordinator, trustees (DOC & DOI), and resource protection managers will occur in the development and implementation of incident specific dispersant operations in the "green zone".** All responses where *in-situ* burn operational use has been determined to be an effective strategy for the mitigation of oil spill impacts will involve the support of respective trustees at the local, state, and federal level, and notably the assigned NOAA scientific support coordinator for the	FOSC NOAA SSC

CONSERVATION MEASURE - INSITU BURN OPS	DUTY
response; and will further require either a notification (within preauthorized area) or emergency consultation (not within preauthorized area) with the RRT4. When *in-situ* burning is proposed, due consideration shall be given to the trajectory of the oil, smoke, and any burn residue considering surface, sub-surface and air transport. If resources in adjacent areas are at risk, consultation with the trustees must be conducted. - Within the Incident Command Post, close coordination between Planning/Environmental Unit and Operations/In-Situ Burn Management/Team(s) is necessary.	
Approved Chemical Agents & Pre-determined Locations of In-situ burn Operations Chemical agents listed on the NCP product schedule for *in-situ* burning may be used in designated preapproved zones in the RRT4 area of operation, which includes marine waters off the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi out to the Exclusive Economic Zone boundary. The state territorial boundary is typically 3 nautical miles seaward from any land, with the exception of the west coast of Florida where state waters extend out to 9 nautical miles seaward from any land in certain areas. Designated preapproved zones in the RRT4 are termed *green or Yellow Zones*.	FOSC RRT4 NOAA SSC
Operational Monitoring (Safety of Humans and Fish/Wildlife/Habitat)	
Operational Monitoring Requirements For safety, effects to any natural resources of concern, and for fate and transport of smoke and burn residue (including sinking of residue), operational monitoring is required. Documentation of any observable post-burn effects such as fish or wildlife mortalities or sub-lethal effects is advised. **Safety Note Regarding PM-10.** In-situ burning generates a thick black smoke that contains primarily particulates, soot, and various gases (carbon dioxide, carbon monoxides, water vapor, nitrous oxides and PAHs). The components of the smoke are similar to those of car exhaust. Of these smoke constituents, small particulates less than 10 microns in diameter, known as PM-10, (which can be inhaled deeply into the lungs) are considered to pose the greatest risk to humans and nearby wildlife. For this reason, in-situ burning is discouraged where the plume may reach any populated areas. All other areas are considered on a case-by-case basis. **Air Monitoring Plan Considerations.** Decisions to burn or not to burn oil in areas considered case-by-case are made on the basis of the potential for humans to be exposed to the smoke plume, and pollutants associated with it. PM-10 exposure is generally limited to 150 micrograms per cubic meter. Smoke plume modeling is done to predict which areas might be adversely affected. In addition, in-situ burning responses require downwind air monitoring for PM-10. Aerial surveys are also conducted prior to initiating a burn to minimize the chance that concentrations of mammals, turtles and birds are in the operational area and affected by the response. **SMART (Special Monitoring for Advanced Response Technologies) protocols are used.** SMART protocols recommend that sampling is conducted for particulates at sensitive downwind sites prior to the burn (to gather background data) and after the burn has been initiated. Data on	FOSC RP NOAA SSC

CONSERVATION MEASURE - INSITU BURN OPS	DUTY
particulate levels are recorded and the Scientific Support Team forwards the data and recommendations to the Unified Command. Readers interested in learning more about SMART protocols can visit the following site: http://response.restoration.noaa.gov/oil-and-chemical-spills/oilspills/resources/smart.html.	
Pre-action On-Site Survey Flight Prior to commencing *in-situ* burn operations, an on-site survey will be conducted for effects to any natural resources of concern, in consultation with natural resource specialists, to determine if: Any threatened or endangered species are present in the projected operation areas or otherwise at risk from operations. Any endangered species critical habitats are present in the projected application areas, and the potential increased risks associated with respective species or special features to those habitats; in order to determine if additional measures might be necessary to minimize impacts. What essential fish habitats are present in the projected application areas, in order to determine if additional measures might be necessary to minimize impacts. On-site surveys will be discussed with appropriate federal, state, and local trustees; measures will be taken to prevent impacts to wildlife, especially threatened and endangered species, listed critical habitats, and essential fish habitats. Local Area Contingency Plans, Environmental Sensitivity Indexes, and Geographic Response Plans for the area shall also be consulted to help determine what resources are present.	FOSC NOAA SSC US FWS RP
Survey Flights during In-situ burn Operations Survey flights in the area of application, in accordance with operational guidance and site safety plan, will be conducted during *in-situ* burn operations to not only evaluate effectiveness of operations, but also to identify any threatened or endangered species in the area of *in-situ* burn operations. Record and report each sighting event, including GPS location, species (if known) and description of the encounter on the Marine Species Observation Form (Attachment 1). All in-situ burn operational flights must be in accordance with and approved by the flight ops chief.	FOSC RP
Post Burn Survey A survey should be conducted in the burn area after the burn is complete.	FOSC RP

<table>
<tr><th>CONSERVATION MEASURE - INSITU BURN OPS</th><th>DUTY</th></tr>
<tr><td>Any dead sea turtles or marine mammals should be counted and collected if possible.

Contact the Environmental Unit or your supervisor to report any sea turtle or marine mammal that is impacted by burn operations or that has signs of oil impacts also report this to the Wildlife Branch as quickly as possible.

All affected wildlife shall be documented and reported to the Environmental Unit and Wildlife Branch as soon as practicable.</td><td></td></tr>
<tr><td>Air Operations Best Management Practices

All in-situ burn flights must be in accordance with and with approval from flight ops chief. All flight restrictions should be disseminated and communicated by the flight ops chief prior to any crews deploying. The Environmental Unit can assist the flight ops chief in identifying environmental restrictions, but other flight restrictions from operational or regulatory issues are also likely to be valid, including implementation of the following best management practices if applicable to the operation:

- Avoid hovering or landing of aircraft near posted or known bird sites. Clarification/Rationale – Hovering or landing aircraft will flush adult birds from nests, leaving chicks or eggs vulnerable to the elements and predators; or may alter vital behaviors such as roosting, foraging, courtship, and nest-site selection. Operating aircraft within close proximity to birds increases the potential for aircraft strikes that kill birds and endanger aircraft and crews.

- Unless previously authorized, overflights to identify locations of oiled wildlife should not fly below 500 feet over Wildlife Refuges, Management Areas, bird rookeries, or National Parks without prior authorization from the land manager or Natural Resource Trustee.

- Unless previously authorized, all other aircraft are requested to maintain a minimum altitude of 2,000 feet above the surface of lands and waters of such areas. Federal Aviation Administration (FAA) Advisory Circular (AC 91-36C), "Visual Flight Rules (VFR) Near Noise Sensitive Areas," defines the surface as: the highest terrain within 2,000 feet laterally of the route of flight, or the uppermost rim of a canyon or valley.

- All aircraft flying over water are to be aware of marine mammals/sea turtles, and report sightings.

- Dead wildlife spotted from aircraft should be reported to the appropriate agency and/or hotline.</td><td>FOSC
RP</td></tr>
</table>

CONSERVATION MEASURE - INSITU BURN OPS	DUTY
Vessel Operations in support of *In-Situ* Burning	
NOAA's Vessel Strike Avoidance Measures and Reporting for Mariners NOAA's Vessel Strike Avoidance Measures and Reporting for Mariners (Attachment 2) should be implemented to reduce the risk associated with vessel strikes or disturbance of protected species to discountable levels. Operate vessels at appropriate speeds to watch for and avoid collision with wildlife, and to avoid accidental groundings. Report all turtle sightings, all distressed or dead birds, sharks, rays, and marine mammals to the appropriate incident hotline. Clarification/Rationale – Operate all vessels at speeds that minimize the likelihood of hitting any wildlife (e.g., shorebirds, seabirds, marine mammals, nesting or hatching sea turtles) or accidentally grounding the vessel. Report distressed or dead wildlife to the appropriate agency and/or hotline. Any clearly visible band or tag numbers encountered on dead or injured birds should be reported to www.reportband.gov. Only freshly oiled intact bird carcasses should be reported to the hotline. All other bird carcasses should be left in situ. Report vessel groundings to the USCG. If operating vessels in shallow water, avoid impacts to seagrass beds, reef or colonized hard ground. This could be an issue for some nearshore clean-up efforts Clarification/Rationale – Minimize impacts to sensitive habitats by avoiding them to the maximum extent practicable by maintaining a distance of no less than 10 feet, and traveling through established corridors **Daytime/Nighttime Operations** Operation of vessels only during daylight hours is recommended. If nighttime operations are necessary, avoid night-time activities in identified exclusion areas to allow longer periods without disturbance to wildlife and to minimize vessel damage to within optimal habitat. In areas where sea turtle nesting is known to occur, deck lighting at night should be minimized so as not to attract sea turtle hatchlings or disorient nesting females. Lighting of night operations should be shielded to avoid attracting in-water sea turtle hatchlings to the response area. Clarification/Rationale – Night work increases the likelihood of accidental encounters with wildlife, as well as movement into areas with ESA-listed coral colonies. Generally, adult sea turtle nesting and egg hatching occurs at night. Nesting shorebirds and seabirds are more sensitive and prone to nest abandonment when disturbed at night. All vessels shall operate at "no wake/idle" speed in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels shall follow deep water routes whenever possible.	FOSC RP

CONSERVATION MEASURE - INSITU BURN OPS	DUTY
Clarification/Rationale – The intent of this BMP is to avoid and minimize scouring and prop-scarring of submerged aquatic vegetation and coral habitats, as well as collision with marine mammals or other aquatic life. When not feasible, vessel operators should take all precautions to avoid impacts to submerged aquatic vegetation and coral habitats. Operate in idle within 50 ft of shorelines to avoid damage from wakes. Use caution in areas where sea turtles marine mammals are frequently observed. Land or stage boats to avoid crushing the shoreline vegetation. Clarification/Rationale – The intent of this BMP is to avoid and minimize adverse impacts to important shoreline habitat during cleanup operations. For actions such as towing of vessels, anchoring, and spudding, areas shall be selected in coordination with NMFS and based on benthic surveys, in order to minimize impacts to ESA listed species and designated critical habitat. Anchoring of all response vessels should be in uncolonized sand bottoms only. The installation of mooring pins or other anchor systems that eliminate the use of non-floating line and minimize impacts to bottom substrate is preferred if uncolonized sand areas are not available or are not large enough to anchor the vessels. Anchor methods and anchor and spud locations should be selected in coordination with NMFS for all response vessels associated with a particular response action. The response area should be surveyed daily by divers to ensure proper placement of anchors, lines, and other equipment, and to remove debris and other materials to avoid damage to ESA resources, including corals, sea turtles, and designated critical habitat. Properly tie-down or secure all equipment in designated areas to prevent accidental loss of equipment into the water. Any debris that accidentally falls into the water during response actions should be retrieved immediately. In shallow waters, in order to minimize the potential for propeller wash damage to ESA resources, the use of propulsion systems and high RPMs should be avoided. If this is not possible, then areas for these operations should be selected in coordination with NMFS and based on benthic surveys of the site.	
Sea Turtles and Marine Mammals within 100 yards.	FOSC

CONSERVATION MEASURE - INSITU BURN OPS	DUTY
If a sea turtle or marine mammal is observed, all appropriate precautions shall be implemented to ensure its protection. Precautions may include possible relocation of the burn, or implementation of hazing, moving or other strategies in consultation with the appropriate resource protection manager. If practicable, vessel operations should cease if a marine mammal approaches within 100 yards of the vessel until the marine mammal moves away from the operational area of its own volition.	RP
Collision with Marine Mammal or Sea Turtle Any collision with and/or injury to a marine mammal or sea turtle shall be reported immediately to the NMFS Southeast Regional Office by email (takereport.nmfsser@noaa.gov), using the attached Ship Strike Reporting form (Attachment 3).	FOSC RP
Manatee Collision or Stranding Any collision with or stranding of a manatee should be reported to USFWS and applicable U.S. State trustee, department of wildlife or natural resources. In addition, the local authorized sea turtle and marine mammal stranding/rescue organizations should also be notified.	FOSC RP
Marine Mammals and Sea Turtles	
Watch for and avoid marine mammals and sea turtles while operating vessels or aircraft involved directly or in support of *in-situ* burn operations. Record and report each sighting event, including GPS location, species (if known) and description of the encounter. Have a trained observer (if available) or a crew member dedicated to looking for sea turtles and marine mammals during burn operations and record each sighting event, including GPS location, species (if known), and description of encounter on the Marine Species Observation Form (Attachment 1). The observer or crew member should be looking for marine mammals and sea turtles that may be affected by the burn or are impacted by oil. A survey for marine mammals/sea turtles must be conducted by the ignitor vessel by a designated observer or other personnel as assigned. The sea turtle and marine mammal observer on the ignition vessel will monitor the following areas prior to the burn: The area in front of the collection vessels, The oil concentrated in the boom, and Any oil trailing behind the boom.	FOSC RP

CONSERVATION MEASURE - INSITU BURN OPS	DUTY
Marine Species Observation Form (Attachment 1) Observers will submit a Marine Species Observation Form (Attachment 1) to the Environmental Unit RAR Specialist at the end of each burn day. If marine mammals/sea turtles are sighted in the *in-situ* burn safety zone, measures must be taken to prevent harm such as implementing sea turtle retrieval protocols, relocating the burn area, or standing down until the animals exit the area. Report distressed or dead wildlife to the appropriate agency and/or hotline. Contact the Sec 7 Resources at Risk (RAR) Specialist to report the turtle/marine mammals immediately.	
ALL STOP/Avoid Marine Mammals and Sea Turtles If possible, watch for and avoid burn operations where sea turtles or marine mammals have been spotted. If a sea turtle or marine mammal is spotted during operations, stop the operations if possible, until the animal is outside the operations area (consider moving burn location, or other strategies moving hazing in consult with resource managers.)	FOSC RP
Comatose Sea Turtles If a turtle appears to be comatose (unconscious), crews should attempt to revive it before release per 66 CFR 67495, December 31, 2001. Place the turtle on its plastron (lower shell) and elevate the hindquarters several inches to permit the lungs to drain off water. A comatose but live sea turtle may, in some cases, exhibit absolutely no movement or signs of life (no muscle reflexes). In other cases, an unconscious turtle may show some evidence of eyelid or tail movement when touched. Sea turtles may take some time to revive; do not give up too quickly. Contact the Section 7 RAR Specialist and Wildlife Group for recovery. Regulations allow holding a sea turtle on deck up to 24 hours for resuscitation purposes without a permit. Even turtles successfully resuscitated benefit from being held as long as possible to allow toxins that built up as a result of stress to dissipate from the body. Keep the skin, and especially the eyes, moist while the turtle is on deck by covering the animal's body with a wet towel, periodically spraying it with water, or by applying petroleum jelly to its skin and carapace.	FOSC RP
Sea Turtle Rescue If possible, send wildlife rescue vessels (with trained rescue personnel if available) into the projected burn area to search for and rescue turtles in accordance with the attached Sea Turtle Observer and Retrieval protocols (Attachment E.).	US FWS NOAA

CONSERVATION MEASURE - INSITU BURN OPS	DUTY
Feasibility will depend on the size of the projected area and whether material has already been boomed or otherwise collected. If conditions on the burn platform allow (e.g. size and space of vessel), without risk to human safety, collect live and dead sea turtles according to the attached Sea Turtle Retrieval Protocols.	
Deceased Sea Turtles Any dead sea turtles or marine mammals should be counted and collected if possible. Contact the Environmental Unit or your supervisor to report any sea turtle or marine mammal that is impacted by burn operations or that has signs of oil impacts also report this to the Wildlife Branch as quickly as possible.	US FWS NOAA
Birds	
Watch for and avoid rafting or flocking birds while operating vessels or aircraft involved directly or in support of dispersant operations Record and report each sighting event, including GPS location, species (if known) and description of the encounter on a standard form.	FOSC US FWS RP
Avoidance of rafting birds Do not burn areas known to contain rafting birds.	FOSC RP
West Indian Manatee	
Awareness Instruct all personnel associated with vessel operations of the potential presence of manatees and the need to avoid collisions with manatees. All personnel are responsible for observing water-related activities for the presence of manatees. If manatees are seen within 100 yards, all appropriate precautions shall be implemented to ensure their protection.	FOSC RP
Manatees within 50 feet As a general precaution, no operation of any moving equipment should occur within 50 ft of a manatee. Activities will not resume until the manatee(s) has departed the project area on its own, or upon direction of the appropriate resource protection manager.	FOSC RP
Collisions with Manatee	FOSC RP

CONSERVATION MEASURE - INSITU BURN OPS	DUTY
Any collision with and/or injury to a manatee shall be reported immediately to the FWS RAR Specialist and appropriate state trustee.	
Essential Fish Habitat	
Avoidance of Sargassum/Drift Algae If possible, avoid burning unoiled or lightly oiled *Sargassum*. Watch for *Sargassum*/drift algae while operating vessels or aircraft involved directly or in support of *in-situ* burn. Record and report each sighting event, including GPS location, species (if known) and description of the encounter.	FOSC RP
As a standard, preauthorization for use of chemical agents is not used in, on, or over waters containing reefs; waters designated as marine reserves; mangrove areas; or waters in coastal wetlands. These cases require incident specific review with the commonwealth/territory and EPA, and in consultation with DOC and DOI. Coastal wetlands are identified as including: Submerged algae beds (rocky or unconsolidated bottom) Submerged seagrass beds Coral reefs	FOSC RP

Additional Conservation/Protection Measures for Habitat Areas of Particular Concern (EFH-HAPC) - South Atlantic Fishery Management Council

The following table lists the habitats of particular concern identified by the SAFMC. Accompanying this listing are the protective measures associated with each essential fish habitat, which will be incorporated into the dispersant use and *in-situ* burn operations plans. This information is from the Essential Fish Habitat—Habitat Areas of Particular Concern (EFH-HAPC) and Coral Habitat Areas of Particular Concern (C-HAPC), South Atlantic Fishery Management Council, http://www.safmc.net/ecosystem-management/essential-fish-habitat

Table IV-3. South Atlantic Fishery Management Council Habitat Areas of Particular Concern

FMP Name	EFH-HAPC Description/Coordinates	Protection Measures *Underlined items may have nexus to Dispersant/ISB Plans.
Shrimp	All coastal inlets, all state designated habitats of particular importance to shrimp, state identified overwintering areas.	* Prohibition on trawling for rock shrimp the Oculina Bank * Mandatory use of bycatch reduction devices in the penaeid shrimp fishery * Mandatory use of Vessel Monitoring System in the rock shrimp fishery * Concurrent closure of the EEZ to penaeid shrimping if environmental conditions in state waters are such that the over wintering spawning stock is severely depleted * SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development and transportation; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.
Sargassum	All areas within the EEZ that contain *Sargassum* population (Rejected by NMFS – Council to readdress. This pelagic habitat is protected through the Fishery Management Plan for Pelagic *Sargassum* Habitat)	* Prohibition on all harvest of *Sargassum* in the EEZ south of the SC-NC border * Prohibition on all harvest of *Sargassum* in the EEZ within 100 miles of shore off North Carolina * Harvest allowed only between November and June * Total allowable catch (TAC) = 5,000 lbs landed wet weight * Official observer must be present on each *Sargassum* harvesting trip * SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development and transportation; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.
Red drum	All coastal inlets, all state designated nursery habitats of particular importance to red drum; documented sites of spawning aggregations in NC, SC, GA and FL described in the Habitat Plan; other spawning areas	* Closed to possession or harvest in or from the EEZ * SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development and transportation; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations

FMP Name	EFH-HAPC Description/Coordinates	Protection Measures *Underlined items may have nexus to Dispersant/ISB Plans.
	identified in the future; and habitats identified for submerged aquatic vegetation (SAV).	to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.
Snapper Grouper Complex	medium to high profile offshore hard bottoms where spawning normally occurs; localities of known or likely periodic spawning aggregations; nearshore hard bottom areas; The Point, The Ten Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump (South Carolina); mangrove habitat; seagrass habitat; oyster/shell habitat; all coastal inlets; all state designated nursery habitats of particular importance to snapper grouper; pelagic and benthic *Sargassum*; Hoyt Hills for wreckfish; the Oculina Bank Habitat Area of Particular Concern; all hermatypic coral habitats and reefs; manganese outcroppings on the Blake Plateau; and Council designated Artificial Reef Special Management Zones (SMZs).	<u>* Prohibition on the use of the following gears to protect habitat: bottom longlines in the EEZ inside of 50 ftm or anywhere south of St. Lucie Inlet, FL; fish traps, bottom tending (roller-rig) trawls on live bottom habitat, and entanglement gear</u> * Prohibition on the harvest or possession of all snapper grouper species in the Oculina Experimental Closed Area * Prohibition on the use of explosive charges, including powerheads, in the EEZ off South Carolina * SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development and transportation; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation * Prohibition or restriction of highly efficient and potentially damaging fishing gears that are not compatible with the intent of the SMZ permittee for the artificial reef or fish attraction device. <u>* Prohibition on take, damage and possession in the EEZ of prohibited corals (except under a federal permit for scientific, educational, or restoration purposes), wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans.</u>
Spiny lobster	Florida Bay, Biscayne Bay, Card Sound, and coral/hard bottom habitat from Jupiter Inlet, Florida through the Dry Tortugas, Florida.	* SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development and transportation; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation <u>* Prohibition on take, damage and possession in the EEZ of prohibited corals (except under a federal permit for scientific, educational, or restoration purposes), wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans.</u> <u>* Prohibition on the use of the following gears to protect habitat: bottom longlines in the EEZ inside of 50 ftm or anywhere south of St. Lucie Inlet, FL; fish traps, bottom tending (roller-rig) trawls on live bottom habitat, and entanglement gear</u>
Coastal Migratory Pelagics	Sandy shoals of Capes Lookout, Cape Fear, and Cape Hatteras from shore to the ends of the respective shoals, but shoreward of the Gulf stream; The	* Prohibition on the use of gill nets in the coastal migratory pelagics fishery * SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development

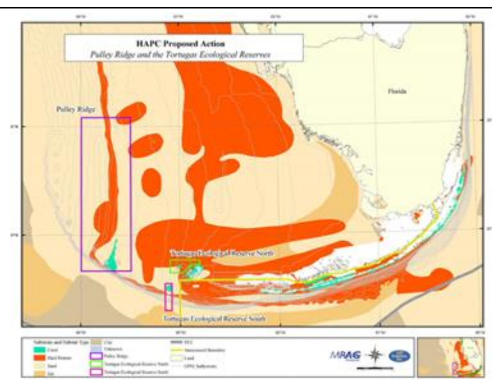
FMP Name	EFH-HAPC Description/Coordinates	Protection Measures *Underlined items may have nexus to Dispersant/ISB Plans.
	Point, The Ten-Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump and Hurl Rocks (South Carolina); The Point off Jupiter Inlet (Florida); Phragmatopoma (worm reefs) reefs off the central east coast of Florida; nearshore hard bottom south of Cape Canaveral; The Hump off Islamorada, Florida; The Marathon Hump off Marathon, Florida; The "Wall" off of the Florida Keys; Pelagic *Sargassum*; and Atlantic coast estuaries with high numbers of Spanish mackerel (Bogue Sound and New River, NC) and Cobia (Broad River, SC)	and transportation; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation * Prohibition on the use of the following gears to protect habitat: bottom longlines in the EEZ inside of 50 ftm or anywhere south of St. Lucie Inlet, FL; fish traps, bottom tending (roller-rig) trawls on live bottom habitat, and entanglement gear. * Prohibition on take, damage and possession in the EEZ of prohibited corals (except under a federal permit for scientific, educational, or restoration purposes), wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans.
Coral, Coral Reef and live/ hardbottom habitat	The Ten-Fathom Ledge, Big Rock, and The Point; Hurl Rocks and The Charleston Bump; Gray's Reef National Marine Sanctuary; The Phragmatopoma (worm reefs) reefs off the central east coast of Florida; nearshore (0-4 meters; 0-12 feet) hard bottom off the east coast of Florida from Cape Canaveral to Broward County); offshore (530 meter; 15-90 feet) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks; Biscayne Bay, Florida; Biscayne National Park, Florida; and the Florida Keys National Marine Sanctuary. Oculina Banks off the east coast of Florida from Ft. Pierce to Cape Canaveral	* Prohibition on take, damage and possession in the EEZ of prohibited corals (except under a federal permit for scientific, educational, or restoration purposes), wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans. * A toxic chemical may not be used or possessed in a coral area in the EEZ * A power assisted tool may not be used to take prohibited coral, allowable octocoral or live rock * In the Oculina Bank HAPC: prohibition on bottom longline, bottom trawl, dredge, pot or trap; prohibition on anchoring, use of an anchor and chain or grapple and chain by any fishing vessel; prohibition on fishing or possession of rock shrimp from the area; prohibition on the possession of Oculina coral; prohibition on fishing for or retention of snapper grouper species in the Experimental Closed Area (located within the HAPC). * Framework procedure to modify or establish Coral HAPCs * SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development and transportation; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation
Dolphin Wahoo	The Point, The Ten-Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump Complex and Georgetown Hole (South Carolina); The Point off Jupiter Inlet (Florida); The Hump off Islamorada, Florida; The Marathon Hump off Marathon,	* Protection of dynamic benthic habitats associated with pelagic habitat. Prohibition on the use of the following gears to protect habitat: bottom longlines in the EEZ inside of 50 ftm or anywhere south of St. Lucie Inlet, FL; fish traps, bottom tending (roller-rig) trawls on live bottom habitat, and entanglement gear.

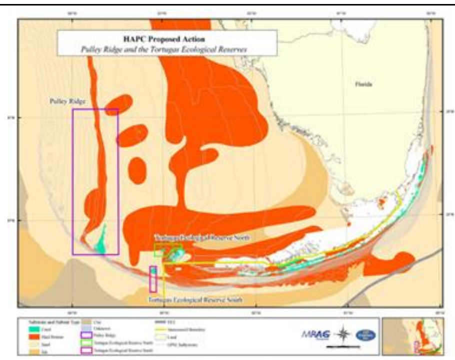
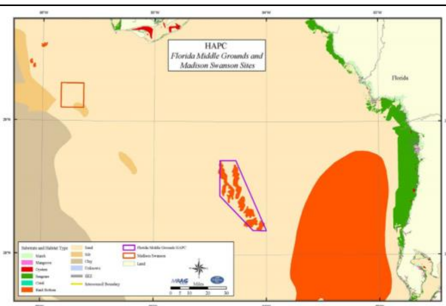
FMP Name	EFH-HAPC Description/Coordinates	Protection Measures *Underlined items may have nexus to Dispersant/ISB Plans.
	Florida; The “Wall” off of the Florida Keys.	* Prohibition on take, damage and possession of prohibited corals, wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans. * Prohibition on all harvest of *Sargassum* in the EEZ south of the SC-NC border * Prohibition on all harvest of *Sargassum* in the EEZ within 100 miles of shore off North Carolina * SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development and transportation; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.
Oculina Bank HAPC	North boundary: 28^{O}30’ N. Lat; South boundary: 27^{O}30’ N. Lat.: East boundary: 100 ftm contour; West boundary: 80^{O} 00’ W. Long.)	* Prohibition on take, damage and possession in the EEZ of prohibited corals (except under a federal permit for scientific, educational, or restoration purposes), wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans. * A toxic chemical may not be used or possessed in a coral area in the EEZ * A power assisted tool may not be used to take prohibited coral, allowable octocoral or live rock * In the Oculina Bank HAPC: prohibition on bottom longline, bottom trawl, dredge, pot or trap; prohibition on anchoring, use of an anchor and chain or grapple and chain by any fishing vessel; prohibition on fishing or possession of rock shrimp from the area; prohibition on the possession of Oculina coral; prohibition on fishing for or retention of snapper grouper species in the Experimental Closed Area (located within the HAPC). * Framework procedure to modify or establish Coral HAPCs * SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development and transportation; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation
Satellite Oculina Bank HAPC #1	North boundary: 28O30’ N. Lat.; South boundary: 28O29’ N. Lat.; East boundary: 80O 00’ W. Long.; West boundary: 80O 03’ W. Long.)	
Satellite Oculina Bank HAPC #2	North boundary: 28^{O}17’ N. Lat.; South boundary: 28^{O}16’ N. Lat.; East boundary: 80^{O} 00’ W. Long.; West boundary: 80^{O} 03’ W. Long.)	

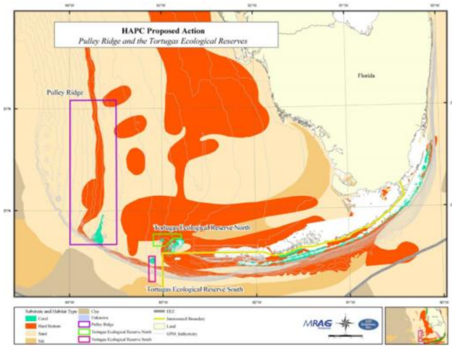
Additional Conservation/Protection Measures for Habitat Areas of Particular Concern (EFH-HAPC) – Gulf of Mexico Fishery Management Council [EPA Region 4 Only]

The following table lists the habitats of particular concern identified by the GMFMC. Accompanying this listing are the protective measures associated with each essential fish habitat, which will be incorporated into the dispersant use and *in-situ* burn operations plans. This information is from the GOMFMC Generic Amendment Number 3 for Addressing Essential Fish Habitat Requirements, Habitat Areas of Particular Concern, and Adverse Effects of Fishing. (March 2005), Gulf of Mexico Fishery Management Council pursuant to National Oceanic and Atmospheric Award No. NA03NMF4410028, http://gulfcouncil.org/Beta/GMFMCWeb/downloads/FINAL3_EFH_Amendment.pdf)

Table IV-4. Gulf of Mexico Fishery Management Council Habitat Areas of Particular Concern

HAPC Name	EFH-HAPC Description/Coordinates	Protection Measures *Underlined items may have nexus to Dispersant/ISB Plans.
Florida Middle Grounds	 Boundary Coordinates A 28 º 42.5’ 84 º 24.8’ B 28 º 42.5’ 84 º 16.3’ C 28 º 11.0’ 84 º 00.0’ D 28 º 11.0’ 84 º 07.0’ E 28 º 26.6’ 84 º 24.8’ A 28 º 42.5’ 84 º 24.8’	1. Prohibit bottom anchoring over coral reefs in HAPC (East and West Flower Garden Banks, McGrail Bank, Pulley Ridge, and North and South Tortugas Ecological Reserves) and on the significant coral resources on Stetson Bank 2. Prohibit use of trawling gear, bottom longlines, buoy gear, and all traps/pots on coral reefs throughout the Gulf of Mexico EEZ (East and West Flower Garden Banks, McGrail Bank, Pulley Ridge, and North and South Tortugas Ecological Reserves) and on the significant coral communities on Stetson Bank 3. Require a weak link in the tickler chain of bottom trawls on all habitats throughout the Gulf of Mexico EEZ. A weak link is defined as a length or section of the tickler chain that has a breaking strength less than the chain itself and is easily seen as such when visually inspected. 4. Establish an education program on the protection of coral reefs when using various fishing gears in coral reef areas for recreational and commercial fishermen.
Tortugas North	 Boundary Coordinates	

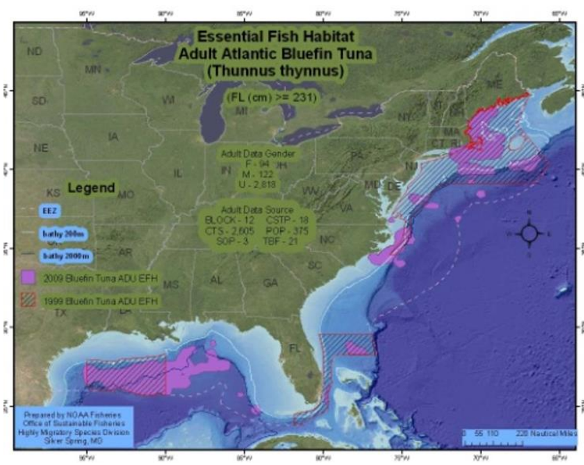
HAPC Name	EFH-HAPC Description/Coordinates	Protection Measures *Underlined items may have nexus to Dispersant/ISB Plans.
	A 24 º 40.0’ 83 º 06.0’ B 24 º 46.0’ 83 º 06.0’ C 24 º 46.0’ 83 º 00.0’ *along the line denoting the seaward limit of Florida’s waters as shown on the current edition of NOAA chart 11438 A 24 º 40.0’ 83 º 06.0’	
Tortugas South	 Boundary Coordinates A 24 º 33.0’ 83 º 09.0’ B 24 º 33.0’ 83 º 05.0’ C 24 º 18.0’ 83 º 05.0’ D 24 º 18.0’ 83 º 09.0’ A 24 º 33.0’ 83 º 09.0’	1. Prohibit bottom anchoring over coral reefs in HAPC (East and West Flower Garden Banks, McGrail Bank, Pulley Ridge, and North and South Tortugas Ecological Reserves) and on the significant coral resources on Stetson Bank 2. Prohibit use of trawling gear, bottom longlines, buoy gear, and all traps/pots on coral reefs throughout the Gulf of Mexico EEZ (East and West Flower Garden Banks, McGrail Bank, Pulley Ridge, and North and South Tortugas Ecological Reserves) and on the significant coral communities on Stetson Bank 3. Require a weak link in the tickler chain of bottom trawls on all habitats throughout the Gulf of Mexico EEZ. A weak link is defined as a length or section of the tickler chain that has a breaking strength less than the chain itself and is easily seen as such when visually inspected. 4. Establish an education program on the protection of coral reefs when using various fishing gears in coral reef areas for recreational and commercial fishermen.
Madison-Swanson Marine Reserve	 Boundary Coordinates A 29 º 17.0’ 85 º 50.0’ B 29 º 17.0’ 85 º 38.0’ C 29 º 06.0’ 85 º 38.0’ D 29 º 06.0’ 85 º 50.0’	

HAPC Name	EFH-HAPC Description/Coordinates	Protection Measures *Underlined items may have nexus to Dispersant/ISB Plans.
	A 29 º 17.0’ 85 º 50.0’	
Pulley Ridge	 <u>Boundary Coordinates</u> A 26 º 05’ B 24 º 40’ C 84 º 0’ D 83 º 30’ A 26 º 05’	

Additional Conservation/Protection Measures for Habitat Areas of Particular Concern (EFH-HAPC) – National Marine Fisheries Service [EPA Region 4 Only]

The following table lists the habitats of particular concern identified by the NMFS. Protective measures associated with each essential fish habitat are still being developed at the time this Biological Assessment was completed and these measures may be incorporated into the dispersant use and *in-situ* burn operations plans. This information is from the NMFS EFH – Gulf of Mexico Overview (National Marine Fisheries Service Southeast Region, NOAA Fisheries Service, Version: 08-2015).

Table IV-5. National Marine Fisheries Service Habitat Areas of Particular Concern

FMP Name	**EFH-HAPC Description/Coordinates**	**Protection Measures** ***Underlined items** **may have nexus to Dispersant/ISB Plans.**
Highly Migratory Species	Gulf of Mexico. The Gulf of Mexico is the only known spawning location for western Atlantic bluefin tuna. For this reason, it was designated as an EFH HAPC and is the only EFH HAPC designation for HMS in the Gulf of Mexico.  	[Under development]

Attachment A. Marine Species Observation Form

The information contained herein is confidential and should be submitted to NOAA Resources at Risk Specialist at the Environmental Unit

MARINE SPECIES OBSERVATION FORM	**ANIMALS SIGHTED: Y OR N**
	ANIMALS RETRIEVED: Y OR N
OBSERVER#:	**PAGE: OF:**
TRIP#:	**DATE (MM/DD/YY):**
SURVEY#:	**SKIMMER TYPE:**
OBSERVATION PLATFORM:	

LOCATION		
	START LAT/LONG (DD.MM.mmm)	**START TIME(24hr)**
	END LAT/LONG (DD.MM.mmm)	**END TIME(24hr)**

SOURCE □	**NON-SOURCE □**	**NEARSHORE □**	**BEACH □**

TARGET OIL	**HABITAT TYPES**	
HEAVY(dork block/brown) □	**SARGASSUM WEEDLINE: OIL: □ NO OIL: □**	**OIL LINE NO SARGASSUM: □**
MEDIUM (brown to peanut color) □	**DISPERSED SARGASSUM: OIL: □ NO OIL: □**	**OTHER: □**
LIGHT (sliver/rainbow sheen, metallic bm) □	**HEAVY CONINUOUS OIL NO SARGASSUM □**	
Emulsified (orange) □	**DISPERSED PATCHES OF OIL NO SARGASSUM □**	

LENGTH OF BOOM (FT):	**SKIRT HIEGHT (INCHES):**	
START BURN TIME (24hr):	**WEATHER DESCRIPTION:**	**VISIBILITY (FT):**
		SEA STATE:

ANIMAL OBSERVATION SUMMARY

ANIMAL TYPE	NUMBER OF ANIMALS	
	ALIVE	DECEASED
Sea turtles		
Dolphins		
Whales		
Manatees		
Sea birds		
Other (Specify):		

CRRT Best Management Practices for Oil Spill Response Operations, October, 2015
Caribbean Regional Response Team
http://www.crrt.nrt.org/production/nrt/RRTHomeResources.nsf/resources/CRRTPolicies2015/$File/CRRT_BMPs_Final_Oct_2015.pdf

The information contained herein is confidential and should be submitted to NOAA Resources at Risk Specialist at the Environmental Unit

SIGHTING AND RETRIEVALS – ADDITIONAL INFORMATION							
SPEC. #	SPECIES	CONDITION	PHOTOS (Y OR N)	LATITUDE	LONGITUDE	SURVEY PHASE	COMMENT (Y OR N)

COMMENTS (Describe any interactions with equipment, species identification, characteristics, behavioral characteristics, etc.)

SPECIMEN DELIVERY INFORMATION		
Date Specimen Delivered	Vessel/Organization Name	Name of Individual Receiving

Attachment B. Sea Turtle Handling and Resuscitation Requirements

CODE OF FEDERAL REGULATIONS

Title 50: Wildlife and Fisheries

PART 223—THREATENED MARINE AND ANADROMOUS SPECIES

Subpart B—Restrictions Applicable to Threatened Marine and Anadromous Species

§223.206 Exceptions to prohibitions relating to sea turtles.

(d) Exception for incidental taking.

(1) Handling and resuscitation requirements. (i) Any specimen taken incidentally during the course of fishing or scientific research activities must be handled with due care to prevent injury to live specimens, observed for activity, and returned to the water according to the following procedures:

(A) Sea turtles that are actively moving or determined to be dead as described in paragraph (d)(1)(i)(C) of this section must be released over the stern of the boat. In addition, they must be released only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels.

(B) Resuscitation must be attempted on sea turtles that are comatose, or inactive, as determined in paragraph (d)(1) of this section, by:

(1) Placing the turtle on its bottom shell (plastron) so that the turtle is right side up and elevating its hindquarters at least 6 in (15.2 cm) for a period of 4 up to 24 hours. The amount of the elevation depends on the size of the turtle; greater elevations are needed for larger turtles. Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about 3 in (7.6 cm) then alternate to the other side. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response.

(2) Sea turtles being resuscitated must be shaded and kept damp or moist but under no circumstance be placed into a container holding water. A water-soaked towel placed over the head, carapace, and flippers is the most effective method in keeping a turtle moist.

(3) Sea turtles that revive and become active must be released over the stern of the boat only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. Sea turtles that fail to respond to the reflex test or fail to move within 4 hours (up to 24, if possible) must be returned to the water in the same manner as that for actively moving turtles.

(C) A turtle is determined to be dead if the muscles are stiff (rigor mortis) and/or the flesh has begun to rot; otherwise the turtle is determined to be comatose or inactive and resuscitation attempts are necessary.

(ii) In addition to the provisions of paragraph (d)(1)(i) of this section, a person aboard a vessel in the Atlantic, including the Caribbean Sea and the Gulf of Mexico, that has pelagic or bottom longline gear on board and that has been issued, or is required to have, a limited access permit for highly migratory species under §635.4 of this title, must comply with the handling and release requirements specified in §635.21 of this title.

Attachment C. Sea Turtle Retrieval Protocol

CRRT Best Management Practices for Oil Spill Response Operations, October, 2015
Caribbean Regional Response Team
http://www.crrt.nrt.org/production/nrt/RRTHomeResources.nsf/resources/CRRTPolicies2015/$File/CRRT_BMPs_Final_Oct_2015.pdf

All live and dead sea turtles (includes oiled turtles) should be recorded and retrieved (if possible) and taken to an onshore facility for cleaning and rehabilitation or salvage/necropsy. Animals can be netted at the surface using dip nets or other hoists. Once on board, sea turtles need to be carefully handled and transported to shore as soon as possible, in accordance with NMFS guidance.

BE SURE TO USE APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT

(Gloves, Tyvek suits, boots, and goggles if necessary)

Sea Turtle Retrieval Kit (1 per boat) Includes:

- Large Diameter dip net
- Large Plastic Crate
- PPE (Gloves, Tyvek, goggles)
- Several beach towels

1. Bring turtle on board (dip nets are useful for small turtles less than - 3 ft length). Do not pick up turtles by their flippers, but rather, lift them by grasping both sides of the carapace. If the turtle attempts to evade capture, do not pursue. When handling turtles, be aware of the head and flippers - they will bite and have powerful flippers with claws.
2. Determine position at sea (latitude/longitude coordinates as DD.dddd).
3. Contact the RAR Sec 7 or your supervisor to report the turtle as quickly as possible.
4. Place a wet towel in the bottom of the transport crate. Place the turtle on top of the towel. Put the crate with the turtle inside in the shade. Do not add more water to the crate.
5. If the turtle appears to be dead, follow the same process but roll the towel up to raise the hind end a few inches higher than the head. Keep the crate in the shade. (Note: live turtles may appear comatose for up to 24 hours!)
6. Deliver the sea turtle (live or dead) to the designated Response Center. Transport turtles in individual containers when possible. Be sure to provide location, date and time data, and a chain of custody form with each turtle.

Attachment D. Vessel Strike Avoidance Measures and Reporting for Mariners

Vessel Strike Avoidance Measures
and Reporting for Mariners
NOAA Fisheries Service, Southeast Region

Background

The National Marine Fisheries Service (NMFS) has determined that collisions with vessels can injure or kill protected species (e.g., endangered and threatened species, and marine mammals). The following standard measures should be implemented to reduce the risk associated with vessel strikes or disturbance of these protected species to discountable levels. NMFS should be contacted to identify any additional conservation and recovery issues of concern, and to assist in the development of measures that may be necessary.

Protected Species Identification Training

Vessel crews should use an Atlantic and Gulf of Mexico reference guide that helps identify protected species that might be encountered in U.S. waters of the Atlantic Ocean, including the Caribbean Sea, and Gulf of Mexico. Additional training should be provided regarding information and resources available regarding federal laws and regulations for protected species, ship strike information, critical habitat, migratory routes and seasonal abundance, and recent sightings of protected species.

Vessel Strike Avoidance

In order to avoid causing injury or death to marine mammals and sea turtles the following measures should be taken when consistent with safe navigation:

1. Vessel operators and crews shall maintain a vigilant watch for marine mammals and sea turtles to avoid striking sighted protected species.
2. When whales are sighted, maintain a distance of 100 yards or greater between the whale and the vessel.
3. When sea turtles or small cetaceans are sighted, attempt to maintain a distance of 50 yards or greater between the animal and the vessel whenever possible.
4. When small cetaceans are sighted while a vessel is underway (e.g., bow-riding), attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until the cetacean has left the area.
5. Reduce vessel speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures should always be exercised. The vessel shall attempt to route around the animals, maintaining a minimum distance of 100 yards whenever possible.

NMFS Southeast Region Vessel Strike Avoidance Measures and Reporting for Mariners; revised February 2008. http://sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/copy_of_vessel_strike_avoidance_february_2008.pdf

6. Whales may surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel and when safety permits, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.

Additional Requirements for the North Atlantic Right Whale

1. If a sighted whale is believed to be a North Atlantic right whale, federal regulation requires a minimum distance of 500 yards be maintained from the animal (50 CFR 224.103 (c)).
2. Vessels entering North Atlantic right whale critical habitat are required to report into the Mandatory Ship Reporting System.
3. Mariners shall check with various communication media for general information regarding avoiding ship strikes and specific information regarding North Atlantic right whale sighting locations. These include NOAA weather radio, U.S. Coast Guard NAVTEX broadcasts, and Notices to Mariners. 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 NMFS Southeast Region, Protected Resources Division for more information regarding the CD).
4. Injured, dead, or entangled right whales should be immediately reported to the U.S. Coast Guard via VHF Channel 16.

Injured or Dead Protected Species Reporting

Vessel crews shall report sightings of any injured or dead protected species immediately, regardless of whether the injury or death is caused by your vessel.

Report marine mammals to the Southeast U.S. Stranding Hotline: 877-433-8299

Report sea turtles to the NMFS Southeast Regional Office: 727-824-5312

If the injury or death of a marine mammal was caused by a collision with your vessel, responsible parties shall remain available to assist the respective salvage and stranding network as needed. NMFS' Southeast Regional Office shall be immediately notified of the strike by email (takereport.nmfsser@noaa.gov) using the attached vessel strike reporting form.

For additional information, please contact the Protected Resources Division at:

NOAA Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701
Tel: (727) 824-5312
Visit us on the web at http://sero.nmfs.noaa.gov

NMFS Southeast Region Vessel Strike Avoidance Measures and Reporting for Mariners; revised February 2008. http://sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/copy_of_vessel_strike_avoidance_february_2008.pdf

Attachment E. In-Situ Burn Sea Turtle Observer Protocol

CRRT Best Management Practices for Oil Spill Response Operations, October, 2015
Caribbean Regional Response Team
http://www.crrt.nrt.org/production/nrt/RRTHomeResources.nsf/resources/CRRTPolicies2015/$File/CRRT_BMPs_Final_Oct_2015.pdf

Preferably the observer will be stationed on the ignition boat and conduct the survey from a position that optimizes visibility. A general header data collection sheet will be filled out by the observer that includes information on the time survey begins, location, sea state, a general description of the oil and habitat, and unique information to track the survey data.

A sea turtle survey includes monitoring of 3 areas prior to the burn including: 1) the area in front of the boom boats; 2) oil concentrated in the boom; and, 3) any oil trailing behind the boom. As part of the survey, observers will note the type of oil encountered during the survey, the type of habitat (e.g. sea weed or other aquatic vegetation) encountered during the survey.

Sea turtles encountered during the survey that can be removed from the oil will be captured with a dip net. The sea turtle will be boarded and the observer will provide a cursory assessment of its status. Data relative to condition, location, and survey phase will be recorded. Sea turtles will be placed in a confined urea/container and covered with a wet towel to minimize stress if the animal is alive. The sea turtle will be transported to the support vessel and the observer will notify the support vessel to arrange transport the sea turtle back to land.