Draft
Environmental Impact Statement/Overseas Environmental Impact Statement
Atlantic Fleet Training and Testing

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3.5 Habitats

HABITATS SYNOPSIS

The United States Department of the Navy considered all potential stressors that abiotic substrate as a habitat for marine life could potentially be exposed to from the Proposed Action. The following conclusions have been reached for the Preferred Alternative (Alternative 1):

- Acoustics: Acoustic stressors are not applicable to habitats, due to the fact that habitats do not have hearing capabilities, and are not analyzed further in this section.
- Explosives: Most of the high-explosive military expended materials would detonate at or near the water surface. The surface area of bottom substrate affected would be a tiny fraction of the total training and testing area available in the Study Area.
- Energy: Energy stressors are not applicable to habitats because of the lack of sensitivity of habitats and are not analyzed further in this section.
- Physical Disturbance and Strike: Most seafloor devices would be placed in areas that would result in minor and temporary bottom substrate impacts. Once on the seafloor and over time, military expended material would be buried by sediment, corroded from exposure to the marine environment, or colonized by benthic organisms. The surface area of bottom substrate affected over the short-term would be a tiny fraction of the total training and testing area available in the Study Area.
- Entanglement: Entanglement stressors are not applicable because habitats do not have the ability to become “entangled” by materials. The potential for expended material to cover a substrate is discussed under the physical disturbance and strike stressor.
- Ingestion: Ingestion stressors are not applicable because habitats lack the ability to ingest; therefore, ingestion stressors are not analyzed for habitats.
- Secondary stressors: Secondary stressors are not applicable to habitats, as they are not susceptible to impacts from secondary stressors, and are not analyzed further in this section.

3.5.1 Introduction

This chapter provides the analysis of potential impacts on marine and estuarine nonliving (abiotic) substrates found in the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area). This section provides an introduction to the abiotic habitats that occur in the Study Area. The following sections describe the abiotic habitats in greater detail (Section 3.5.2, Affected Environment) and evaluate the potential impacts of testing and training activities on abiotic habitats (Section 3.5.3, Environmental Consequences). A summary of the potential impacts on abiotic habitats for each alternative is provided in Section 3.5.4 (Summary of Potential Impacts on Habitats).

The Study Area covers a range of marine and estuarine habitats, each supporting communities of organisms that may vary by season and location. The intent of this section is to cover abiotic habitat features and impacts that are not addressed in the individual living resources chapters. The water column and bottom substrate provide the necessary habitats for living resources, including those that form biotic habitats such as aquatic plant beds and coral reefs, which are discussed in other sections (e.g., Section 3.3, Vegetation; Section 3.4, Invertebrates). The potential for training or testing to impact the chemical quality of abiotic habitat is addressed in a separate chapter (Section 3.2, Sediments and Water Quality). Potential impacts to organisms and biotic habitats are covered in their respective resource sections. Potential impacts to the water column are not addressed in this section, because the effects would not be associated with a change in habitat type but rather would be limited to changes in water quality, which are addressed in Section 3.2 (Sediments and Water Quality). Therefore this section only addresses impacts to habitat substrate.

Table 3.5-1 presents the types of habitats discussed in this section in relation to the open ocean areas; large marine ecosystems; and bays, estuaries, and rivers in which they occur. Habitat types are derived from *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979), which includes a basic classification of intertidal shores, subtidal bottoms, and associated substrates. Whereas there are many classification systems spanning a range of spatial dimensions and granularity (Allee et al., 2000; Cowardin et al., 1979; Howell et al., 2010; Kendall et al., 2001; United Nations Educational Scientific and Cultural Organization, 2009; Valentine et al., 2005), there are basically three types of abiotic substrates based on the grain size of unconsolidated material: "soft bottom" (e.g., sand, mud), "intermediate" (e.g., cobble, gravel), and "hard bottom" (e.g., bedrock, boulders).

Spatial and temporal variation in abiotic substrate is created by the interplay of underlying geology, currents, and water quality at a location. The modified classification system provided in Table 3.5-1 starts at the subsystem level (e.g., intertidal shores/subtidal bottoms) and focuses analysis on a modified class level (e.g., soft shores/bottoms, intermediate shores/bottoms, hard shores/bottom) differentiating non-living substrates from the living structures on the substrate. Living structures on the substrate are termed biotic habitats, and include wetland shores, aquatic plant beds (i.e., attached macroalgae, rooted vascular plants), sedentary invertebrate beds, and reefs (e.g., corals, oysters).

Table 3.5-1: Habitat Types Within the Large Marine Ecosystems and Open Ocean of the Atlantic Fleet Training and Testing Study Area

Substrate Type	*Subtypes (Examples)*	*Open Ocean*	*Large Marine Ecosystems*	*Bays, Estuaries, and Rivers*
Intertidal Shores				
Soft Shores	Beach, Tidal Delta/Flat	–	All	All
Intermediate Shores	Cobble/Gravel, Mixed	–	Northeast U.S. Continental Shelf	All
Hard Shores	Rocky Intertidal	–	Northeast U.S. Continental Shelf, Caribbean Sea	Bath, ME; Portsmouth Naval Shipyard; Kittery, ME; coastal southern New England waters; Naval Submarine Base New London; Groton, CT
Subtidal Bottoms				
Soft bottoms	Channel, Flat, Shoal	All	All	All
Intermediate Bottom	Cobble/Gravel, Mixed	All	All	All
Hard bottom	Rocky Subtidal	All	All	All
Intertidal Shore or Subtidal Bottom				
Artificial Structures	Artificial reefs, ship wrecks, oil/gas platforms, bulkheads, and piers	All	All	All

The physical characteristics of substrates, whether they are unconsolidated and soft or hard and rocky, are key factors in structuring sedentary biological communities (Nybakken, 1993). The difference between substrates represents a viable target for the best available mapping technology (i.e., multibeam sonar) and is useful for characterizations of Navy impacts (e.g., explosive charges on soft bottom).

Differences among the physical and chemical environments of various abiotic habitats dictate both the variety and abundance of sessile marine organisms supported. The assessment in this section focuses on the potential for testing or training activities to change or modify the physical properties of abiotic substrates and their ecological functions as habitat for organisms. A physical impact on abiotic marine habitats is anticipated where training or testing activities have the potential to displace sediment, convert one substrate type into another (e.g., bedrock to unconsolidated soft bottom), alter vertical relief, or modify structural complexity.

3.5.2 Affected Environment

3.5.2.1 General Background

Abiotic marine habitats vary according to geographic location, underlying geology, hydrodynamics, atmospheric conditions, and suspended particles and associated biogenic features. Sediments may be derived from material eroded from land sources associated with coastal bluff erosion and sediment flows from creeks and rivers, which may create channels, tidal deltas, intertidal and subtidal flats, and shoals of unconsolidated material along the shorelines and estuaries.

The influence of land-based nutrients on habitat type and sediment increases with proximity to streams, bays and harbors, and nearshore waters. In the open ocean, gyres, eddies, and oceanic currents influence the distribution of organisms. Major bottom features in the offshore areas of large marine ecosystems include shelves, banks, breaks, slopes, canyons, plains, and seamounts. Geologic features such as these affect the hydrodynamics of the ocean water column (i.e., currents, gyres, upwellings) as well as living resources present. Bathymetric features of the Study Area are described in Section 3.0.2.2 (Bathymetry). The distribution of abiotic marine habitats among the large marine ecosystems and open ocean areas is described in their respective sections.

The majority of the Study Area lies outside of state waters. State waters extend from shore to 3 nautical miles (NM) throughout the Study Area, with the exception of the Gulf coast of Florida, Texas, and Puerto Rico, where state waters extend 9 NM offshore. Therefore, relatively little of the Study Area includes intertidal and shallow subtidal areas in state waters where numerous habitats are exclusively present (e.g., salt/brackish marsh, mangrove, seagrass beds, kelp forests, oyster reefs). Intertidal abiotic habitats (i.e., beaches, tidal deltas, mudflats, rocky shores) represent only a small portion of the Study Area; however, they are addressed the same as all other habitats (where those habitats overlap with naval training or testing activities).

3.5.2.1.1 Shore Habitats

3.5.2.1.1.1 Description

<u>Soft Shores</u>

Soft shores include all aquatic habitats that have three characteristics: (1) unconsolidated substrates with less than 25 percent areal cover of stones, boulders, or bedrock; (2) unconsolidated sediment composed of predominantly sand or mud; and (3) primarily intertidal water regimes (Cowardin et al., 1979). Note that a shoreline covered in vegetation (e.g., marsh) could still have a soft substrate foundation. Soft shores include beaches, tidal flats/deltas, and streambeds of the tidal riverine and estuarine systems.

Intermittent or intertidal channels of the riverine system and intertidal channels of the estuarine system are classified as streambed. Intertidal flats, also known as tidal flats or mudflats, consist of loose mud, silt, and fine sand, with organic-mineral mixtures, and are regularly exposed and flooded by the tides (Karleskint et al., 2006). Muddy and fine sediment tends to be deposited where wave energy is low, such as in sheltered bays and estuaries (Holland & Elmore, 2008). Mudflats are typically unvegetated, but may be covered with encrusting microscopic algae (e.g., diatoms) or sparsely vegetated with low-growing aquatic plants (e.g., macroalgae/seaweed, seagrass). Muddy intertidal habitat occurs most often as part of a patchwork of intertidal habitats that may include rocky shores, tidal creeks, sandy beaches, salt marshes, and mangroves. A flat area of unconsolidated sediment that is covered in aquatic plants could be considered an aquatic bed growing on soft shore habitat.

Beaches form through the interaction of waves and tides, as particles are sorted by size and are deposited along the shoreline (Karleskint et al., 2006). Wide flat beaches with fine-grained sands occur where wave energy is limited. Narrow steep beaches of coarser sand form where energy and tidal ranges are high (Speybroeck et al., 2008). Three zones characterize beach habitats: (1) dry areas above mean high water, (2) wrack lines (the area where seaweed and debris is deposited at high tide), and (3) a high-energy intertidal zone (area between high and low tide).

Intermediate Shores

Intermediate shores include all aquatic habitats with the following three characteristics: (1) substrates with at least 25 percent cover in particles smaller than stones, (2) unconsolidated substrate is predominantly gravel or cobble-sized, and (3) primarily intertidal water regimes. These areas may or may not be stable enough for attached vegetation or invertebrates, depending on overlying hydrology and water quality. Note that a shoreline covered in vegetation (e.g., macroalgae/seagrass) could still have an intermediate substrate foundation.

Hard Shores

Rocky shores include intertidal aquatic habitats characterized by bedrock, stones, and/or boulders that cover 75 percent or more of an area (Cowardin et al., 1979). Note that a shoreline covered in vegetation could still have a hard substrate foundation. Rocky intertidal shores are areas of bedrock occupying the area between high and low tide lines (Menge & Branch, 2001). Extensive rocky shorelines can be interspersed with sandy areas, estuaries, or river mouths.

Environmental gradients between hard shorelines and subtidal habitats are determined by wave action, depth, frequency of tidal inundation, and stability of substrate (Cowardin et al., 1979). Where wave energy is extreme, only rock outcrops may persist. In lower energy areas, a mixture of rock sizes will form the intertidal zone. Boulders scattered in the intertidal provide substrate for attached macroalgae and sessile invertebrates.

3.5.2.1.1.2 Distribution

Soft Shores

Mudflats occur to some extent in virtually every large marine ecosystem within the Study Area. Muddy deposits accumulate in many wave-protected pockets on the Gulf of Maine coast along the northern part of the Northeast United States (U.S.) Continental Shelf Large Marine Ecosystem, especially at the heads of bays. Extensive mudflats occur in the upper reaches of the Bay of Fundy. In the Southeast

U.S. Continental Shelf Large Marine Ecosystem, mudflats are most often associated with tidal creeks and estuaries. In the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems, salt marshes and tidal creeks occur along the coastal margins behind barrier islands. Mudflats associated with mangroves occur on the east coast of Florida, roughly from St. Augustine to the Florida Keys, and north to Cedar Key on the west coast in the southern part of the Southeast U.S Continental Shelf Large Marine Ecosystem. Tidal deltas and intertidal flats are present along the coast of Puerto Rico and Vieques (National Ocean Service, 2011).

Sandy beaches are less abundant but do occur in the northern part of the Northeast U.S. Continental Shelf Large Marine Ecosystem, which are otherwise dominated by rocky coasts. Small pocket beaches occur within the northern Gulf of Maine, and sandy beaches are abundant on Cape Cod in the southern Gulf of Maine. Some sandy intertidal habitats occur in all the states and provinces on the Gulf of Maine coast.

The Mid- and South Atlantic coast region is protected by an almost continuous string of barrier islands, which provide sandy intertidal shores (National Ocean Service, 2011). Sandy coasts and barrier islands are common from Long Island, New York to as far south as Florida. A long arc of barrier islands known as the Outer Banks protects the shore stretching from southeastern Virginia almost to South Carolina.

Sandy intertidal habitat predominates in the Southeast U.S. Continental Shelf Large Marine Ecosystem. The east and west coasts of Florida have long stretches of sandy beaches. The West Central Barrier Chain, a series of sandy barrier islands, stretches from Anclote Key (north of Tampa Bay) south to Cape Romano and protects the west coast of Florida. Sandy beaches are present along the shoreline of Puerto Rico and Vieques.

The eastern portion of the Gulf of Mexico Large Marine Ecosystem is fringed by sandy intertidal habitat, including barrier islands off the coast of the Florida panhandle. Shorelines of the western portion of the Gulf of Mexico Large Marine Ecosystem are dominated by sand that forms broad straight beaches and barrier islands (Britton & Morton, 1998). The longest undeveloped barrier island in the world is Padre Island National Seashore in Texas, which has 70 miles of sand beaches that provide nesting ground for sea turtles, foraging ground for shorebirds, and sandy intertidal habitat for numerous other species (National Park Service, 2010). Other barrier islands continue in an arc, trending up the Texas coast (Mustang, San Jose, Matagorda, Follets, and Galveston Islands) (Britton & Morton, 1998).

Intermediate Shores

Most of the intermediate coastline of the U.S. Atlantic coast occurs in the transitional area of the Northeast U.S. Continental Shelf Large Marine Ecosystem where the mostly consolidated rocky shores primarily off of Maine give way to the sandy shores in the south (Roman et al., 2000). On the U.S. Atlantic shore, intermediate rocky and gravelly areas do not typically occur south of New York (National Ocean Service, 2011).

Hard Shores

Most of the rocky coastline of the U.S. Atlantic coast occurs from Massachusetts northward into the Gulf of Maine, in the northern part of the Northeast U.S. Continental Shelf Large Marine Ecosystem (Roman et al., 2000). Glacial terrain made of bedrock, gravel, and sediment typical of the New England coast is unique on the east coast of the United States. Rocky shorelines border training or testing activities originating from the shipyard in Bath, Maine; Portsmouth Naval Shipyard (Kittery, Maine); coastal southern New England waters; and the shipyard and Naval Submarine Base New London (Groton, Connecticut). On the U.S. Atlantic shore, rocky and gravelly areas do not typically occur south of New

York (National Ocean Service, 2011). Rocky coasts in the northern areas give way to intermediate or mixed shores and sandy shores toward the south. In the Southeast U.S. Continental Shelf Large Marine Ecosystem, sandy beaches predominate. In the Caribbean Sea, rocky bedrock shorelines are mapped along the coast of Puerto Rico and Vieques (National Ocean Service, 2011). Very little hard shores occur anywhere in the northern Gulf of Mexico.

3.5.2.1.2 Bottom Habitats

3.5.2.1.2.1 Description

Soft Bottom

Soft bottoms include all aquatic habitats with the following three characteristics: (1) at least 25 percent cover of particles smaller than stones, (2) unconsolidated sediment is predominantly mud or sand, and (3) primarily subtidal water regimes (Cowardin et al., 1979). Soft bottom forms the substrate of channels, shoals, subtidal flats, and other features of the bottom. Sandy channels emerge where strong currents connect estuarine and ocean water columns. Shoals or capes form where sand is deposited by interacting, sediment-laden currents. Subtidal flats occur between the soft shores and the channels or shoals. The continental shelf extends seaward of the shoals and inlet channels and includes relatively coarse-grained, softbottom habitats. Relatively finer-grained sediments collect off the shelf break, continental slope, and abyssal plain. Organisms characteristic of soft bottom environments, such as worms and clams, may be found at all depths where there is sufficient oxygen and sediment accumulation (Nybakken, 1993).

Intermediate Bottom

Intermediate bottom includes all aquatic habitats with the following three characteristics: (1) substrates with at least 25 percent cover in particles smaller than stones, (2) unconsolidated substrate is predominantly gravel or cobble-sized, and (3) primarily subtidal water regimes. These areas may or may not be stable enough for attached vegetation or sedentary invertebrates, depending on overlying hydrology and water quality.

Hard Bottom

Hard bottom includes all aquatic habitats with substrates having a surface of stones, boulders, or bedrock (75 percent or greater coverage) (Cowardin et al., 1979). Subtidal rocky habitat occurs as extensions of intertidal rocky shores and as isolated offshore outcrops. The shapes and textures of the larger rock assemblages and the fine details of cracks and crevices are determined by the type of rock, the wave energy, and other local variables (Davis, 2009). Maintenance of mostly low-relief hard bottom (e.g., bedrock) requires wave energy sufficient to sweep sediment away (Lalli & Parsons, 1993) or offshore areas lacking a significant sediment supply; therefore, rocky reefs are rare on broad coastal plains near sediment-laden rivers and are more common on high-energy shores and beneath strong bottom currents, where sediments cannot accumulate.

In the deep waters of the Gulf of Mexico and Atlantic Ocean, there are also a number of cold seeps and thermal vents, which tend to support unique biotic communities. A cold seep, or cold vent, is an area of the ocean floor where chemical fluid seepage occurs. Cold seeps develop unique topography over time, where reactions between methane and seawater create carbonate rock formations and reefs. A thermal, or hydrothermal, vent is a fissure in the seafloor where geothermally heated water is released. Hard substrate in the abyssal zone and some locations landward of the deep ocean are virtually devoid of encrusting or attached organisms due to the scarcity of drifting food particles in the deep ocean

(Nybakken, 1993). Exceptions are areas on seamounts and along the Mid-Atlantic Ridge where chemosynthetic communities occur (see Section 3.4, Invertebrates, for additional information).

3.5.2.1.2.2 Distribution

Soft, intermediate, and hard bottom occur in all large marine ecosystems and the open ocean. However, the bottom types vary across the Study Area (Figure 3.5-1 through Figure 3.5-4) and are depicted by over 25 datasets. These datasets were ranked by quality and assembled into the non-overlapping mosaic as described in *Building and Maintaining a Comprehensive Database and Prioritization Scheme for Overlapping Habitat Data* (U.S. Department of the Navy, 2016). The datasets employ a variety of data collection techniques and data analysis to characterize the seafloor; results are summarized below. Thousands of acres of lower quality data were superseded by high quality data in the process of creating the non-overlapping abiotic substrate maps for the AFTT study area. However, some data sources were excluded due to the quality of the data, availability at the time of database assembly, or for other reasons.

Most of the bottom within the Study Area (approximately 80 percent) has not been mapped. However the majority of the unmapped portion is seaward of the U.S. continental shelf in the Atlantic Basin/Abyssal Zone (Table 3.5-2). Available mapping for abiotic substrate indicates a benthic surface composed of mostly soft bottom (less than 88 percent) with a little over 5 percent hardbottom, adjusted qualitatively for over- or under-estimation. The intermediate category of substrate (7 percent) could add to either the soft bottom or hard bottom type, depending on other environmental variables affecting stability and the supply of colonizing sedentary organisms and nutrition sources, which also affect hard substrate as a habitat for hard bottom organisms (to a lesser degree). It should be noted that percent of bottom area does not account for the vertical relief of some hard bottom areas, which contribute disproportionately to hard bottom community biomass. The data also does not account for the typically smaller dimensions of hard bottom features present in predominantly soft bottom areas; the Southeast Area Monitoring and Assessment Program – South Atlantic (Southeast Area Monitoring and Assessment Program—South Atlantic, 2001) line data is based primarily on trawl samples that indicate hard bottom with the collection of species associated with hard bottom, suggesting there were numerous hard bottom features too small to be resolved by even the highest quality data in the Study Area. U.S. Department of the Navy (2011) data and classification came the closest to finding these smaller areas of hardbottom attracting associated species.

Table 3.5-2: Percent Coverage of Abiotic Substrate Types in Large Marine Ecosystems and the Atlantic Basin/Abyssal Zone of the AFTT Study Area

Large Marine Ecosystem	*Percent of Large Marine Ecosystem*				*Total Acres*
	Hard	*Intermediate*	*Soft*	*Unknown*	
Atlantic Basin / Abyssal Zone	0.04 %	0.04%	7.13%	92.79%	1,907,486,932
Canadian Eastern Arctic - West Greenland	0.00%	0.00%	0.00%	100.00%	64,745,140
Caribbean Sea	4.91%	1.60%	20.76%	72.73%	31,139,231
Gulf of Mexico	2.73%	4.10%	62.97%	30.21%	360,245,296
Labrador - Newfoundland	0.00%	0.00%	0.00%	100.00%	151,841,856
Northeast U.S. Continental Shelf	1.54%	28.75%	69.58%	0.14%	69,321,609
Scotian Shelf	0.03%	1.69%	6.11%	92.16%	39,949,769
Southeast U.S. Continental Shelf	19.19%	5.3%	75.5%	0.01%	67,064,801
Grand Total	0.97%	1.49%	17.48%	80.06%	2,691,794,634

Soft Bottom

Softbottom occupies the largest habitat area within mapped portions of the Study Area and occur in all large marine ecosystems and the open ocean, and are depicted in Figure 3.5-1 through Figure 3.5-4 based on over 25 datasets (U.S. Department of the Navy, 2016).

Intermediate Bottom

Intermediate bottoms occur in all large marine ecosystems and the open ocean, and are depicted in Figure 3.5-1 through Figure 3.5-4 by at least eight datasets (U.S. Department of the Navy, 2016).

Hard Bottom

Hard bottoms occur in all large marine ecosystems and the open ocean, and are depicted in Figure 3.5-1 through Figure 3.5-4 based on at least eight datasets (U.S. Department of the Navy, 2016).

3.5.2.1.3 Artificial Structures

3.5.2.1.3.1 Description

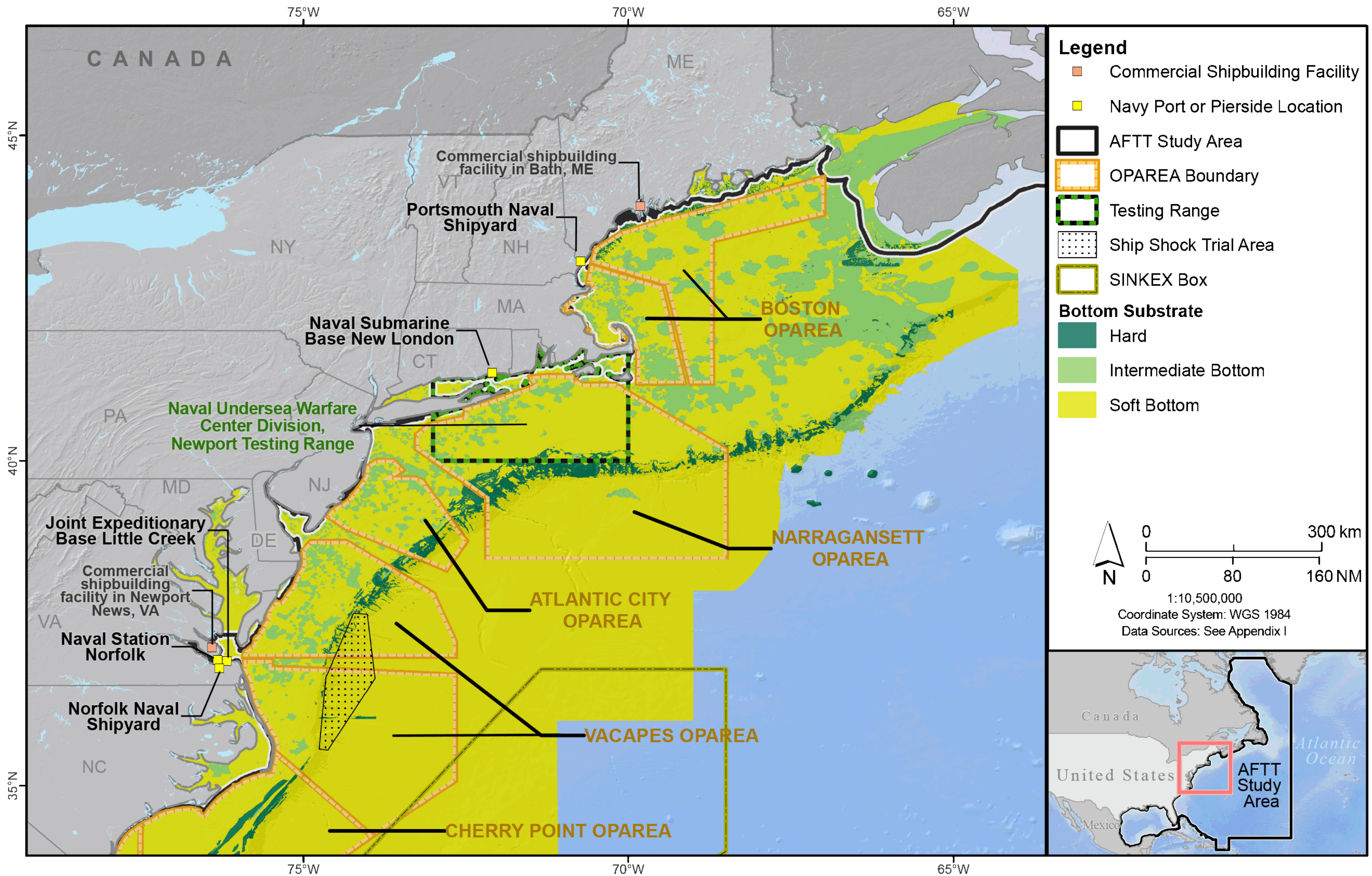
Man-made structures that are either deliberately or unintentionally submerged underwater create artificial habitats that mimic some characteristics of natural habitats, such as providing hard substrate and vertical relief (Broughton, 2012). Artificial reef habitats have been intentionally created with material from sunken ships, rock and stone, concrete and rubble, car bodies, tires, and scrap metal, etc. Artificial habitats also have been created as a result of structures built for other purposes (e.g., breakwaters, jetties, piers, wharves, bridges, oil and gas platforms, fish aggregating devices) or unintentional sinking of vessels (i.e., shipwrecks).

Some artificial structures provide similar ecological functions as natural hardbottom habitats, such as providing attachment substrate for algae and sessile invertebrates, which in turn supports a community of mobile organisms that may forage, shelter, and reproduce there (National Oceanic and Atmospheric Administration, 2007). Other structures may or may not support sessile organisms and only temporarily attract mobile organisms. Factors such as the materials, structural features, and surface area of the artificial substrate, as well as local environmental conditions, influence the variety and abundance of sessile organisms that may become established and the relative success of attracting or enhancing local fish populations (Ajemian et al., 2015; Broughton, 2012; Macreadie et al., 2011; Powers et al., 2003; Ross et al., 2016).

Artificial habitats in the Study Area include artificial reefs, shipwrecks, oil and gas platforms, man-made shoreline structures (e.g., piers, wharfs, docks, pilings), and obsolete military towers used for aircraft training (Macfadyen et al., 2009; Seaman, 2007; U.S. Department of the Navy, 2016). Artificial reefs are designed and deployed to supplement the ecological services provided by coral or rocky reefs. Artificial reefs range from simple concrete blocks to highly engineered structures. Vessels that are unintentionally sunk in the Study Area may be colonized by encrusting and attached marine organisms if there is a larval source and enough nutrition (e.g., detritus) drifting through the water column. Wrecks in the abyssal zone and some locations landward of the deep ocean are virtually devoid of encrusting or attached organisms due to the scarcity of drifting food particles in the deep ocean (Nybakken, 1993).

3.5.2.1.3.2 Distribution

Artificial shoreline structures (e.g., piers, wharfs, docks, pilings) in the Study Area occur at or along pierside locations (Section 2.1.10.1, Pierside Locations), including facilities associated with Navy ports and naval shipyards, and channels and routes to and from Navy ports.



Notes: AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area; SINKEX: Sinking Exercise

Figure 3.5-1: Bottom Types Within the Northeast U.S. Continental Shelf Large Marine Ecosystem and Open Ocean Areas

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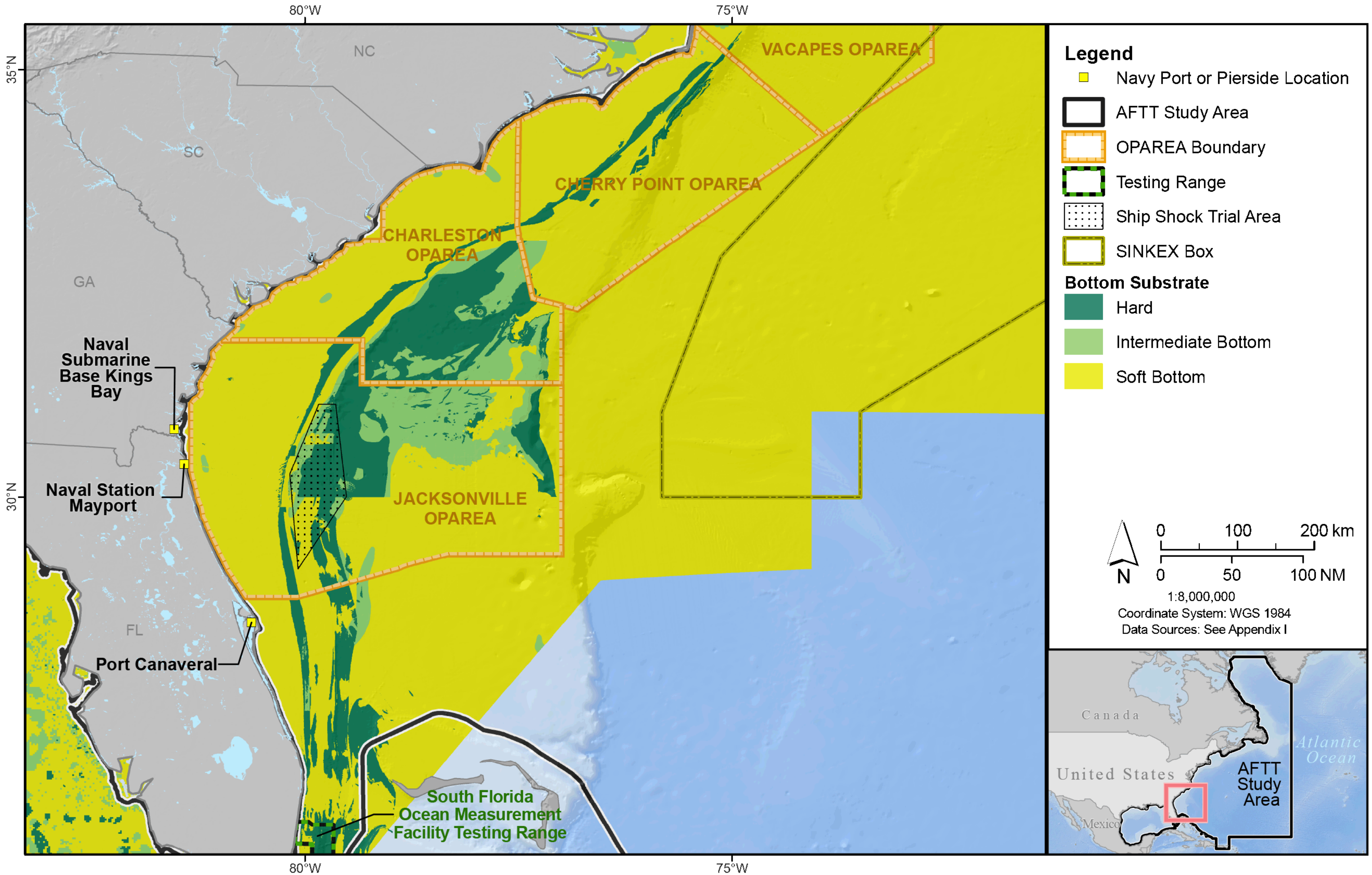

Notes: AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area; SINKEX: Sinking Exercise

Figure 3.5-2: Bottom Types Within the Southeast U.S. Continental Shelf Large Marine Ecosystem and Open Ocean Areas

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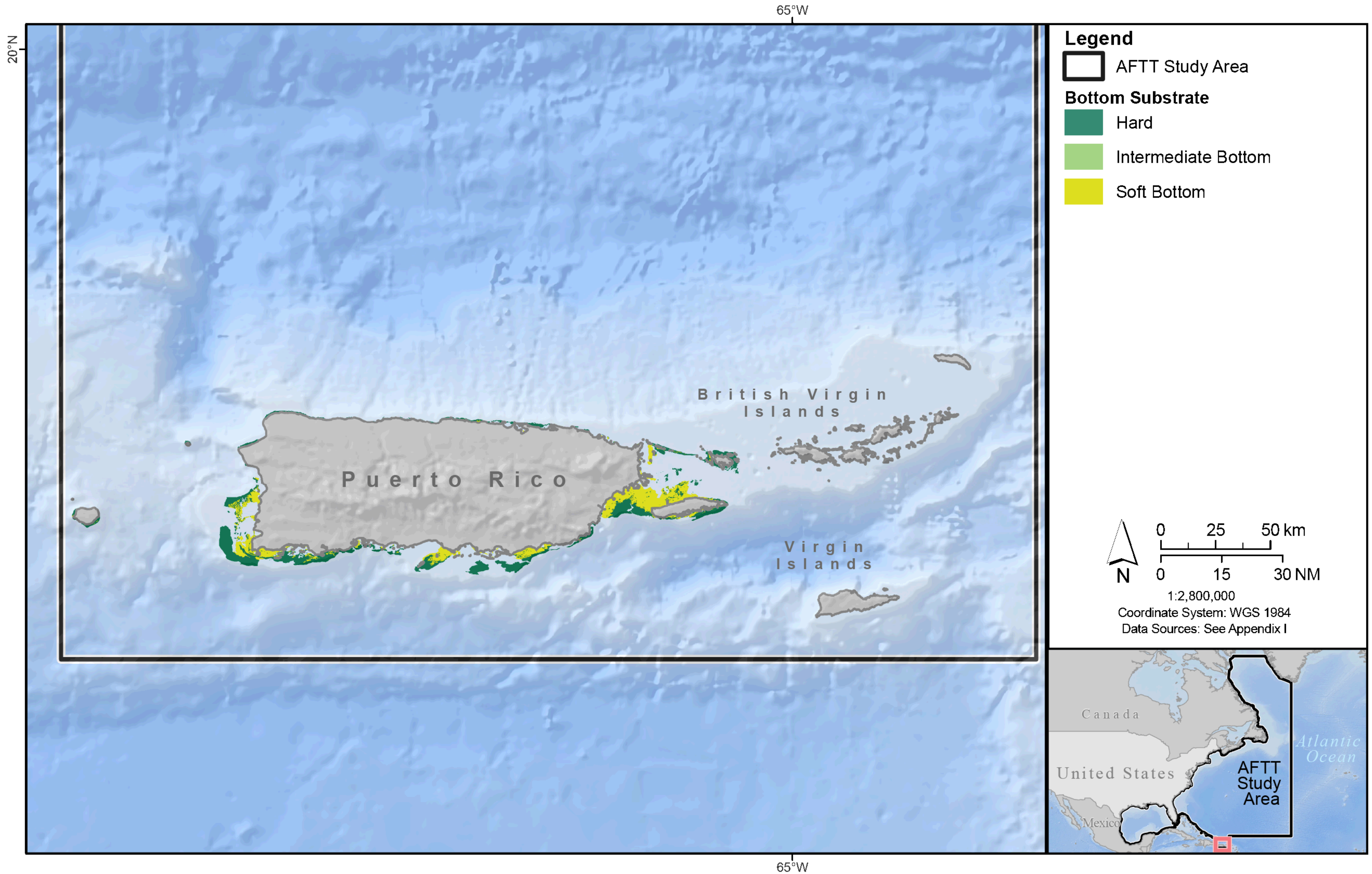

Notes: AFTT: Atlantic Fleet Training and Testing

Figure 3.5-3: Bottom Types Within the Caribbean Sea Large Marine Ecosystem

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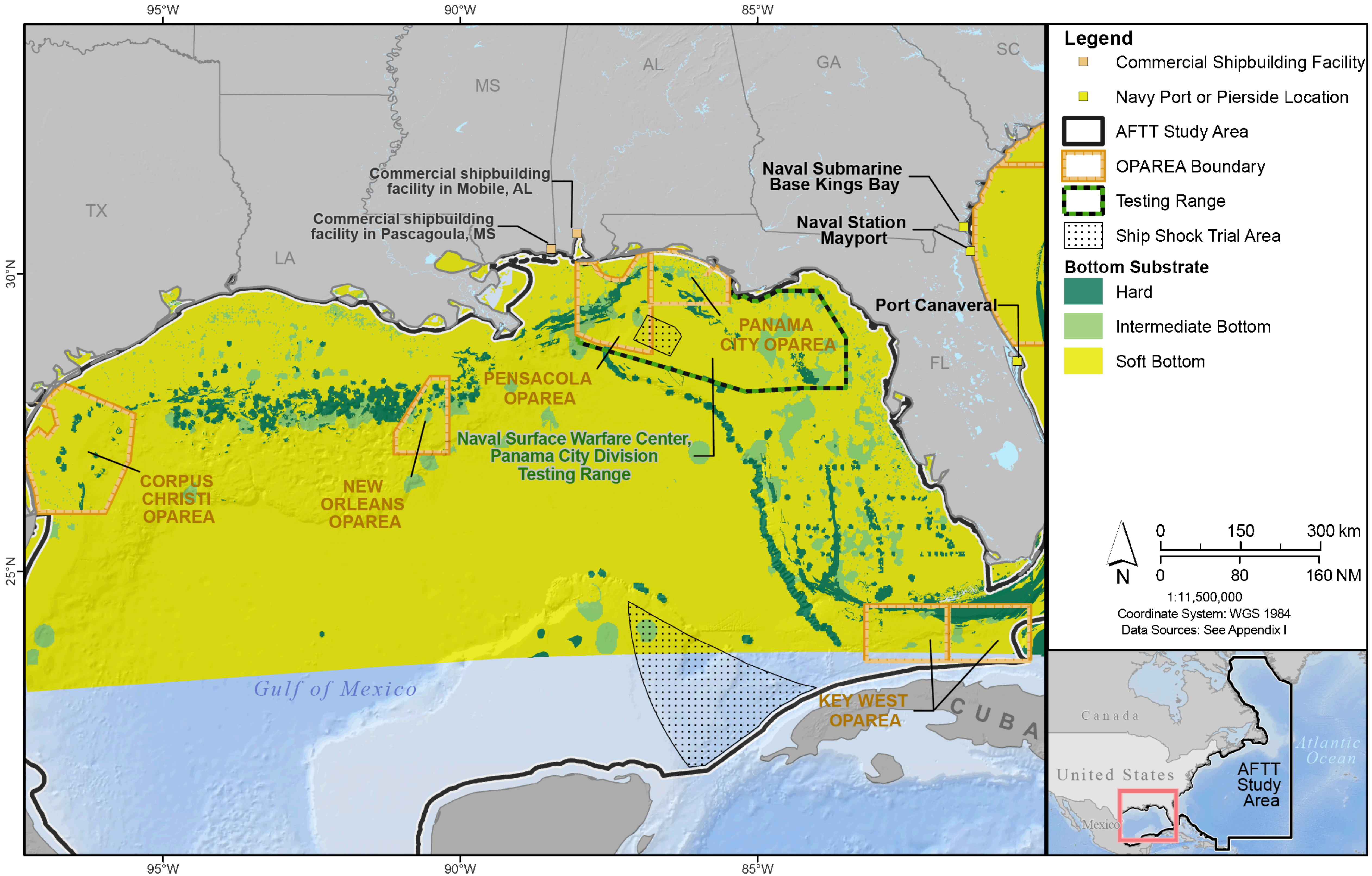

Notes: AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area

Figure 3.5-4: Bottom Types Within the Gulf of Mexico Large Marine Ecosystem

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The centroid points of mapped artificial structures in waters of the Study Area are depicted on Figure 3.5-5 through Figure 3.5-8. These include more than 15,000 mapped points, including mostly shipwrecks (over 11,000), oil/gas platforms (2,400), artificial reefs (1,400), and military towers (18) (Table 3.5-3). Artificial reefs may occur at individual permit sites or within large General Permit areas. Very large individual permit areas and General Permit areas range from nearly 100 to several hundred square miles (shown as polygons on the artificial structure figures); whereas, typical artificial reef permit areas range from less than 0.5 square mile to a few square miles (U.S. Department of the Navy, 2016). Not shown on Figure 3.5-5 through Figure 3.5-8 are shipwrecks that are "address restricted" due to status on the National Register of Historic Places (e.g., Gen. C.B. Comstock located in Texas state waters) and ship hulks sunk during Naval sinking exercises.

Table 3.5-3: Number of Artificial Structures Documented in Large Marine Ecosystems of the AFTT Study Area

Large Marine Ecosystem	*Air Force Towers*	*Artificial Reef*	*Navy Towers*	*Oil/Gas Platform*	*Shipwreck*	*Grand Total*
Atlantic Basin / Abyssal Zone	0	0	0	0	106	106
Caribbean Sea	0	9	0	0	350	359
Gulf of Mexico	6	1,166	0	2,400	6,174	9,746
Northeast U.S. Continental Shelf	0	62	4	0	3,845	3,911
Scotian Shelf	0	0	0	0	18	18
Southeast U.S. Continental Shelf	0	163	8	0	1,284	1,455
Grand Total	6	1,400	12	2,400	11,777	15,595

3.5.2.1.4 General Threats

Estuarine and ocean environments worldwide are under pressure from a variety of human activities, such as coastal development, shoreline stabilization, dredging, flood control, and water diversion; destructive fishing practices; offshore energy and resource development and extraction; and global climate change (Boehlert & Gill, 2010; Clark et al., 2016; Clarke et al., 2014; Crain et al., 2009; National Oceanic and Atmospheric Administration Marine Debris Program, 2016). These activities produce a range of physical and chemical stressors on habitats. Primary threats to marine habitats include habitat loss, degradation, or modification. Although stressors may be similar or wide-spread geographically, their effects on marine habitats are not random or equal. Human activities vary in their spatial distribution and intensity of impact (Halpern et al., 2008). Accordingly, their effects on habitats will vary depending on local differences in the duration, frequency, and intensity of stress; scale of effect; and environmental conditions. Areas where heavy concentrations of human activity co-occur with naval training and testing activities have the greatest potential for cumulative stress on the marine ecosystem (see Chapter 4, Cumulative Impacts, for more information).

3.5.2.1.4.1 Urbanization

Habitat loss and degradation are the primary threats of urbanization. Coastal development has resulted in loss of coastal dune and wetland habitats, modification of shorelines and estuaries, and degradation of water quality (Crain et al., 2009; Lotze et al., 2006). In addition, development has resulted in a proliferation of artificial structure habitats, such as breakwaters, jetties, rock groins, seawalls, oil and gas platforms, docks, piers, wharves, and underwater cables and pipelines, as well as artificial reefs.

Maintenance of coastal infrastructure, ports, and harbors disturbs or modifies intertidal and subtidal habitats, the extent of which varies depending on the type, scale, or frequency of the activity. For example, maintenance has increased the use of shoreline stabilization measures (engineered structures, beach nourishment) to reduce storm-related damages to coastal infrastructure. Flood control or shoreline stabilization measures may have temporary or long-term impacts on beach habitats and may also affect adjacent intertidal and subtidal habitats due to suspended sediment and sedimentation, altered sediment supply and transport dynamics, or creation of artificial substrates (Bacchiocchi & Airoldi, 2003). Periodic dredging and excavation of sediment is undertaken to maintain navigable channels, tidal exchange, and/or flood control capacity in bays and estuaries. Sediment removal directly disturbs subtidal softbottom habitat and may indirectly disturb or modify adjacent habitats (Newell et al., 1998). A number of factors may influence maintenance frequency, including sediment characteristics, shoreline and watershed characteristics, oceanographic conditions, and climate.

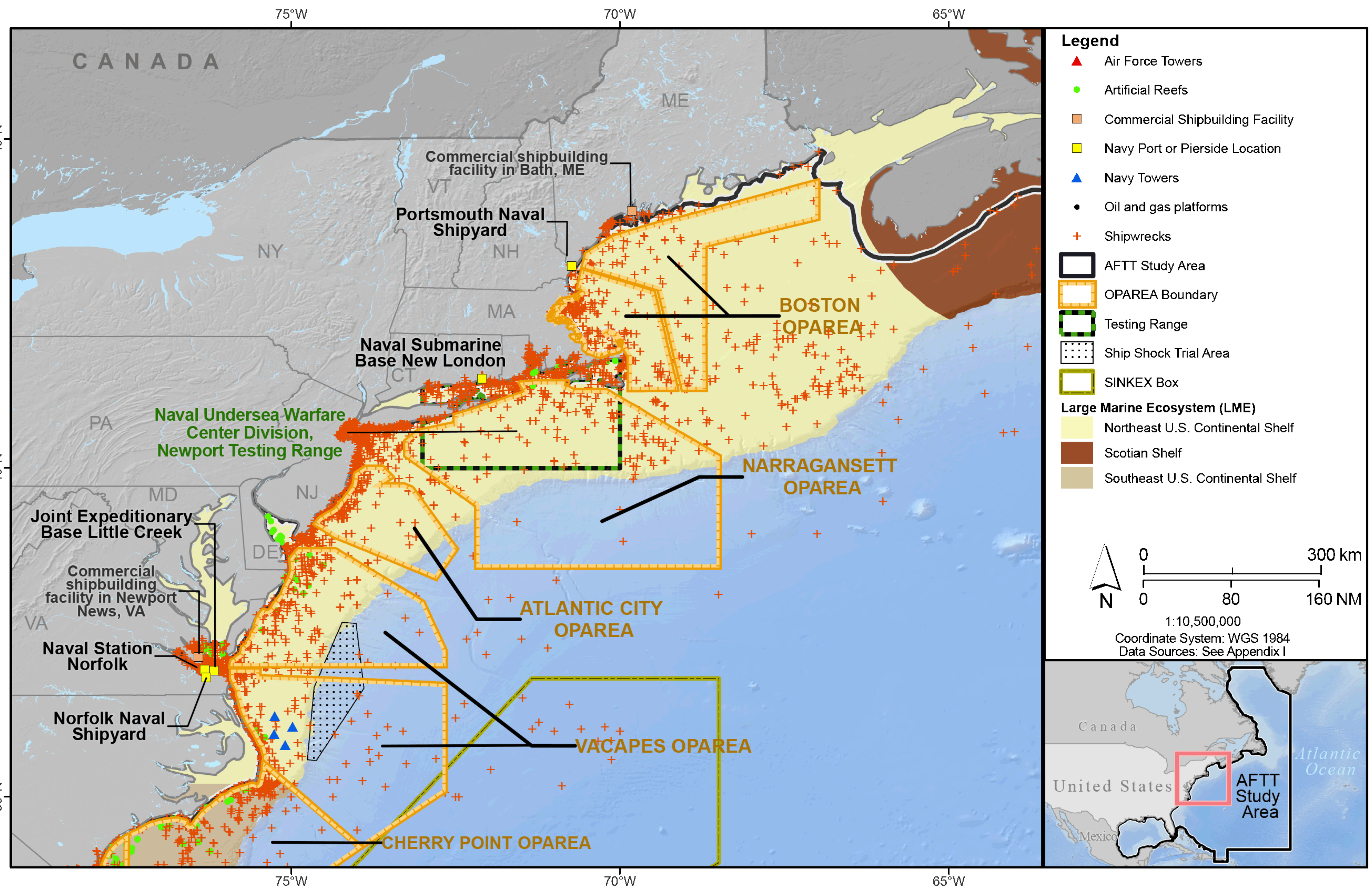
3.5.2.1.4.2 Water Quality

Pollution of marine waters and the accumulation of contaminants in marine sediments pose threats to marine ecosystems, public health, and local economies of coastal regions (Crain et al., 2009).Marine and estuarine water and sediment quality may be influenced by industrial and wastewater discharges, soil erosion, stormwater runoff, vessel discharges, marine construction, and accidental spills. Activities that disturb or remove marine sediments also impact water quality and may alter physical and chemical properties of sediments at and adjacent to the disturbance due to sediment resuspension and sedimentation. Generally, threats to water and sediment quality are greater in waterbodies adjacent to watersheds with substantial urban or agriculture land uses. For more detailed discussion of water quality and potential impacts, see Section 3.2 (Sediments and Water Quality).

Large areas of bottom waters lacking dissolved oxygen, or “dead zones,” are documented in the Study Area off the Mississippi River outlet (Rabalais et al., 2002) and other large rivers flowing into coastal ocean waters (Diaz & Rosenberg, 2008). Whereas the physical structure of abiotic substrate is unaffected by dead zones, associated organisms are adversely impacted there. Refer to individual resource sections for specific stressors and impacts on living resources associated with marine substrates.

3.5.2.1.4.3 Commercial Industries

A variety of commercial development, operations, and activities impact marine habitats and associated organisms (e.g., oil/gas development, telecommunications infrastructure, steam and nuclear power plants, desalinization plants, alternative energy development, shipping and cruise vessels, commercial fishing, aquaculture, and tourism operations) (Crain et al., 2009). Commercial activities are conducted under permits and regulations that require companies to avoid and minimize impacts to marine habitats, especially sensitive hardbottom and biogenic habitats (e.g., coral reefs, shellfish beds, and vegetated habitats).



Notes: AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area; SINKEX: Sinking Exercise

Figure 3.5-5: Artificial Structures Within the Northeast U.S. Continental Shelf Large Marine Ecosystem and Open Ocean Areas

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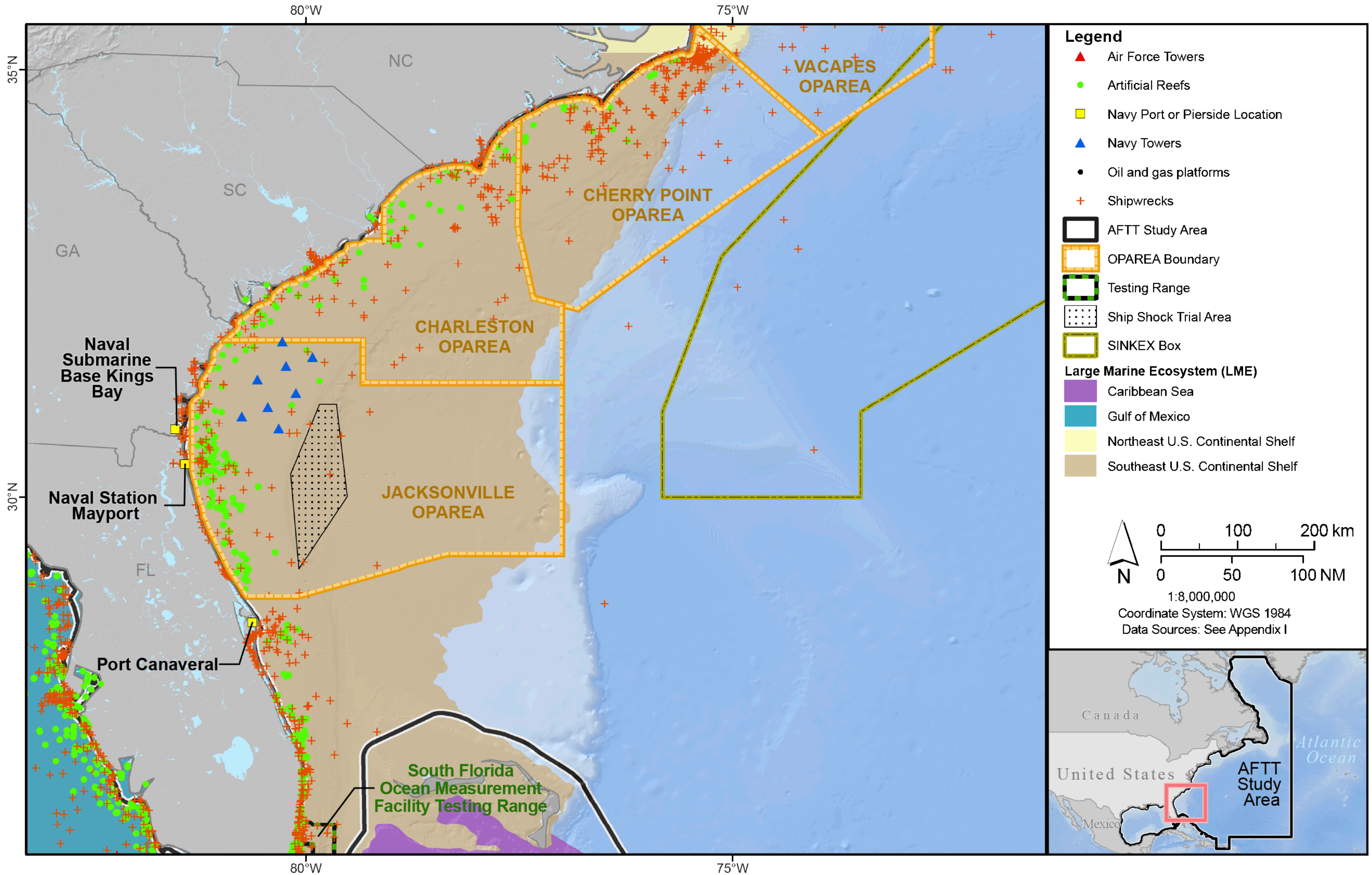

Notes: AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area; SINKEX: Sinking Exercise

Figure 3.5-6: Artificial Structures Within the Southeast U.S. Continental Shelf Large Marine Ecosystem and Open Ocean Areas

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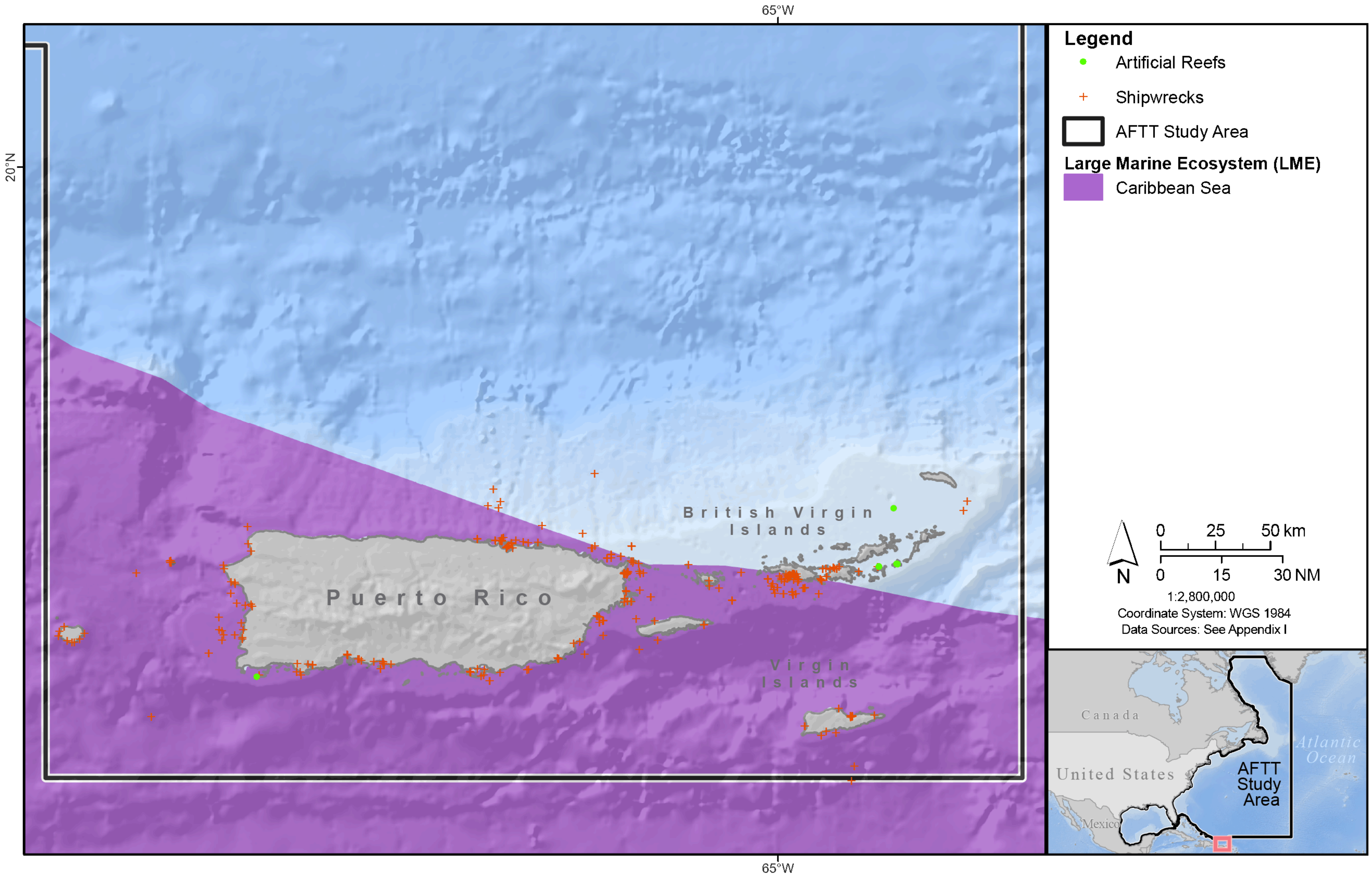

Notes: AFTT: Atlantic Fleet Training and Testing

Figure 3.5-7: Artificial Structures Within the Caribbean Sea Large Marine Ecosystem

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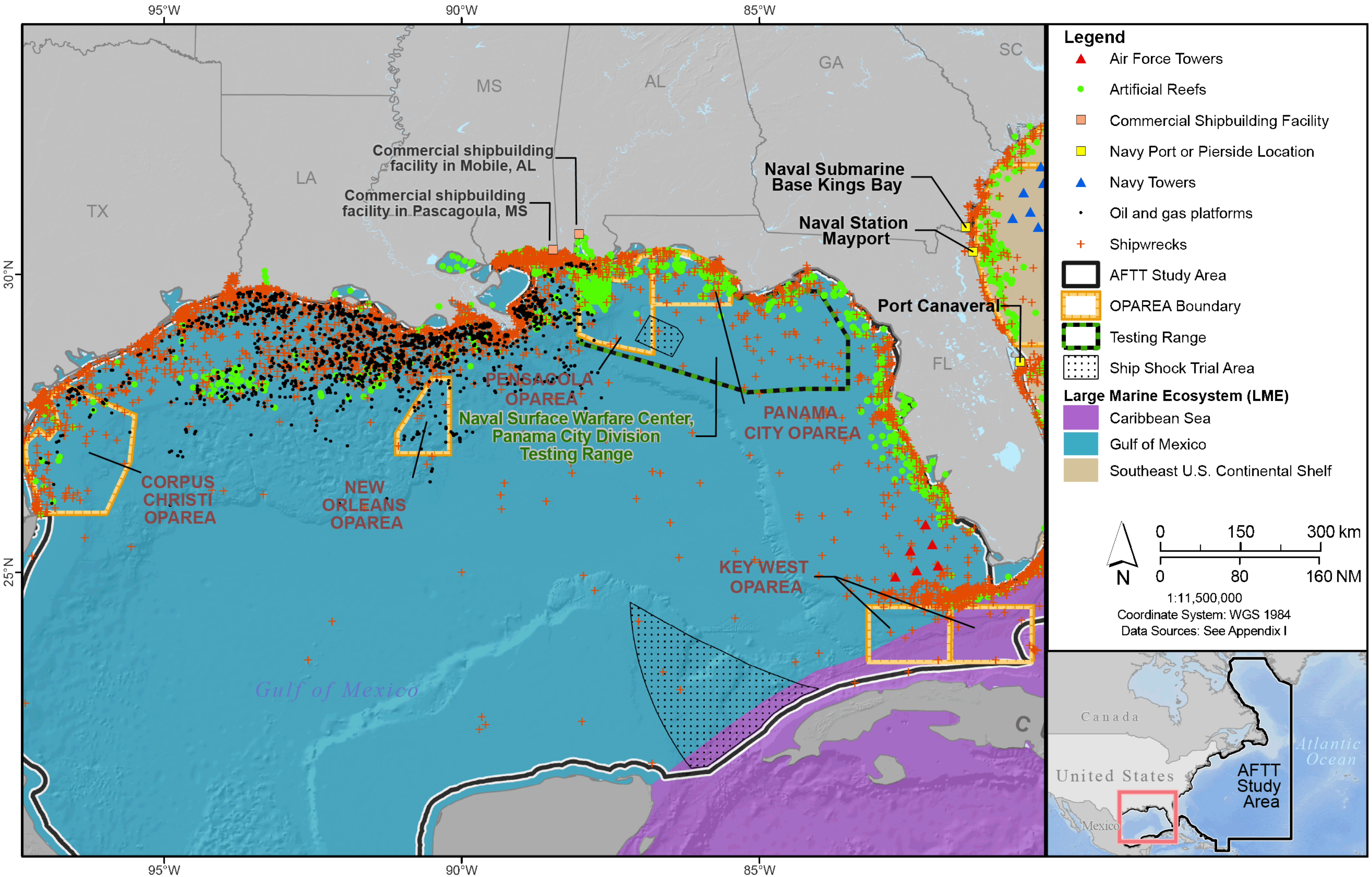

Notes: AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area

Figure 3.5-8: Artificial Structures Within Western Portion of the Gulf of Mexico Large Marine Ecosystem

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Marine habitats may be directly impacted during marine construction (e.g., cable laying and burial, dredging, pipeline installation, pile driving, work boat anchoring), and commercial bottom fishing and by commercial vessel anchoring. Generally, disturbance impacts to softbottom habitats are temporary; however, there is the potential to degrade the quality of softbottom habitat for biological resources depending on the extent and frequency of disturbance (Newell et al., 1998). Hardbottom and biogenic habitats are most vulnerable to damage or degradation by commercial industry development and operations. For example, anchors, anchor chains, or cables may damage habitats and abrade and remove organisms from hardbottom surfaces. Commercial fishing use of dredges and bottom trawls impacts bottom topography and sediments and may degrade habitat quality and associated biological communities (Clark et al., 2016). Abandoned or lost fishing gear may alter the structure of abiotic habitats and result in abrasion or entanglement of organisms.

Indirect impacts to habitats may occur from commercial development, discharges, or accidental spills that degrade water or sediment quality. Threats associated with impacts to water and sediment quality are further described in Section 3.5.2 (Affected Environment). Accidental spills have the potential to contaminate and degrade marine habitats by coating hard bottom or biogenic substrates as well as mixing into bottom sediments (Hanson et al., 2003). Many factors determine the degree of environmental damage from oil spills, including the type of oil, size and duration of the spill, geographic location, season, and types of habitats and resources present. Effects of oil on the bottom habitat have the potential to have long-term impacts on fish and wildlife populations.

3.5.2.1.4.4 Climate Change

All marine ecosystems are vulnerable to the widespread effects of climate change, which include increased ocean temperatures, sea level rise, ocean acidification, and changes in precipitation patterns (Hoegh-Guldberg & Bruno, 2010; Scavia et al., 2002). Rising ocean temperatures will cause waters to expand and ice caps to melt, driving sea levels to rise at various rates depending on geographic location and local environmental conditions. Sea level rise will have the greatest impacts on intertidal and coastal ecosystems that have narrow windows of tolerance to flooding frequency or depth (Crain et al., 2009). Changes in ocean temperatures also are projected to alter ocean circulation, upwelling, and nutrient distribution patterns. It is projected that wet tropical areas and mid-latitude land will experience more frequent and extreme precipitation, which will increase erosion-related sedimentation and runoff to coastal habitats (Keener et al., 2012). The climatic effects will be superimposed upon, and interact with, a wide array of current stresses, including excess nutrient loads, overfishing, invasive species, habitat destruction, and chemical contamination (Scavia et al., 2002).

3.5.2.1.4.5 Marine Debris

In the past decade, marine debris has been increasingly recognized as a key threat to marine ecosystems throughout the world. The Marine Debris Act (33 United States Code 1951 et seq.) defines marine debris as any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment. Artificial substrate that provides hard bottom habitat for marine organisms is discussed in Section 3.4 (Invertebrates). This section focuses on the aspects of marine debris that pose a threat to marine habitats. The accumulation of marine debris can alter and degrade marine habitats through physical damage (e.g., abrasion, shearing); changes to the physical and chemical composition of sediments; and reductions in oxygen and underwater light levels (National Oceanic and Atmospheric Administration Marine Debris Program, 2016). Accumulation or concentration also can degrade the aesthetic appeal of coastal habitats for recreational use, decrease visitation and tourism, require costly cleanups, and impact local economies (Leggett et al., 2014).

3.5.3 Environmental Consequences

The Navy considered all potential stressors and the following have been analyzed for habitats: explosives and physical disturbance and strikes. This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) and Section 3.0.3.3 (Identifying Stressors for Analysis) could impact marine habitats as defined in this section in the Study Area. Table 2.6-1 (Proposed Training Activities per Alternative) through Table 2.6-4 (Office of Naval Research Proposed Testing Activities per Alternative) present the proposed training and testing activities (including number of events and locations). General characteristics of all Navy stressors were introduced in Section 3.0.3.3 (Identifying Stressors for Analysis). The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors analyzed for habitats are:

- **Explosives** (explosives detonated on or near the bottom);
- **Physical Disturbance and Strikes** (vessels and in-water devices; military expended materials; seafloor devices; pile driving)

Impacts of explosives and military expended material were assessed based on three types of analyses: (1) a worst-case scenario assuming all the impacts occur on a single habitat type in an affected area (1-year totals), (2) a more realistic situation in which the impacts are spread proportionally among the habitat types in an affected area, and (3) a 5-year cumulative analysis. The most accurate projection would be somewhere between the worst-case and proportional distribution because there are locations that specific training or testing occurs most frequently within range complexes. However, training and testing in those areas are not limited by a percentage as a proposed action in this document. The remaining stressors (vessels and in-water devices, seafloor devices, and pile driving) were analyzed based on the number of annual events estimated to occur annually within each Range Complex. The analysis includes consideration of the mitigation that the Navy will implement to avoid potential impacts on habitats from explosives and physical disturbance and strike stressors. Mitigation for habitats will be coordinated with NMFS through the consultation processes.

3.5.3.1 Acoustic Stressors

Acoustic stressors are not applicable to habitats due to the lack of hearing capabilities of abiotic habitats and will not be analyzed further in this section.

3.5.3.2 Explosive Stressors

Background

This section analyzes the potential impacts of in-water explosions on or near the bottom resulting from training and testing activities within the Study Area, because those are the only explosives that are expected to potentially impact abiotic substrate.

In-water detonations are used during various mine warfare training and testing activities, surface-to-surface gunnery exercises, air-to-surface gunnery, missile, and bombing exercises, as well as sinking exercises, underwater demolition, and other training activities. Likewise, air-to-surface gunnery, missile, and bombing tests, anti-submarine warfare tracking tests, mine warfare, detection, neutralization tests, and other testing activities also employ underwater explosives. The potential impacts of in-water detonations on marine habitats are assessed according to size of charge (net explosive weight), charge radius, height above the bottom, substrate types in the area, and equations linking all these factors.

Most explosive detonations during training and testing involving the use of high-explosive munitions, including bombs, missiles, and projectile casings, would occur in the air or near the water's surface. Explosives associated with torpedoes, explosive sonobuoys, and explosive mines would occur in the water column; demolition charges could occur near the surface, in the water column, or the ocean bottom. Most surface and water column detonations would occur in waters greater than 3 NM from shore in water depth greater than 100 feet (ft.), although mine warfare and demolition detonations could occur in shallow water, and typically in a few specific locations within the Study Area. This section only evaluates the impact of explosives placed on the bottom, because the physical structure of the water column is not affected by explosions.

An explosive charge would produce percussive energy that would be absorbed and reflected by the bottom. Hard bottom would mostly reflect the charge (Berglind et al., 2009), whereas a crater would be formed in soft bottom (Gorodilov & Sukhotin, 1996). For a specific size of explosive charge, crater depths and widths would vary depending on depth of the charge and substrate type. There is a nonlinear relationship between crater size and depth of water, with relatively small crater sizes in the shallowest water, followed by a spike in size at some intermediate depth, and a decline to an average flat line at greater depth (Gorodilov & Sukhotin, 1996; O'Keeffe & Young, 1984). Radii of the craters reportedly vary little among unconsolidated substrate types (O'Keeffe & Young, 1984). On substrate types with nonadhesive particles (everything except clay), the effects should be temporary, whereas craters in clay may persist for years (O'Keeffe & Young, 1984). Soft substrate moves around with the tides and currents and depressions are only short-lived (days – weeks) unless they are maintained.

3.5.3.2.1 Impacts from Explosives

3.5.3.2.1.1 Impacts from Explosives Under Alternative 1

<u>Impacts from Explosives Under Alternative 1 for Training Activities</u>

Relevant training activities under Alternative 1 include explosives used during mine countermeasures, mine neutralization using remotely operated vehicles, mine neutralization explosive ordnance disposal, and other activities (see Table 2.6-1, Proposed Training Activities per Alternative, and Appendix B, Activity Stressor Matrices). The number and locations for these stressors under Alternative 1 are provided in Section 3.0.3.3.4.2, Military Expended Materials. The Navy testing and training areas listed by range complex, and acreages of abiotic habitat by type are shown in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

The analysis assumes that half the charges that could be detonated on the bottom during training activities are actually detonated on the bottom. The determination of impact is based on this scenario: 0.5, 5, 10, 20, and 60 pounds (lb.) net explosive weight explosions on the bottom. Note that mitigation measures that may prevent impacts are not included in the quantitative assessment (Chapter 5, Mitigation). Only the acreage in the large marine ecosystem areas was included in percentages shown in Table 3.5-2. The areas within the Atlantic Basin/Abyssal Zone were not included in order to focus on bottom areas likely to have a combination of suitable habitat, supply of sedentary invertebrate larvae, and sufficient food particles for filtration or deposit-feeding. Artificial substrate was not included, because it was inconsistently included for mapping and it likely represented a miniscule percentage of habitat types in the large marine ecosystems.

The mine neutralization and other training activities involving explosives could occur over a larger area, to support the added flexibility of conducting activities anywhere within the specified range complexes. Based on the number of charges and impact areas per year, the worst-case scenarios for hard bottom impacts are 8.0, less than 0.5, less than 0.5, and 0.5 acres in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Caribbean and Gulf of Mexico, and Gulf of Mexico Large Marine Ecosystems, respectively. This represents less than 0.01 percent of the available hard bottom in each of the large marine ecosystems.

Analysis was conducted in order to determine the proportional impact of explosives training on marine habitats in each of the training areas within the Study Area (Figure 3.5-9). Based on the proportional analysis, total explosive impacts to hard substrate from explosives training activities would be less than 0.5 acre. Impacts to other substrate types would be approximately 0.5, 8.0, and less than 0.5 acres for intermediate, soft, and unknown substrates, respectively. See Appendix F (Military Expended Materials and Direct Strike Impact Analyses) for detailed analysis of explosive impacts from training activities in each Training Area.

Analysis was also conducted to evaluate impacts accumulating over the course of a 5-year period. The analysis assumed that all impacts would accumulate. In reality, some habitat would recover over time as soft substrates are dynamic systems and craters could refill. Areas of hard bottom and other sensitive habitats could be avoided using the Protective Measures Assessment Protocol. The total footprint for impacts from high explosives over the 5-year period would be approximately 44.2 acres. Of this, less than 0.6 percent of the total area of each habitat type (hard, intermediate, and soft) would be impacted, and less than 0.01 percent of hard bottom. Details of this analysis can be found in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

Under Alternative 1, the areas of bottom habitat in the AFTT Study Area affected annually or over a 5-year period by in-water detonations for training activities would be a negligible portion of available bottom habitat. Training events that include seafloor detonations would be infrequent, the percentage of the Study Area affected would be small, and the disturbed areas are likely soft bottom areas that recover relatively quickly from disturbance. Therefore, underwater explosions under Alternative 1 would be limited to local and short-term impacts on habitat structure in the Study Area.

As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy will implement mitigations to avoid impacts from explosives on habitats in mitigation areas throughout the Study Area. For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of shallow-water coral reefs, live hard bottom, artificial reefs, and shipwrecks. Mitigation for seafloor resources was not included in the quantitative assessment of habitat impacts; however, it will help the Navy further avoid the potential for impacts on habitats from certain explosive activities.

Impacts from Explosives Under Alternative 1 for Testing Activities

Various types of explosives are used during testing activities. The type, number, and location of activities that use explosives are described in Section 3.0.3.3.2 (Explosive Stressors), and the resulting footprints on bottom habitats are quantified in Appendix F (Military Expended Materials and Direct Strike Impact Analyses). The general locations for Alternative 1 activities are listed in Appendix A (Navy Activity Descriptions) and shown on Figure 3.5-1 through Figure 3.5-4.

Based on the number of charges and impact areas per year, the worst-case scenarios for hardbottom area impacted are 3.0, 1.5, and 10.0 acres in the Northeast U.S. Continental Shelf, Southeast

U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, respectively (Figure 3.5-17).This represents less than 0.01 percent of hardbottom habitat for each of the large marine ecosystems.

Additional analysis was conducted in order to determine the proportional impact of explosives testing on marine habitats in each of the range complexes and testing ranges within the Study Area (Figure 3.5-9). Based on the proportional analysis of impacts, total explosive impacts to hard substrate from testing activities would be approximately 0.9 acre. Impacts to other substrate types would be approximately 1.5 and 12.0 acres for intermediate and soft substrates, respectively. Impacts to unknown substrate would be less than 0.5 acre. See Appendix F (Military Expended Materials and Direct Strike Impact Analyses) for detailed analysis of explosive impacts from testing activities in each range complex and testing range.

Analysis was also conducted to evaluate impacts accumulating over the course of a 5-year period. The analysis assumed that all impacts would be cumulative. In reality, some habitat would recover over time, as soft substrates are dynamic systems and craters could refill. Areas of hard bottom and other sensitive habitats could be avoided using the Protective Measures Assessment Protocol. The total footprint for impacts from high explosives over the 5-year period would be approximately 70.5 acres. Of this, less than 0.01 percent of the total area of each habitat type (hard, intermediate, and soft) would be impacted. Details of this analysis can be found in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

Under Alternative 1, the areas of bottom habitat in the AFTT Study Area affected annually by in-water detonations for testing activities would be a negligible portion of available bottom habitat (less than 0.01 percent for each substrate type). Testing events that include seafloor detonations would be infrequent, the percentage of testing area affected would be small, and the disturbed areas are likely soft bottom areas that recover relatively quickly from disturbance. Therefore, in-water explosions under Alternative 1 would be limited to local and short-term impacts on habitat structure in the Study Area.

3.5.3.2.1.2 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

Relevant training activities included in Alternative 2 include explosives used during mine countermeasures, mine neutralization using remotely operated vehicles, mine neutralization explosive ordnance disposal, and other training activities (see Table 2.6-1, Proposed Training Activities per Alternative). Explosive activities would be the same under Alternative 2 as those analyzed under Alternative 1, as only the frequency and duration of sonar activities would differ. The general locations for these activities under Alternative 2 are listed in Appendix A (Navy Activity Descriptions) and are shown on Figure 3.5-1 through Figure 3.5-4. The Navy testing and training areas, listed by large marine ecosystem and acreages of abiotic habitat by type, are shown in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

Testing events that include seafloor detonations would be infrequent, the percentage of testing area affected would be small, and the disturbed areas are likely soft bottom areas that recover relatively quickly from disturbance. Therefore, in-water explosions under Alternative 2 would be limited to local and short-term impacts on habitat structure in the Study Area.

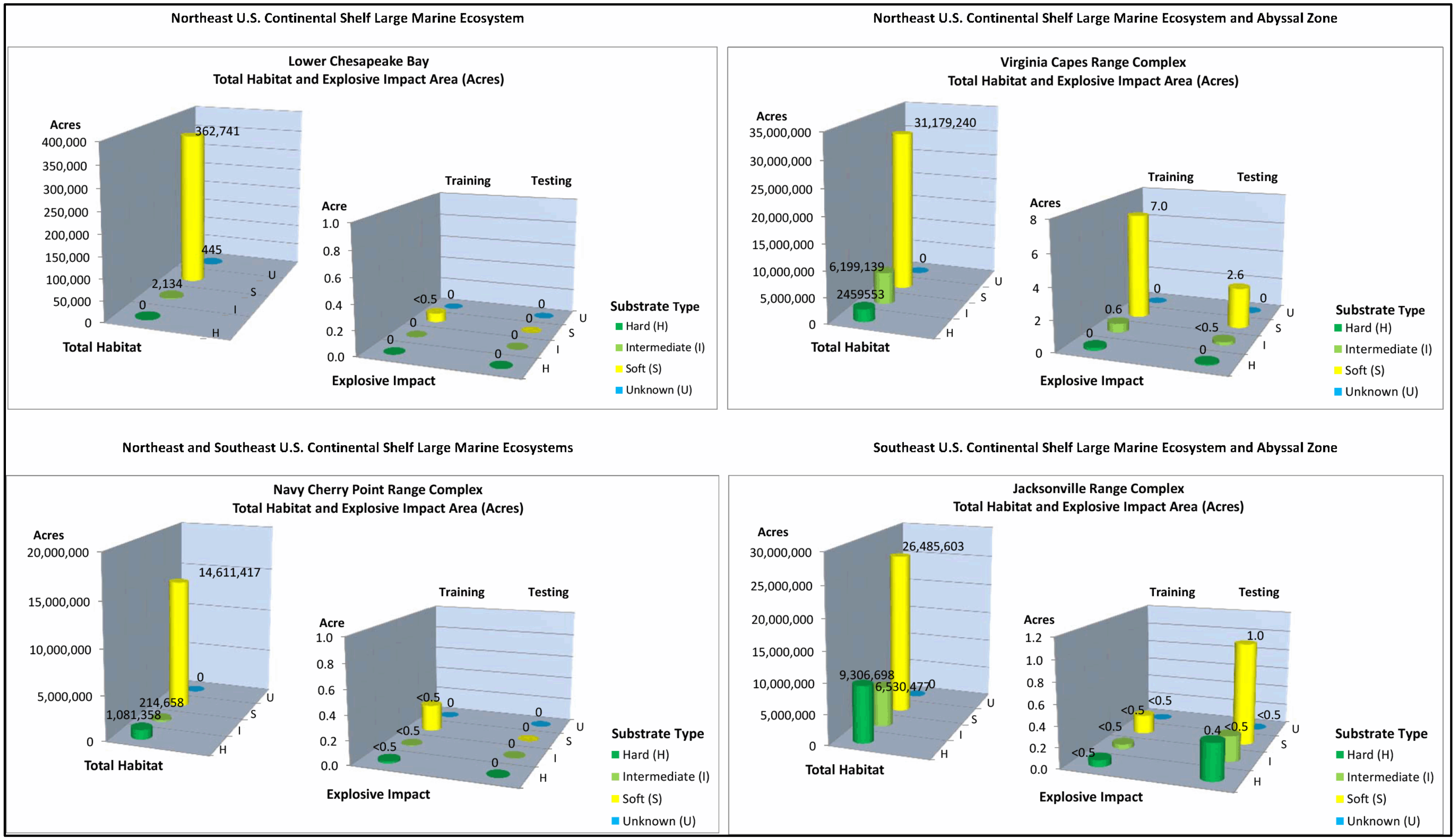


Figure 3.5-9: Alternative 1 – Proportional Impact (Acres) from Explosives by Substrate Type for Training and Testing Compared to Total Vulnerable Habitat Within the Range Complexes of the Large Marine Ecosystems Within the Study Area

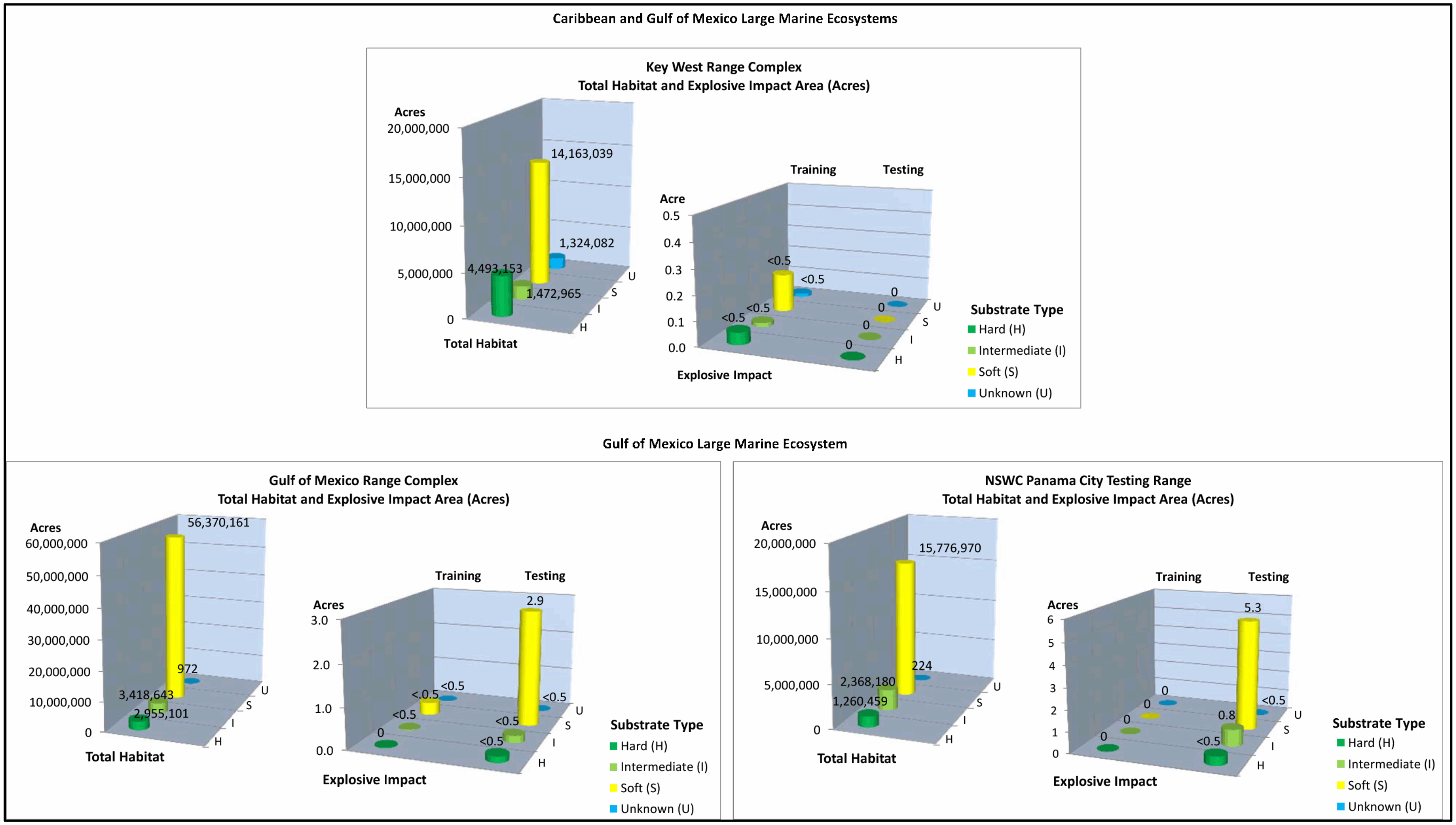


Figure 3.5-9 (Continued): Alternative 1 – Proportional Impact (Acres) from Explosives by Substrate Type for Training and Testing Compared to Total Vulnerable Habitat Within the Range Complexes of the Large Marine Ecosystems Within the Study Area

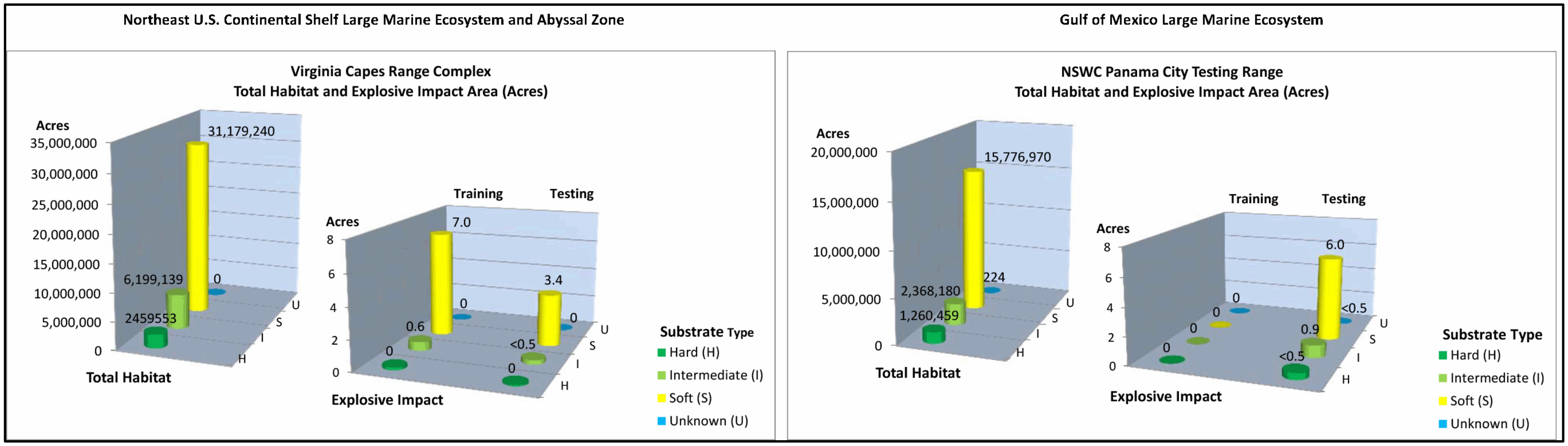


Figure 3.5-10 Alternative 2 – Proportional Impact (Acres) from Explosives by Substrate Type for Training and Testing Compared to Total Vulnerable Habitat Within the Range Complexes of the Large Marine Ecosystems Within the Study Area

Impacts from Explosives Under Alternative 2 for Testing Activities

Relevant testing activities included in Alternative 2 that differ from Alternative 1 include NAVAIR's airborne mine neutralization system test and anti-submarine warfare tracking test–maritime patrol aircraft. Impacts from other activities would remain the same as discussed above under Alternative 1 impacts from explosives for testing. The general locations for Alternative 2 activities are listed in Appendix A (Navy Activity Descriptions) and shown on Figure 3.5-1 through Figure 3.5-4.

Based on the number of charges and impact areas per year, the worst-case scenarios for hard bottom are 4.0, 1.5, and 14.0 acres in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, respectively (Figure 3.5-17). This represents less than 0.01 percent of hard bottom, intermediate bottom, and softbottom habitat in each area.

Analysis was conducted in order to determine the proportional impact of explosives testing on marine habitats in each of the training areas within the Study Area. Only Virginia Capes and Naval Surface Warfare Center Panama City would differ in impacts from Alternative 1 (Figure 3.5-10). Based on the proportional analysis of impacts, total explosive impacts to hard substrate from testing activities would be approximately 1.0 acre. Impacts to other substrate types would be approximately 1.5 and 13.5 acres for intermediate and soft substrates, respectively. Impacts to unknown substrate would be less than 0.5 acre. See Appendix F (Military Expended Materials and Direct Strike Impact Analyses) for detailed analysis of explosive impacts from testing activities in each training area.

Analysis was also conducted to evaluate impacts accumulating over the course of a 5-year period. The analysis assumed that all impacts would accumulate. In reality, some habitat would recover over time, as soft substrates are dynamic systems and craters could refill. Areas of hard bottom and other sensitive habitats could be avoided using the Protective Measures Assessment Protocol. The total footprint for impacts from high explosives over the 5-year period would be approximately 80.0 acres. However, proportional impacts would still affect less than 0.01 percent of the total area of each habitat type (hard, intermediate, and soft). Details of this analysis can be found in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

Under Alternative 2, the areas of bottom habitat in in the large marine ecosystems affected annually by in-water detonations for testing activities would be a negligible portion of available bottom habitat (less than 0.01 percent annually). Testing events that include seafloor detonations would be infrequent and the percentage of testing area affected would be small, and the disturbed areas are likely softbottom areas that recover relatively quickly from disturbance. Therefore, in-water explosions under Alternative 2 would be limited to local and short-term impacts on marine habitat structure in the Study Area.

3.5.3.2.1.3 Impacts from Explosives Under the No Action Alternative

Impacts from Explosives Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the AFTT Study Area. Various explosive stressors (e.g., underwater detonations occurring on or near the seafloor) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.5.3.3 Energy Stressors

Energy stressors are not applicable to habitats, since activities that include the use of energy-producing devices are typically conducted at or above the surface of the water and would not impact bottom habitats. Therefore, they are not analyzed further in this section.

3.5.3.4 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts of the various types of physical disturbance and strike stressors resulting from the Navy training and testing activities within the Study Area. This analysis includes the potential impacts of (1) vessels and in-water devices, (2) military expended materials (3) seafloor devices, and (4) pile driving.

Impacts from physical disturbances or strikes resulting from Navy training and testing activities on biota inhabiting soft bottom (habitat for seagrasses, clams, etc.) and hard bottom (habitat for hard corals, seaweed, sponges, etc.) substrates are discussed in Section 3.3 (Vegetation) and Section 3.4 (Invertebrates). Potential impacts to the underlying substrates (soft, intermediate, hard, or artificial) are analyzed here.

3.5.3.4.1 Impacts from Vessels and In-Water Devices

Vessels conducting training and testing activities in the Study Area include large ocean-going ships and submarines typically operating in waters deeper than 100 m, but also occasionally transiting inland waters from ports and through the operating areas. Training and testing activities also include smaller vessels operating in inland waters, typically at higher speeds (greater than 10 knots). Vessels used for training and testing activities range in size from small boats (less than 40 ft.) to nuclear aircraft carriers (greater than 980 ft.). Table 3.0-16 (Representative Vessel Types, Lengths, and Speeds) lists representative types of vessels, including amphibious warfare vessels, used during training and testing activities. Towed mine warfare and unmanned devices are much smaller than other Navy vessels, but would also disturb the water column near the device. Some activities involve vessels towing in-water devices used in mine warfare activities. The towed devices attached to a vessel by cables are smaller than most vessels, and are not towed at high speeds. Some vessels, such as amphibious vehicles, would intentionally contact the seafloor in the surf zone.

Vessels, in-water devices, and towed in-water devices could either directly or indirectly impact any of the habitat types discussed in this section, including soft and intertidal shores, soft and hard bottoms, and artificial substrates. In addition, a vessel or device could disturb the water column enough to stir up bottom sediments, temporarily increasing the local turbidity. The shore and nearshore environment is typically very dynamic because of its constant exposure to wave action and cycles of erosion and deposition. Along high-energy shorelines like ocean beaches, these areas would be reworked by waves and tides shortly after the disturbance. Along low-energy shorelines in sheltered inland waters, the force of vessel wakes can result in elevated erosion and resuspension of fine sediment (Zabawa & Ostrom, 1980). In deeper waters where the tide or wave action has little influence, sediments suspended into the water column would eventually settle. Sediment settlement rates are highly dependent on grain size. Disturbance of deeper bottom habitat by vessels or in-water devices is possible where the propeller wash interacts with the bottom. However, most vessels transiting in shallow, nearshore waters are confined to navigation channels where bottom disturbance only occurs with the largest vessels. An exception would be for training and testing activities that occur in shallow, nearshore environments. Turbidity caused by vessel operation in shallow water, propeller scarring, and vessel grounding could impact habitats in shallow-water areas. In addition, physical contact with hard bottom areas can cause structural damage to the substrate. However, direct impacts to the substrate are typically avoided because they could slow or damage the vessel or in-water device. These disturbances would not alter the overall nature of the sediments to a degree that would impair their function as habitat. The following alternatives analysis specifies where these impacts could be happening in terms of number of events with vessel movement or in-water devices training/testing in different habitat areas.

3.5.3.4.1.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

As indicated in Section 3.0.3.3.4.1 (Vessels and In-Water Devices), the majority of the training activities include vessels. These activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers, and ranges. Navy training vessel traffic would be concentrated in the Northeast U.S. Continental Shelf Large Marine Ecosystem near Naval Station Norfolk in Norfolk, Virginia, and in the Southeast U.S. Continental Shelf Large Marine Ecosystem near Naval Station Mayport in Jacksonville, Florida. Amphibious landings would be restricted to designated beaches. Large vessel movement primarily occurs within the U.S. Exclusive Economic Zone, with the majority of the traffic flowing in a direct line between Naval Stations Norfolk and Mayport. Large marine ecosystems, as well as the Gulf Stream Open Ocean Area—specifically within the Northeast, Virginia Capes, Navy Cherry Point, Jacksonville, and Gulf of Mexico Range Complexes and anywhere in the Gulf of Mexico. Use of in-water devices is concentrated within the Virginia Capes Range Complex.

Because of the nature of vessel operation and intentional avoidance of bottom strikes, most shore and bottom habitats would not be exposed to vessel strikes but could be exposed to vessel disturbance by propeller wash. Groundings would be accidental and are rare. Amphibious vehicles are an exception, but only designated beaches that are naturally resilient to disturbance are used. Therefore, while vessels may affect shore and bottom habitats, adverse impacts are not likely.

Shallow water habitats within the Study Area would have a very small potential to be exposed to vessel strikes. Vessels would pose little risk to habitats in the open ocean although, in coastal waters, currents from large vessels may cause resuspension of sediment. Vessels travelling at high speeds would generally pose more of a risk through propeller action in shallow waters.

With the exception of amphibious operations, vessel disturbance and strikes affecting habitats would be extremely unlikely. Shallow-water vessels typically operate in defined boat lanes with sufficient depths to avoid propeller or hull strikes of bottom habitats. However, for some inland training activities the training areas outside of navigation channels may not have sufficient depth that it is avoidable.

The direct impact of vessels on bottom habitats is restricted to amphibious training beaches, whereas the indirect impact of propeller wash and wakes from vessels or in-water devices could impact shallow-water training areas and sheltered shoreline habitats. However, the bottom disturbance associated with propeller wash represents only a temporary resuspension of sediment in the shallowest portion of training areas. The effect of surface wakes is limited to high-speed training along relatively sheltered shorelines and is likely indistinguishable from the effect of other vessel wakes or storms in waters open to the public. Sheltered waters restricted to the public are typically harbors where no wake speeds are enforced.

There is very little likelihood of impacts to habitats because in-water devices are not expected to contact the seafloor during training activities, because operational procedures typically avoid shallow areas and intentionally avoid vessels or devices contacting the bottom, and exposures would be localized, temporary, and would cease with the conclusion of the activity.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

As indicated in Section 3.0.3.3.4.1 (Vessels and In-Water Devices), Navy vessel movements and in-water device usage for testing activities would be similar to those described previously under training activities.

Because of the nature of vessel and in-water device operation and intentional avoidance of bottom strikes, most habitat would not be exposed to vessel or in-water device direct strikes.

The impact of vessels and in-water devices on marine habitats would be inconsequential because the footprint of potential impact is extremely small relative to the overall availability of habitat, operational procedures typically avoid shallow areas and intentionally avoid vessels or devices contacting the bottom, and exposures would be localized, temporary, and would cease with the conclusion of the activity.

3.5.3.4.1.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

As indicated in Section 3.0.3.3.4.1 (Vessels and In-Water Devices), Navy vessel movements and in-water device usage under Alternative 2 would be similar to those described previously under Alternative 1 training activities, although the overall vessel operations would be slightly increased due to more active hull-mounted sonar operations.

Because of the nature of vessel and in-water device operation and intentional avoidance of bottom strikes, most habitat would not be exposed to vessel or in-water device direct strikes. Amphibious landings are an exception, but these activities are conducted in designated areas that have been historically used for this type of activity and are generally devoid of any quality habitat.

The impact of vessels and in-water devices on marine habitats would be inconsequential because the footprint of potential impact is extremely small relative to the overall availability of habitat, operational procedures typically avoid shallow areas and intentionally avoid vessels or devices contacting the bottom, and exposures would be localized, temporary, and would cease with the conclusion of the activity.

Impacts from Vessels and In-Water Devices Under Alternative 2 for Testing Activities

As indicated in Section 3.0.3.3.4.1 (Vessels and In-Water Devices), Navy vessel movements and in-water device usage for testing activities under Alternative 2 would be similar to those described previously under Alternative 2 training activities.

Because of the nature of vessel and in-water device operation and intentional avoidance of bottom strikes, most habitats would not be exposed to vessel or in-water device direct strikes. Amphibious landings are an exception; however, they are not included in testing activities.

The impact of vessels and in-water devices on marine habitats would be inconsequential because the footprint of potential impact is extremely small relative to the overall availability of habitat, operational procedures typically avoid shallow areas and intentionally avoid vessels or devices contacting the bottom, and exposures would be localized, temporary, and would cease with the conclusion of the activity.

3.5.3.4.1.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Impacts from Vessels and In-Water Devices Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the AFTT Study Area. Various physical disturbance and strike stressors (e.g., vessels and in-water devices) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.5.3.4.2 Impacts from Aircraft and Aerial Targets

Impacts from aircraft and aerial targets are not applicable to habitats, because aircraft and aerial targets would not contact or otherwise affect shore or bottom habitats and are not analyzed further in this section.

3.5.3.4.3 Impacts from Military Expended Materials

This section analyzes the potential for physical disturbance to marine substrates from the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than munitions, such as sonobuoys, expendable targets, and ship hulks. Note that expended materials do not include materials that are recovered or considered in-water or seafloor devices. Areas expected to have the greatest amount of expended materials are the Northeast U.S. Continental Shelf Large Marine Ecosystem, the Southeast U.S. Continental Shelf Large Marine Ecosystem, and the Gulf Stream Open Ocean Area (specifically within the Virginia Capes and Jacksonville Range Complexes). For a discussion of the types of activities that use military expended materials, where they are used, and how many events would occur under each alternative, see Tables 2.6-1 through 2.6-4. Military expended materials have the potential to physically disturb marine substrates to the extent that they impair the substrate's ability to function as a habitat. These disturbances can result from several sources, including the impact of the expended material contacting the seafloor and moving around, the covering of the substrate by the expended material, or alteration of the substrate from one type to another.

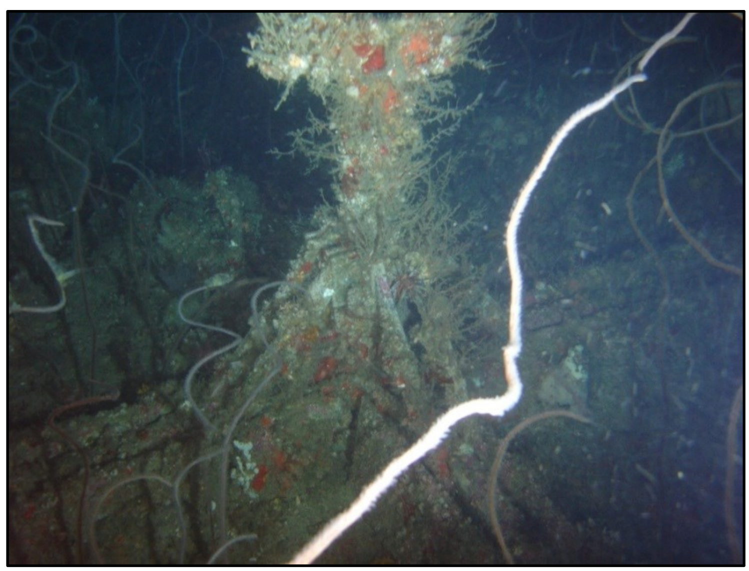
The potential for military expended materials to physically impact marine substrates as they come into contact with the seafloor depends on several factors. These factors include, but are not limited to, the size, shape, type, density, and speed of the material through the water column; the amount of the material expended; the frequency of training or testing; water depth, water currents, or other disturbances; and the type of substrate. Most of the kinetic energy of the expended material, however, is dissipated within the first few feet of the object entering the water causing it to slow considerably by the time it reaches the substrate. Because the damage caused by a strike is proportional to the force of the strike, slower speeds result in lesser impacts. Due to the water depth at which most training and testing events take place, a direct strike on either hardbottom or artificial structures (e.g., artificial reefs and shipwrecks) is unlikely to occur with sufficient force to damage the substrate. In softer substrates (e.g., sand, mud, silt, clay, and composites), the impact of the expended material coming into contact with the seafloor, if large enough and striking with sufficient momentum, may result in a depression and a localized redistribution of sediments as they are temporarily suspended in the water column. There may also be redistribution of unconsolidated sediment in areas with sufficient flow to move the sediment, creating a pattern of scouring on one side of the material and deposition on the other.

During Navy training and testing, countermeasures such as flares and chaff are introduced into marine habitats. These types of military expended materials are not expected to impact marine habitats as strike stressors, given their smaller size and low velocity when deployed compared to projectiles, bombs, and missiles.

Another potential physical disturbance that military expended materials could have on marine substrates would be to cover them or to alter the type of substrate and, therefore, its function as habitat. The majority of military expended materials that settle on hardbottom or artificial substrates, while covering the seafloor, may serve a similar habitat function as the substrate it is covering by providing a hard surface on which organisms can attach (Figure 3.5-11 and Figure 3.5-12). Similarity in attached organisms over the long term depends on similarity in structural features (Perkol-Finkel et al., 2006; Ross et al., 2016), fine surface texture, and mineral content (Davis, 2009). Natural hardbottom and artificial structures of a similar shape will eventually have similar communities of attached organisms if they have similar fine texture and mineral content. However, the smooth surface texture of intact military expended materials and lack of mineral content suggest a difference in species composition and associated

Note: Observed at approximately 350 meters in depth and 60 nautical miles east of Jacksonville, Florida. Of note is the use of the smoke float as a colonizing substrate for a cluster of sea anemones (U.S. Department of the Navy, 2010).

Figure 3.5-11: A Marine Marker Observed in an Area Dominated by Coral Rubble on the Continental Slope

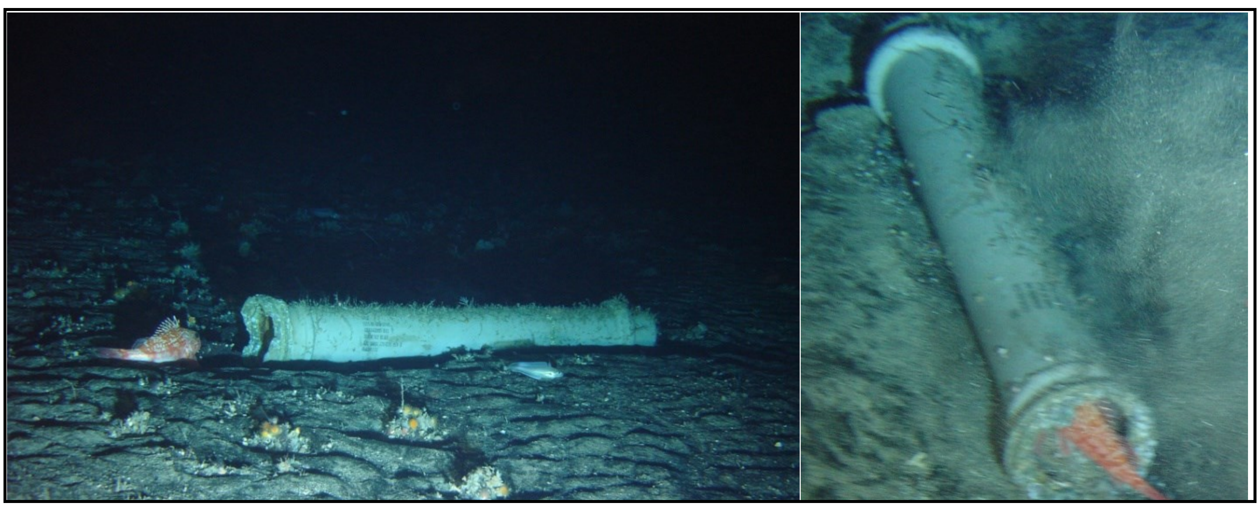


Note: Observed on the ridge system that runs parallel to the shelf break at approximately 80 meters in depth and 55 nautical miles east of Jacksonville, Florida. Of note is that encrusting organisms and benthic invertebrates readily colonize the artificial structure to a similar degree as the surrounding rock outcrop (U.S. Department of the Navy, 2010).

Figure 3.5-12: An Unidentified, Non-Military Structure on Hardbottom

functions. An exception would be expended materials, like the decelerators/parachutes utilized to deploy sonobuoys, lightweight torpedoes, expendable mobile anti-submarine warfare training targets, and other devices from aircraft, which would not provide a hard surface for colonization. In these cases, the hardbottom or artificial substrate covered by the expended material would not be physically damaged, but would have an impaired ability to function as a habitat for colonizing or encrusting organisms.

Most military expended materials that settle on soft bottom habitats, while not damaging the actual substrate, would inhibit the substrate's ability to function as a soft bottom habitat by covering it with a hard surface. This would effectively alter the substrate from a soft surface to a hard structure and, therefore, would alter the habitat to be more suitable for organisms more commonly found associated with hard bottom environments (U.S. Department of the Navy, 2010, 2011). Expended materials that settle in the shallower, more dynamic environments of the continental shelf would likely be eventually covered over by sediments due to currents and other coastal processes, or encrusted by organisms. Depending on the substrate properties and the hydrodynamic characteristics of the area, military expended materials may become buried rather quickly while in other areas they may persist on the surface of the seafloor for a more extended time. The offshore portion of the continental shelf experiences more sediment redistribution from oceanic currents (e.g., Gulf Stream) than distant surface waves. The effect of oceanic currents on sediment redistribution diminishes seaward of the continental shelf break: sediment along the continental slope and the Atlantic Basin/Abyssal Zone experience very little reworking from surface currents and waves. In the deeper waters of the continental slope and beyond where currents do not play as large of a role, expended materials may remain exposed on the surface of the substrate with minimal change for extended periods (Figure 3.5-13).



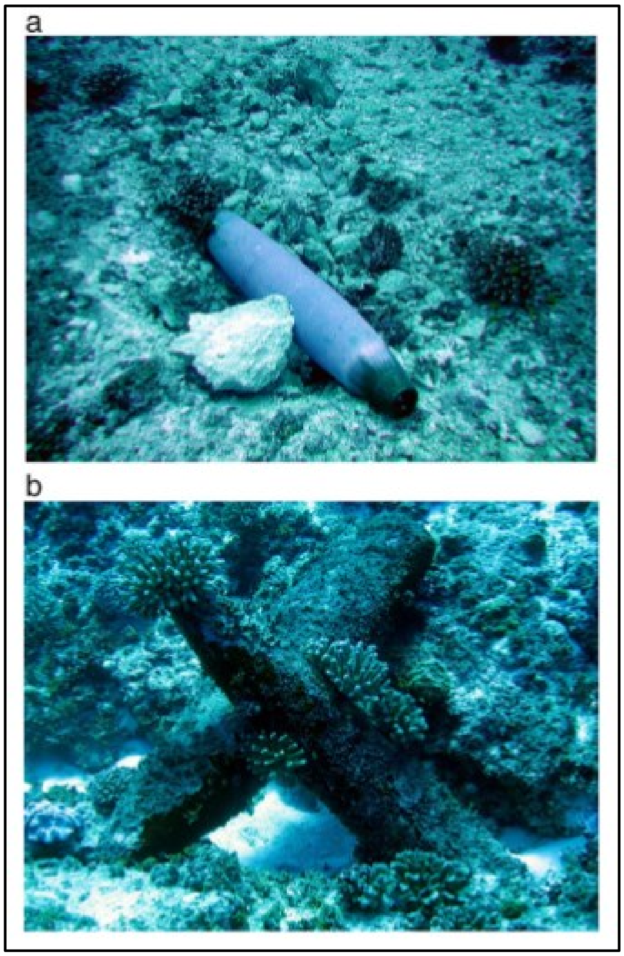
Note: The casing was observed in a sandy area on the continental slope approximately 425 meters in depth and 70 nautical miles east of Jacksonville, Florida. The casing has not become covered by sediments or encrusting organisms due to the depth and the relatively calm, current-free environment.

Figure 3.5-13: A 76-millimeter Cartridge Casing on Softbottom and a Blackbelly Rosefish (*Helicolenus dactylopterus*) Using the Casing for Protection When Disturbed

Whereas the impacts will accumulate somewhat through successive years of training and testing, some portion of the expended material will sink below the surface of shifting soft bottom habitat or become incorporated into natural hard bottom before crumbling into inorganic particulates. This will be the fate of military expended material whose density is greater than or equal to that of the underlying substrate (e.g., metal, cement, sand) (Traykovksi & Austin, 2017). Constituents of military expended material that are less dense than the underlying substrate (e.g., fabric, plastic) will likely remain on the surface substrate after sinking. In this case, the impact on substrate as a habitat is likely temporary and minor due to the mobility of such materials (refer to living resources sections for more information on the entanglement and ingestion risk posed by plastic and fabric constituents of military expended material). The impact of dense expendable materials on bottom substrate is prolonged in the large marine ecosystem areas that are seaward of the continental shelf. Between initial settlement and burial or complete degradation, these relatively stable objects will likely function as small artificial habitats for encrusting algae, attached macroalgae/seaweed, and/or sedentary invertebrates as well as small motile organisms (Figure 3.5-14).

Disturbance of the bottom from ship hulks may occur, but impairment of habitat function is not expected because the material is sunk in the abyssal zone where bottom organisms are generally small and sparsely populated (Nybakken, 1993); the deep ocean has a sparse supply of food items for sedentary deposit or filter feeders. The only densely populated areas in the deep ocean are around the occasional hydrothermal vent/cold seep.

To determine the potential level of disturbance that military expended materials have on soft, intermediate, and hard bottom substrates, an analysis to determine the impact footprint was conducted for each range complex for each alternative. Three main assumptions were made that result in the impact footprints calculated being generally considered overestimates. First, within each category of expended items (e.g., bombs, missiles, rockets, large-caliber projectiles, etc.), the size of the largest item that would be expended was used to represent the sizes of all items in the category. For example, the impact footprints of missiles used during training exercises range



a. MK 82 inert bomb (168 centimeters long) that directly impacted the seafloor at a depth of 12 meters in Z3E on 5 or 6 September 2007; photographed on 13 September 2007. Area of destruction/ disturbance was approximately 17 square meters.

b. MK 82 bombs with Pocilloporid corals, algae, etc.

Source: (Smith & Marx, 2016)

Figure 3.5-14: Military Expended Material Functioning as Habitat

from 1.5 to 40 square feet. For the analyses, all missiles were assumed to be equivalent to the largest in size, or 40 square feet. Second, it was also assumed that the impact of the expended material on the seafloor was twice the size of its actual footprint. This assumption accounts for any displacement of sediments at the time of impact as well as any subsequent movement of the item on the seafloor due to currents or other forces. This should more accurately reflect the potential disturbance to soft bottom habitats, but would overestimate disturbance to hard bottom habitats since no displacement of the substrate would occur. Third, items with casings (e.g., small-, medium-, and large-caliber munitions; flares; sonobuoys; etc.) have their impact footprints doubled to account for both the item and its casing. Items and their casings were assumed to be the same size, even though depending on the munitions, one of them is often smaller than the other.

Once the impact footprints were calculated, three analyses were performed for each range complex: (1) a worst-case scenario in which potential impact to each habitat type (soft, intermediate, and hard bottom habitats) in that range complex if all expended materials settled in areas with that substrate type, (2) a proportional analysis in which potential impact to each habitat type expended materials settled proportionally across all habitat types in the area, and (3) a 5-year scenario in which potential impact to the bottom habitats in that range complex over a 5-year period if activities continued at anticipated levels and impact accumulated over that period. During the analyses, the same dimensions were used for high-explosive munitions as were used for non-explosive practice munitions. The total area of the seafloor covered by the expended materials should be similar regardless of whether the item is intact or fragmented, despite the fact that high-explosive munitions will explode in the air, at the surface, or in the water column and only fragments would make it to the substrate.

Only the acreage in the large marine ecosystem areas was included in percentages. The areas within the Atlantic Basin and Abyssal Zone were not included in order to focus on bottom areas likely to have a combination of suitable habitat, supply of sedentary invertebrate larvae, and sufficient food particles for filtration or deposit-feeding. Artificial substrate was not included, because it was inconsistently included for mapping and it likely represented a miniscule percentage of habitat types in the large marine ecosystems.

According to surveys conducted at Farallon De Medinilla (a Department of Defense bombing range in the Mariana Archipelago) between 1997 and 2012, there was no evidence that the condition of the living resources assessed had changed or been adversely impacted to a significant degree by the training activities being conducted there. It should also be noted that the intended munition target was on the nearby land area, and water impacts were due to inaccuracy. The health, abundance, and biomass of fishes, corals, and other marine resources are comparable to or superior to those in similar habitats at other locations within the Mariana Archipelago (Smith & Marx, 2016). However, the study noted that the decline in some important reef fish during their latest surveys was likely due to increasing attention from fishermen. Also, this is expected to be an extreme case based on the proximity to shallow-water coral reefs and the severe wave impact and associated movement of military expended materials due to the shallow margins of the islands where wave impact is most severe. Impacts to habitat from military expended material in the Study Area would be expected to be less severe. See Appendix F (Military Expended Materials and Direct Strike Impact Analyses) for detailed analyses of the impacts associated with military expended materials from Navy testing and training activities.

3.5.3.4.3.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Training activities involving military expended materials (Appendix A, Navy Activity Descriptions) would have the potential to impact the marine substrates within the areas in which the training is occurring. Each range complex was evaluated to determine what level of impact could be expected under Alternative 1.

To determine the percentage of a given substrate within a range complex that may potentially be impacted by military expended materials under a worst case scenario for each of the alternatives, the total impacted area for each range complex was divided by the total amount of that particular substrate type within the same range complex as provided in Table 3.5-2 (see also Appendix F, Military Expended Materials and Direct Strike Impact Analyses).

Military expended materials associated with training exercises under a worst-case scenario would not impact more than 0.01 percent of the available soft bottom habitat annually within any of the training areas or range complexes. Likewise, the potential impact of the worst-case scenario on intermediate bottom habitats within each range complex does not exceed 0.01 percent of the total available intermediate bottom. Impacts to hard substrate would not exceed 0.01 percent for any of the areas. Given that the probability of these worst case scenarios occurring is highly unlikely, the actual impact of military expended materials within each range complex under the Alternative 1 on hard bottom, intermediate bottom, or soft bottom substrates will be even less.

Additional analysis was conducted in order to determine the proportional impact of military expended material from training activities on marine habitats in each of the training areas within the Study Area (Figure 3.5-15). Based on the proportional analysis of impacts, total military expended materials impacts from training activities to vulnerable hard substrate would be approximately 7.5 acres. Impacts to other substrate types would be approximately 6.0, 63.0, and 5.5 acres for intermediate, soft, and unknown substrates, respectively. See Appendix F (Military Expended Materials and Direct Strike Impact Analyses), for detailed analysis of military expended materials impacts from training activities in each range complex and other training locations.

Analysis was also conducted to evaluate impacts accumulating over the course of a 5-year period. The analysis assumed that all impacts would accumulate. In reality, soft bottom habitats may recover in the short term where heavier military expended materials are buried under shifting sediments; hard bottom habitats would recover over the long term where hard, stable military expended materials become overgrown with similar organisms. The total proportional impact footprint for impacts from high explosives over the 5-year period would be approximately 36.0, 30.5, and 315.5 acres for hard bottom, intermediate bottom, and soft bottom respectively. Approximately 27.0 acres of unknown habitat would be impacted. However, total impacts would still affect less than 0.02 percent of the total area of each habitat type (hard, intermediate, and soft) would be impacted. Details of this analysis can be found in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

Military expended materials, including small caliber projectile casings, marine markers, flares, and flare parts, would also be utilized in inland waterways. In the northeast, military expended materials would be expended in Narragansett Bay, Rhode Island; Lower Chesapeake Bay, James River and Tributaries, and York River. In the southeast, military expended material is employed in Cooper River, South Carolina; Kings Bay, Georgia; Mayport, Florida; and Port Canaveral, Florida. Impacts from training activities under Alternative 1 in inland waterways are very small, totaling only about 2.5 acres combined in the northeast inland waterways and less than 0.5 acre. In the southeast inland waterways in the worst-case scenario. Proportionally, in range complexes in the northeast, less than 0.5, 0.5, 2.5, and 0.5 acres of hard, intermediate, soft, and unknown substrate would be impacted respectively (Figure 3.5-15). In the southeast, less than 0.5 acre would be impacted in any of the substrate types (Figure 3.5-15).

As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy will implement mitigation to avoid impacts from military expended materials on habitats in mitigation areas throughout the Study Area. For example, the Navy will not conduct gunnery activities within a specified distance of shallow-water coral reefs. Mitigation for seafloor resources was not included in the quantitative assessment of habitat impacts; however, it will help the Navy further avoid the potential for impacts on habitats from certain activities that involve the use of military expended materials.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Testing activities involving military expended materials (Appendix A, Navy Activity Descriptions) would have the potential to impact the marine substrates within the areas the testing is occurring. Each range complex and testing range was evaluated to determine what level of impact could be expected under Alternative 1.

To determine the percentage of the total soft bottom or hard bottom substrate within the Study Area that may potentially be impacted by military expended materials under a worst case scenario for each of the alternatives, the total impacted area for each testing range was divided by the total amount of that particular substrate type within the same testing range as provided in Table 3.5-2 (see also Appendix F, Military Expended Materials and Direct Strike Impact Analyses).

Military expended materials associated with testing activities under a worst-case scenario would not impact more than 0.01 percent of the available soft bottom habitat annually within any of the testing areas. Likewise, the potential impact of the worst-case scenario on intermediate bottom habitats within each testing range does not exceed 0.01 percent of the total available hard bottom. Hard bottom impacts would not exceed 0.01 percent for any of the areas. Given that the probability of these worst case scenarios occurring is highly unlikely, the actual impact of military expended materials within each range complex under Alternative 1 on hard bottom, intermediate bottom, or soft bottom substrates will be even less.

Additional analysis was conducted in order to determine the proportional impact of military expended material from testing activities on marine habitats in each of the ranges complexes and training areas within the Study Area (Figure 3.5-15). Based on the proportional analysis of impacts, total military expended materials impacts to hard substrate from testing activities would be approximately 6.5 acres. Impacts to other substrate types would be approximately 6.5 and 57.0 acres for intermediate and soft substrates, respectively. Approximately 0.5 acre of unknown substrate would be impacted. See Appendix F, Military Expended Materials and Direct Strike Impact Analyses, for detailed analysis of military expended materials impacts from testing activities in each range complex or other testing area.

Analysis was also conducted to evaluate impacts accumulating over the course of a 5-year period. The analysis assumed that all impacts would accumulate. In reality, some habitat would recover over time, as soft substrates are dynamic systems and craters could refill. The total proportional impact footprint for impacts from high explosives over the 5-year period would be approximately 32.5, 335.5, and 282.0 acres for hard bottom, intermediate bottom, and soft bottom respectively. Approximately

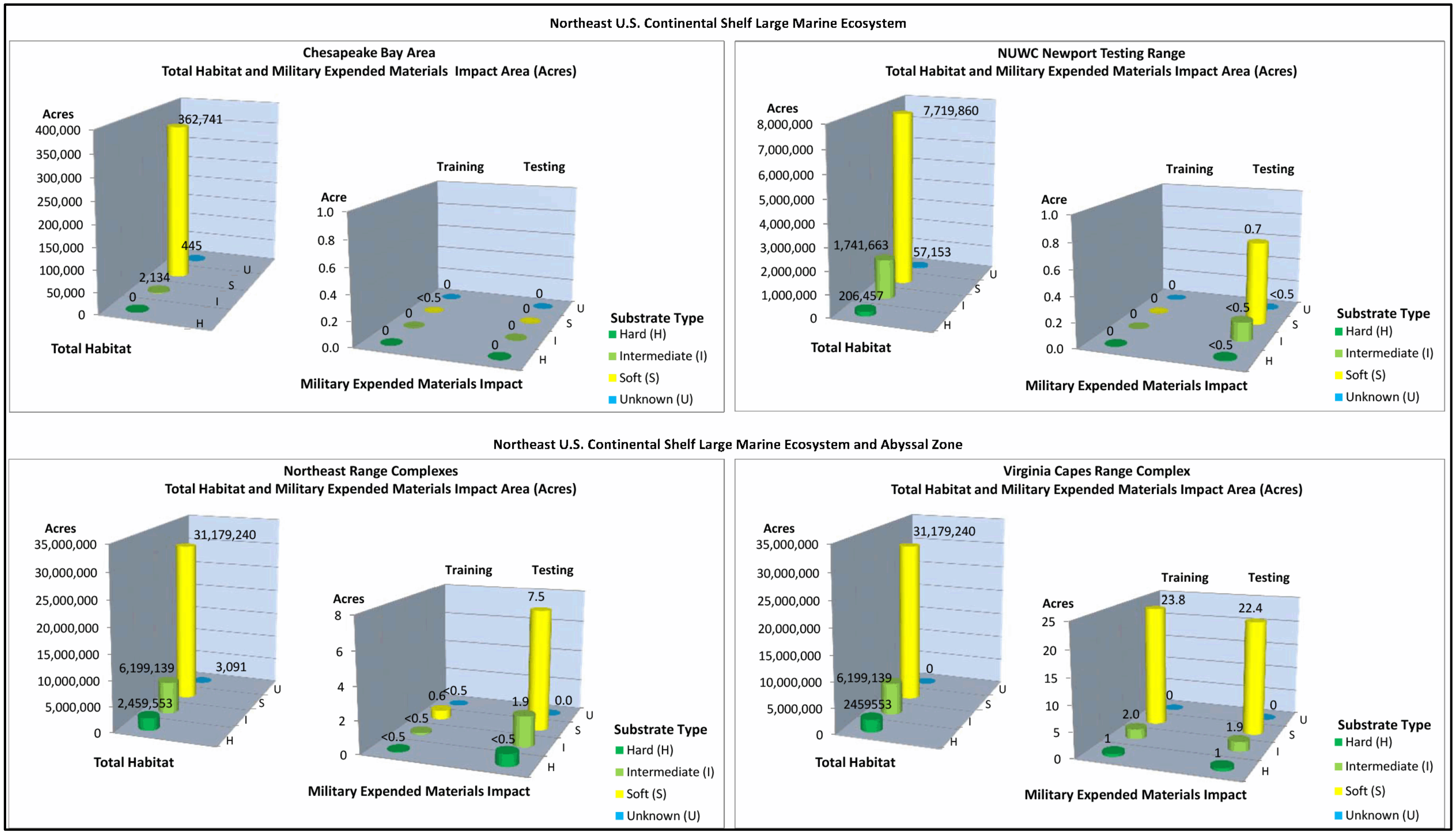


Figure 3.5-15: Alternative 1 – Proportional Impact (Acres) from Military Expended Materials by Substrate Type for Testing and Training Compared to Total Habitat Within the Study Area

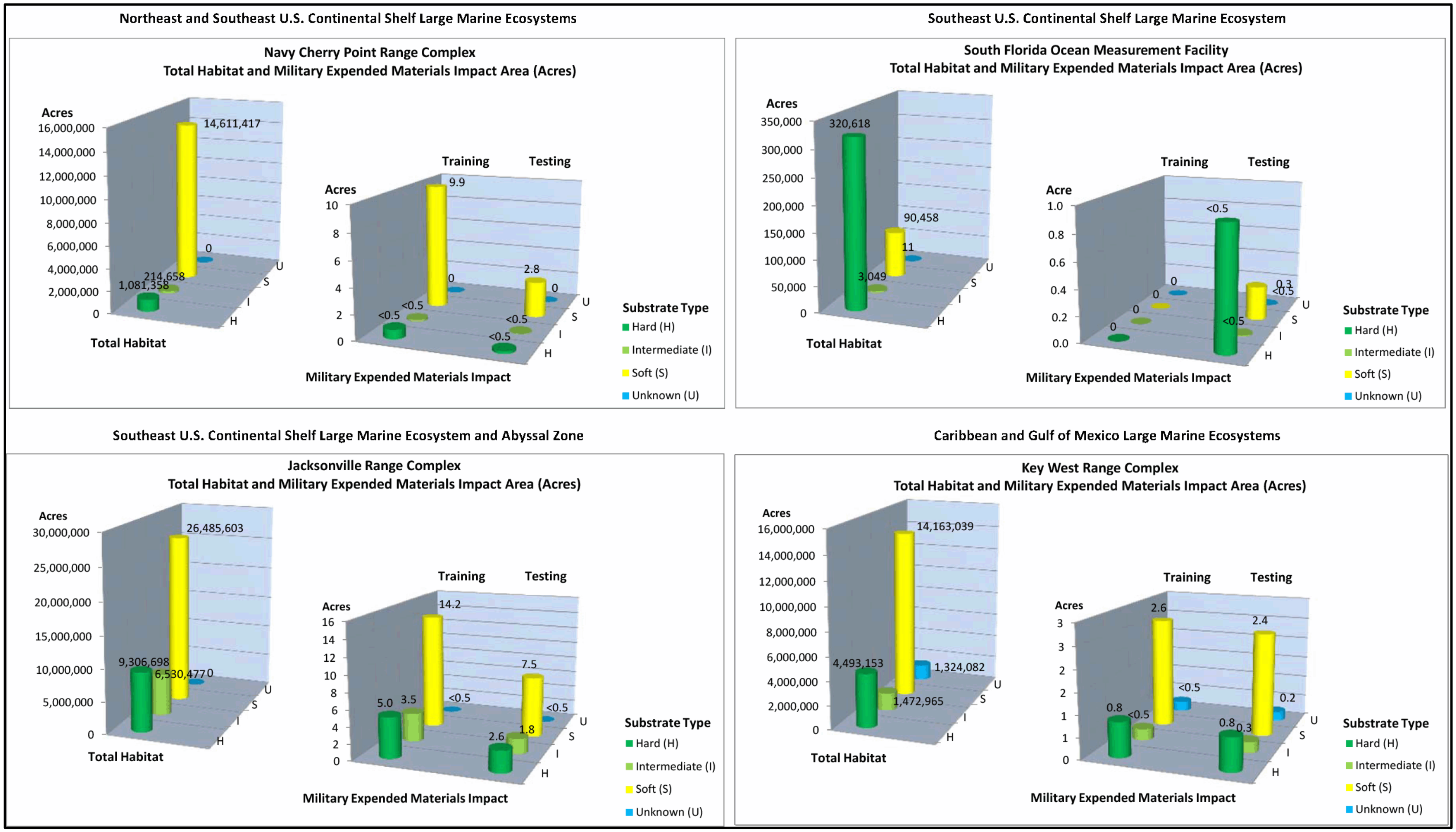


Figure 3.5-15 (Continued): Alternative 1 – Proportional Impact (Acres) from Military Expended Materials by Substrate Type for Testing and Training Compared to Total Habitat Within the Study Area

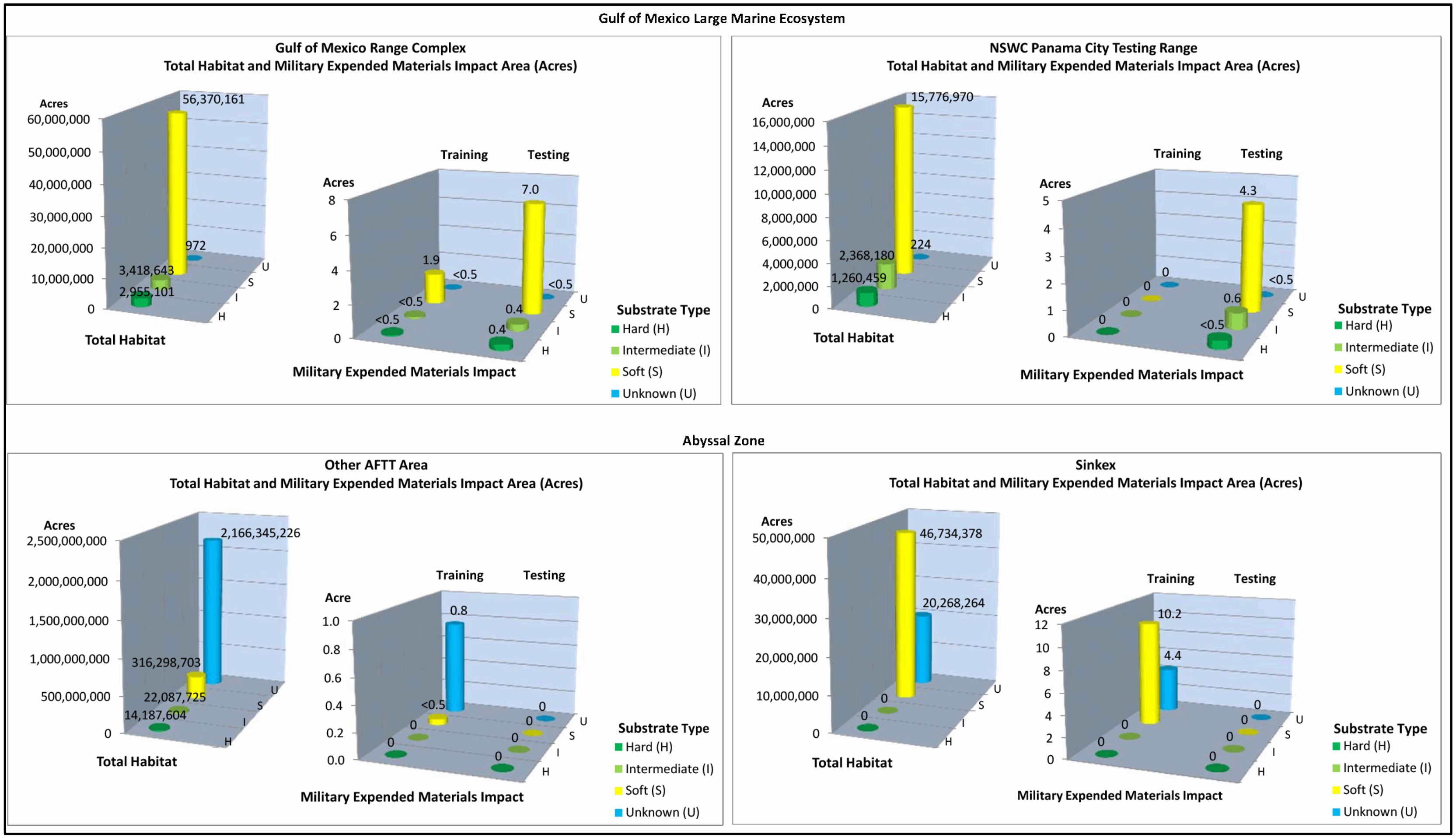


Figure 3.5-15 (Continued): Alternative 1 – Proportional Impact (Acres) from Military Expended Materials by Substrate Type for Testing and Training Compared to Total Habitat Within the Study Area

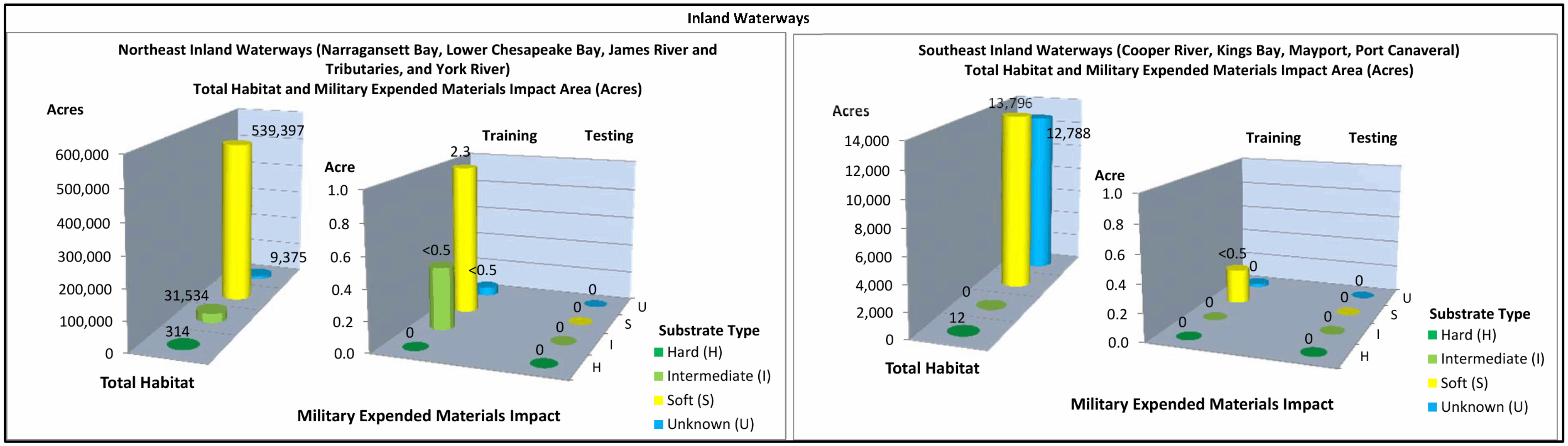


Figure 3.5-15 (Continued): Alternative 1 – Proportional Impact (Acres) from Military Expended Materials by Substrate Type for Testing and Training Compared to Total Habitat Within the Study Area

1.0 acres of unknown habitat would be impacted. However, total impacts would still affect less than 0.05 percent of the total area of each habitat type (hard, intermediate, and soft) would be impacted. Details of this analysis can be found in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

Further, many of the materials used in training are recovered to some degree: non-explosive torpedoes (100 percent), unmanned aerial systems (depends on the type and exercise), targets (depends on the type and exercise), mine shapes (depends on the exercise), and bottom-placed instruments (100 percent). For the purpose of analysis, a worst case (expended) is assumed if the recovery status was unknown. The numbers are also based on a maximum expenditure which is typically not realized in any given year.

As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy will implement mitigation to avoid impacts from military expended materials on habitats in mitigation areas throughout the Study Area. For example, the Navy will not conduct gunnery activities within a specified distance of shallow-water coral reefs. Mitigation for seafloor resources was not included in the quantitative assessment of habitat impacts; however, it will help the Navy further avoid the potential for impacts on habitats from certain activities that involve the use of military expended materials.

3.5.3.4.3.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Training activities involving military expended materials (Appendix A, Navy Activity Descriptions) would have the potential to impact the marine substrates within the areas the testing is occurring. Each range complex was evaluated to determine what the level of impact could be expected under Alternative 2.

As indicated in Section 3.0.3.3.4.2 (Military Expended Materials), under Alternative 2 the total number of military expended materials would be nearly identical to those analyzed under Alternative 1 (see Appendix F, Military Expended Materials and Direct Strike Impact Analyses), and the primary difference between alternatives would be due to an increase in the amount of materials (e.g., sonobuoys) associated with anti-submarine warfare activities. Activities under Alternative 2 would occur in the same geographic locations using the same types of military expended materials as Alternative 1.

To determine the percentage of the total soft bottom, intermediate bottom, or hard bottom substrate within a training range that may potentially be impacted by military expended materials under a worst case scenario for each of the alternatives, the total impacted area for each training range was divided by the total amount of that particular substrate type within the same testing range. Results of this analysis are provided in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

Military expended materials related to training activities under a worst-case scenario would not impact more than 0.01 percent of the available soft bottom habitat annually within any of the training ranges. Likewise, the potential impact of the worst-case scenario on intermediate bottom habitats within each training range does not exceed 0.01 percent of the total available intermediate bottom. Likewise, the potential impact of the worst-case scenario on habitats within each training area, range complex, or other area does not exceed 0.01 percent of the total available hard bottom.

Analysis was conducted in order to determine the proportional impact of military expended material from training on marine habitats in each of the range complexes within the Study Area. Under Alternative 2, impacts would only differ for the Jacksonville and Gulf of Mexico Ranges complexes (Figure 3.5-16). Based on the proportional analysis of impacts, military expended material impacts to hard substrate from training activities would be less than 7.5 acres. Impacts to other substrate types would be approximately 6.0, 63.5, and 5.5 acres for intermediate, soft, and unknown substrates, respectively. See Appendix F (Military Expended Materials and Direct Strike Impact Analyses) for detailed analysis of explosive impacts from training activities in each Training Area.

Analysis was conducted to evaluate impacts accumulating over the course of a 5-year period. The analysis assumed that all impacts would accumulate. In reality, soft bottom habitats may recover in the short term where heavier military expended materials are buried under shifting sediments; hard bottom habitats would recover over the long term where hard, stable military expended materials become overgrown with similar organisms. The total proportional impact footprint for impacts from high explosives over the 5-year period would be approximately 36.5, 31.0, and 316.5 acres for hard bottom, intermediate bottom, and soft bottom respectively. Approximately 27.0 acres of unknown habitat would be impacted. However, total impacts would still affect less than 0.02 percent of the total area of each habitat type (hard, intermediate, and soft) would be impacted. Details of this analysis can be found in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

Given that the probability of these worst case scenarios occurring is highly unlikely, the actual impact of military expended materials within each range complex under Alternative 2 on either hard bottom or soft bottom substrates will be even less than shown in Figure 3.5-16.

Further, many of the military expended materials would be recovered, including, torpedoes, unmanned aerial systems, targets, mine shapes, and instruments.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Testing activities involving military expended materials (Section 3.0.3.3.4, Physical Disturbance and Strike Stressors, and Appendix A, Navy Activity Descriptions) would have the potential to impact the marine substrates within the areas the testing is occurring. Each range complex and testing range was evaluated to determine what the level of impact could be expected under Alternative 2.

As indicated in Section 3.0.3.3.4.2 (Military Expended Materials), under Alternative 2 the total number of military expended materials would be very similar to that under Alternative 1 (see Appendix F, Military Expended Materials and Direct Strike Impact Analyses), and the primary difference between alternatives would be due to an increase in the amount of materials (e.g., sonobuoys) associated with anti-submarine warfare activities. Activities under Alternative 2 would occur in the same geographic locations using the same types of military expended materials as Alternative 1.

To determine the percentage of the total soft bottom, intermediate bottom, or hard bottom substrate within a testing range that may potentially be impacted by military expended materials under a worst case scenario for each of the alternatives, the total impacted area for each testing range was divided by the total amount of that particular substrate type within the same testing range. Results of this analysis are provided in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

Military expended materials related to testing activities under a worst-case scenario would not impact more than 0.01 percent of the available soft bottom habitat annually within any of the testing ranges. Likewise, the potential impact of the worst-case scenario on intermediate bottom habitats within each testing range does not exceed 0.01 percent of the total available intermediate bottom. The potential impact of the worst-case scenario on habitats within each testing range does not exceed 0.1 percent of the total available hard bottom.

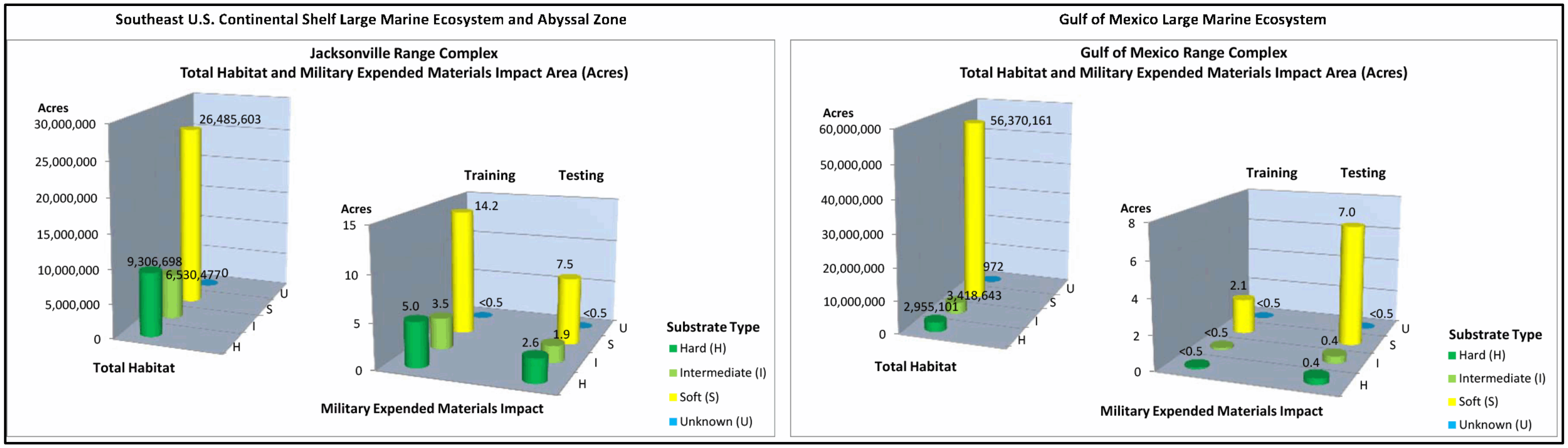


Figure 3.5-16: Alternative 2 – Proportional Impact (Acres) from Military Expended Materials by Substrate Type for Training and Testing Compared to Total Vulnerable Habitat Within the Range Complexes of the Large Marine Ecosystems Within the Study Area

Analysis was conducted in order to determine the proportional impact of military expended material from testing on marine habitats in each of the range complexes within the Study Area. Based on the proportional analysis of impacts, military expended material impacts to hard substrate from training activities would be 6.5 acres. Impacts to other substrate types would be approximately 7.0, 57.0, and less than 0.5 acres for intermediate, soft, and unknown substrates, respectively. See Appendix F (Military Expended Materials and Direct Strike Impact Analyses) for detailed analysis of explosive impacts from training activities in each training area.

Analysis was conducted to evaluate impacts accumulating over the course of a 5-year period. The analysis assumed that all impacts would accumulate. In reality, over time, some habitat would recover as soft substrates are dynamic systems and craters could refill. The total proportional impact footprint for impacts from high explosives over the 5-year period would be approximately 33.0, 36.0, and 285.0 acres for hard bottom, intermediate bottom, and soft bottom respectively. Approximately 1.0 acre of unknown habitat would be impacted. However, total impacts would still affect less than 0.05 percent of the total area of each habitat type (hard, intermediate, and soft) would be impacted. Details of this analysis can be found in Appendix F (Military Expended Materials and Direct Strike Impact Analyses).

Given that the probability of these worst case scenarios occurring is highly unlikely, the actual impact of military expended materials within each range complex under Alternative 2 on either hard bottom or soft bottom substrates will be even less than shown in Figure 3.5-15.

Further, many of the military expended materials would be recovered, including torpedoes, unmanned aerial systems, targets, mine shapes, and instruments.

3.5.3.4.3.3 Impacts from Military Expended Materials Under the No Action Alternative

<u>Impacts from Military Expended Materials Under the No Action Alternative for Training and Testing Activities</u>

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the AFTT Study Area. Various physical disturbance and strike stressors (e.g., military expended materials) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.5.3.4.4 Impacts from Seafloor Devices

The types of activities that use seafloor devices are discussed in Appendix B (Activity Stressor Matrices) and where they are used and how many activities would occur under each alternative are discussed in Section 3.0.3.3.4.3 (Seafloor Devices). Seafloor devices include items that are placed on, dropped on, or moved along the substrate for a specific purpose, and include mine shapes, anchor blocks, vessel anchors, bottom-placed instruments, bottom-crawling unmanned underwater vehicles, and bottom placed targets that are recovered (not expended). Mine shapes are typically deployed via surface vessels or fixed-wing aircraft. These items can damage fragile abiotic or biogenic structures on the bottom, temporarily cover and effectively replace an area of bottom, and resuspend sediment when deployed/retrieved.

3.5.3.4.4.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

As indicated in Section 3.0.3.3.4.3 (Seafloor Devices), under Alternative 1, seafloor devices are deployed in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as Gulf Stream Open Ocean Area—specifically within the Virginia Capes, Navy Cherry Point, Jacksonville, and Gulf of Mexico Range Complexes. Specific bays and inland waters where seafloor devices are deployed include Sandy Hook Bay, Earle, New Jersey; lower Chesapeake Bay, Hampton Roads, Virginia; Beaufort Inlet Channel, Morehead City, North Carolina; Cape Fear River, Wilmington, North Carolina; St. Andrew Bay, Panama City, Florida; Sabine Lake, Beaumont, Texas; and Corpus Christi Bay, Corpus Christi, Texas.

Activities involving seafloor devices have the potential to impact bottom habitats. While hard bottom exists in all these areas, activities in the Virginia Capes Range Complex, Navy Cherry Point Range Complex, and particularly the Jacksonville Range Complex have the potential to impact hard bottom.

Mine shapes or other stationary targets and anchors are typically recovered within 7 to 30 days following the completion of the training or testing events. As a result of their temporary nature, recovered mine shapes do not permanently impact the substrate on which they are placed, but will temporarily impair the ability of the substrate to function as a habitat for as long as the mine shape and anchor is in place. The impairment is due to the temporary covering by artificial substrate along with changes in the bathymetry around the structures due to scouring and deposition patterns around objects on a soft bottom. Additionally, many targets used in inshore waters are placed either pierside or at beachfront locations where the substrate is already disturbed by dredging (for pierside locations) or by nearshore currents and wave action (for beach-front locations).

Potential impacts of precision anchoring are qualitatively different from other seafloor devices because the activity involves repeated disturbance to the same area of seafloor. Precision anchoring training exercises involve releasing of anchors in designated locations. The intent of these training exercises is to practice anchoring the vessel within 300 ft. of the planned anchorage location. These training activities typically occur within predetermined shallow water anchorage locations near ports with seafloors consisting of soft bottom substrate. The level of impact to the soft sediments would depend on the size of the anchor used, which would vary according to vessel type. As most of these activities occur in areas along navigation channels subject to strong currents and shifting sediment, disturbed areas would quickly return to pre-disturbance conditions. The Navy will implement mitigation that includes not conducting precision anchoring (except in designated anchorages) within the anchor swing circle of shallow-water coral reefs, live hard bottom, artificial reefs, and shipwrecks to avoid potential impacts from seafloor devices on habitats in mitigation areas throughout the Study Area (see Section 5.4.1, Mitigation Areas for Seafloor Resources). Mitigation for seafloor resources was not included in the quantitative assessment of habitat impacts; however, it will help the Navy further avoid the potential for impacts on habitats from precision anchoring activities.

Crawlers are fully autonomous, battery-powered amphibious vehicles used for functions such as reconnaissance missions in territorial waters. These devices are used to classify and map underwater mines in shallow water areas. The crawler is capable of traveling 2 ft. per second along the seafloor and can avoid obstacles. The crawlers are equipped with various sonar sensors and communication equipment that enable these devices to locate and classify underwater objects and mines while rejecting miscellaneous clutter that would not pose a threat.

Crawlers move over the surface of the seafloor and would not harm or alter any hard substrates encountered; therefore the hard bottom habitat would not be impaired. However, fragile abiotic or biogenic structures could be harmed by the crawlers moving over the substrate (refer to living resources sections for analysis). In soft substrates, crawlers may leave a trackline of depressed sediments approximately 2 ft. wide (the width of the device) in their wake. However, since these crawlers operate in shallow water, any disturbed sediments would be redistributed by wave and tidal action shortly (days to weeks) following the disturbance. Any disturbance to the soft sediments would not impair its ability to function as a habitat.

The impact of seafloor devices on marine habitats from Alternative 1 training activities is likely to be inconsequential because: (1) the area exposed to the stressor is extremely small relative to overall availability of habitat of each type, (2) the activities are dispersed such that with the exception of precision anchoring activities, few habitats would be exposed to multiple events, (3) impacts would be localized and those involving soft bottom would likely be temporary due to the dynamic nature of the habitats, and (4) sensitive habitats would tend to be avoided due to snagging or entanglement that could hinder recovery of the device. Activities involving seafloor devices are not expected to yield any discernable impacts on the overall availability or quality of habitat.

Impacts from Seafloor Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the use of seafloor devices occurs throughout the Study Area.

Testing activities involving the use of anchor blocks, which are used to moor minefield targets and shapes and are deployed and recovered, have the potential to impact bottom habitat throughout the Study Area. At the conclusion of the testing event, the minefield targets and shapes are typically recovered, but may be left in place.

Crawlers are used in the northeast in Narragansett Bay and waters used for testing by the Naval Undersea Warfare Center Division, Newport Testing Range; off the east coast of Florida at the South Florida Ocean Measurement Facility Testing Range; and at the Gulf of Mexico testing ranges for the Naval Surface Warfare Center, Panama City Division Testing Range. Testing activities involving the use of bottom crawling unmanned underwater vehicles within the South Florida Ocean Measurement Facility Testing Range would be limited to the Port Everglades Restricted Anchorage Area (Section 2.1.6.2, Sea and Undersea Space). In other testing areas, bottom habitats would be exposed to strike and disturbance in the relatively small area transited by bottom-crawling unmanned underwater vehicles.

Impacts to habitats from Alternative 1 testing activities are likely to be similar to those discussed above for training exercises. The impact of seafloor devices on marine habitats is likely to be inconsequential because: (1) the area exposed to the stressor is extremely small relative to overall availability of habitat of each type, (2) the activities are dispersed such that with the exception of precision anchoring activities, few habitats would be exposed to multiple events, (3) impacts would be localized and those involving soft bottom would likely be temporary due to the dynamic nature of the habitats, and (4) sensitive habitats would tend to be avoided due to snagging or entanglement that could hinder recovery of the device. Activities involving seafloor devices are not expected to yield any discernable impacts on the overall availability or quality of habitat. The Navy will implement mitigation to avoid potential impacts from seafloor devices on habitats in mitigation areas within the South Florida Ocean Measurement Facility, as discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources). For example, the Navy will use real-time geographic information system and Global Positioning System (along with remote sensing verification) data during deployment, installation, and recovery of anchors and mine-like objects to avoid impacts on shallow-water coral reefs and live hard bottom. Mitigation for seafloor resources was not included in the quantitative assessment of habitat impacts; however, it will help the Navy further avoid the potential for impacts on habitats from certain activities that involve the use of seafloor devices at the South Florida Ocean Measurement Facility Testing Range.

3.5.3.4.4.2 Impacts from Seafloor Devices Under Alternative 2

Impacts from Seafloor Devices Under Alternative 2 for Training Activities

As indicated in Section 3.0.3.3.4.3 (Seafloor Devices), under Alternative 2, seafloor devices occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as Gulf Stream Open Ocean Area—specifically within the Virginia Capes, Navy Cherry Point, Jacksonville, and Gulf of Mexico Range Complexes. Specific bays and inland waters could include Sandy Hook Bay, Earle, New Jersey; lower Chesapeake Bay, Hampton Roads, Virginia; Beaufort Inlet Channel, Morehead City, North Carolina; Cape Fear River, Wilmington, North Carolina; St. Andrew Bay, Panama City, Florida; Sabine Lake, Beaumont, Texas; and Corpus Christi Bay, Corpus Christi, Texas.

Impacts to habitats from training activities under Alternative 2 are likely to be the same as those discussed above for Alternative 1 training exercises. The number of devices and locations in which they are used would be the same. The impact of seafloor devices on marine habitats is likely to be inconsequential because: (1) the area exposed to the stressor is extremely small relative to overall availability of habitat of each type, (2) the activities are dispersed such that with the exception of precision mooring activities, few habitats would be exposed to multiple events, (3) impacts would be localized and those involving soft bottom would likely be temporary due to the dynamic nature of the habitats, and (4) sensitive habitats would tend to be avoided due to snagging or entanglement that could hinder recovery of the device. Activities involving seafloor devices are not expected to yield any discernable impacts on the overall availability or quality of habitat.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the use of seafloor devices occurs in the Northeast, and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as Gulf Stream Open Ocean Area—specifically within the Northeast, Virginia Capes, Navy Cherry Point, and Jacksonville Range Complexes; Naval Undersea Warfare Center Division, Newport Testing Range, South Florida Ocean Measurement Facility Testing Range, Naval Surface Warfare Center, and the Panama City Division Testing Range; nearshore locations at Newport, Rhode Island and Joint Expeditionary Base Little Creek, Virginia Beach, Virginia; and anywhere in the Gulf of Mexico.

Impacts to habitats from testing activities under Alternative 2 are likely to be similar to those discussed above for Alternative 1 testing exercises. The number of testing activities involving seafloor devices is only slightly increased (approximately 0.5 percent increase) from Alternative 1. The only locations where activities would increase are Virginia Capes Range Complex and Naval Surface Warfare Center Panama City Testing Range, where five additional activities annually would occur at each location. Impact of seafloor devices on marine habitats is likely to be inconsequential because: (1) the area exposed to the stressor is extremely small relative to overall availability of habitat of each type, (2) the activities are dispersed such that with the exception of precision mooring activities, few habitats would be exposed to multiple events, and (3) impacts would be localized and those involving soft bottom would likely be temporary due to the dynamic nature of the habitats. Activities involving seafloor devices are not expected to yield any discernable impacts on the overall availability or quality of habitat.

3.5.3.4.4.3 Impacts from Seafloor Devices Under the No Action Alternative

Impacts from Seafloor Devices Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the AFTT Study Area. Various physical disturbance and strike stressors (e.g., seafloor devices) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.5.3.4.5 Impacts from Pile Driving

Pile driving and removal would involve driving of piles into soft substrate with an impact hammer. Pile driving may have the potential to impact soft bottom habitats temporarily during driving, removal, and in the short-term thereafter.

3.5.3.4.5.1 Impacts from Pile Driving Under Alternative 1

Impacts from Pile Driving Under Alternative 1 for Training Activities

Under Alternative 1, Elevated Causeway System training would include pile driving and removal which could occur once per year in the nearshore and surf zone at one of the following locations: Chesapeake Bay area or Navy Cherry Point Range Complex. While pile driving and removal may have the potential to impact soft bottom habitat, the impacts would be extremely limited since the number of piles is relatively small, and the duration is short (20 days for assembly and 10 days for disassembly). Piles would remain in the water for up to 60 days. Since pile driving would occur in the nearshore and surf zone areas, the dynamic nature of the soft bottom habitat is likely to return to its previous state shortly following removal of the temporary piles. However, the dispersed larvae forming new hard bottom communities may attach to the temporary structures instead of more permanent structures (see Section 3.4, Invertebrates, for details).

Impacts from Pile Driving Under Alternative 1 for Testing Activities

Pile driving stressors are not applicable to habitats since pile driving would not occur under testing activities for Alternative 1 and will not be analyzed further in this section.

3.5.3.4.5.2 Impacts from Pile Driving Under Alternative 2

Impacts from Pile Driving Under Alternative 2 for Training Activities

Under Alternative 2, elevated causeway system training would include pile driving and removal which could occur once per year in the nearshore and surf zone at one of the following locations: Chesapeake Bay area or Navy Cherry Point Range Complex. While pile driving and removal may have the potential to impact softbottom habitat, the impacts would be extremely limited since the number of piles is relatively small, and the duration is short (20 days for assembly and 10 days for disassembly). Piles would remain in the water for up to 60 days. Since pile driving would occur in the nearshore and surf zone areas, the dynamic nature of the softbottom habitat is likely to return to its previous state shortly following removal of the temporary piles.

Impacts from Pile Driving Under Alternative 2 for Testing Activities

Pile driving stressors are not applicable to habitats since pile driving would not occur under testing activities for Alternative 2 and will not be analyzed further in this section.

3.5.3.4.5.3 Impacts from Pile Driving Under the No Action Alternative

Impacts from Pile Driving Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the AFTT Study Area. Various physical disturbance and strike stressors (e.g., pile driving) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.5.3.5 Entanglement Stressors

Entanglement stressors are not applicable to habitats due to the lack of mobility capabilities of habitats and will not be analyzed further in this section.

3.5.3.6 Ingestion Stressors

Ingestion stressors are not applicable to habitats due to the lack of ingestion capabilities of habitats and will not be analyzed further in this section.

3.5.3.7 Secondary Stressors

Secondary stressors are not applicable to habitats as they are not susceptible to impacts from secondary stressors and will not be analyzed further in this section.

3.5.4 Summary of Potential Impacts on Habitats

3.5.4.1 Combined Impacts of All Stressors Under Alternative 1

Of all the potential stressors, only explosives on or near the bottom and military expended materials have any measureable potential to impact marine substrates as habitat for biological communities. The impact area for in-water explosions and military expended materials were all much less than 1 percent of the total area of documented soft bottom or hard bottom in their respective training or testing areas for each mapped substrate type, in any range complex, over 1 year. Furthermore, impacts are expected to be negligible for unknown substrate type habitats. The impacts are unlikely to persist in most cases. Large and dense military expended material (e.g., anchor blocks, large caliber projectile casings, non-explosive bombs) deposited on the bottom along the outer continental shelf would be the most persistent. However, soft bottom habitats may recover in the short term where heavier military expended materials are buried under shifting sediments; hard bottom habitats would recover over the long term where hard, stable military expended materials become overgrown with similar organisms.

The combined impact area of explosive stressors, physical disturbances, and strike stressors proposed for training and testing events in Alternative 1 would have minimal impact on the ability of soft bottom, intermediate bottom, or hard bottom to serve their function as habitat. The total area of mapped hard bottom (Figure 3.5-1 through Figure 3.5-4) in the Study Area is over 26,110,408 acres, which dwarfs the estimated 14.0 acres of potential impacts. Training activities under Alternative 1 would have a total footprint of potential impact across all habitat types of 82.0 acres from military expended materials and 9.0 acres from explosive detonations. This also represents less than 0.01 percent of the bottom habitat within the Study Area. Testing activities under Alternative 1 would have a total footprint of potential impact of 70.5 acres from military expended materials and 14.5 acres from explosive detonations. This represents less than 0.01 percent of the bottom habitat within the Study Area. The combined total proportional impact for training and testing is primarily to soft bottom habitat, much less to hard and intermediate substrate habitats, and very little to areas with unknown substrate type (Figure 3.5-17). See Appendix F (Military Expended Materials and Direct Strike Impact Analyses) for detailed impact analysis.

3.5.4.2 Combined Impacts of All Stressors Under Alternative 2

The combined effects of explosive stressors, physical disturbances, and strike stressors proposed for training and testing events in Alternative 2 would have minimal impact on the ability of soft bottom, intermediate bottom, or hard bottom to function as habitat. The total area of mapped hard bottom (Figure 3.5-1 through Figure 3.5-4) in the Study Area is over 26,110,408 acres, which dwarfs the estimated 7.5 acres of potential impacts. Training activities under Alternative 2 would have a total footprint of potential impact of 82.0 acres across all habitat types from military expended materials and 9.0 acres from explosive detonations. This represents less than 0.01 percent of the bottom habitat within the Study Area. Testing activities under Alternative 2 would have a total footprint of potential impact of 71.0 acres from military expended materials and 16.0 acres from explosive detonations. This also represents less than 0.01 percent of the bottom habitat within the Study Area. The combined total proportional impact for training and testing is primarily to soft bottom habitat, much less to hard bottom and intermediate bottom substrate habitats, and very little to areas with unknown substrate type (Figure 3.5-18). See Appendix F (Military Expended Materials and Direct Strike Impact Analyses) for detailed impact analysis.

3.5.4.3 Combined Impacts of All Stressors Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the AFTT Study Area. Various explosives and physical disturbance and strike stressors (e.g., in-water detonations, military expended materials, seafloor devices, vessels and in-water devices, and pile driving) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

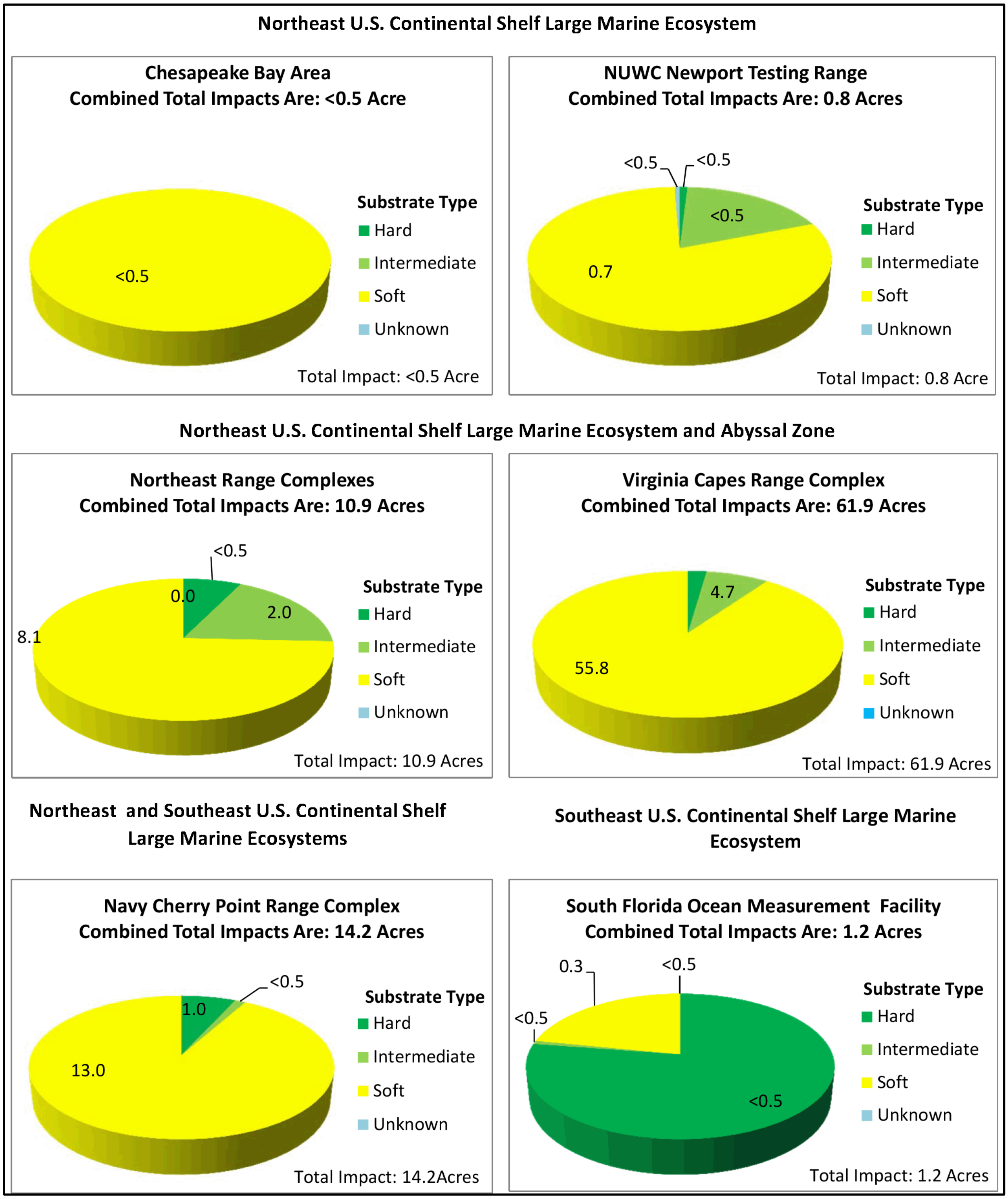


Figure 3.5-17: Alternative 1 – Combined Proportional Impact (Acres) from Explosives and Military Expended Materials for Training and Testing Within the Study Area

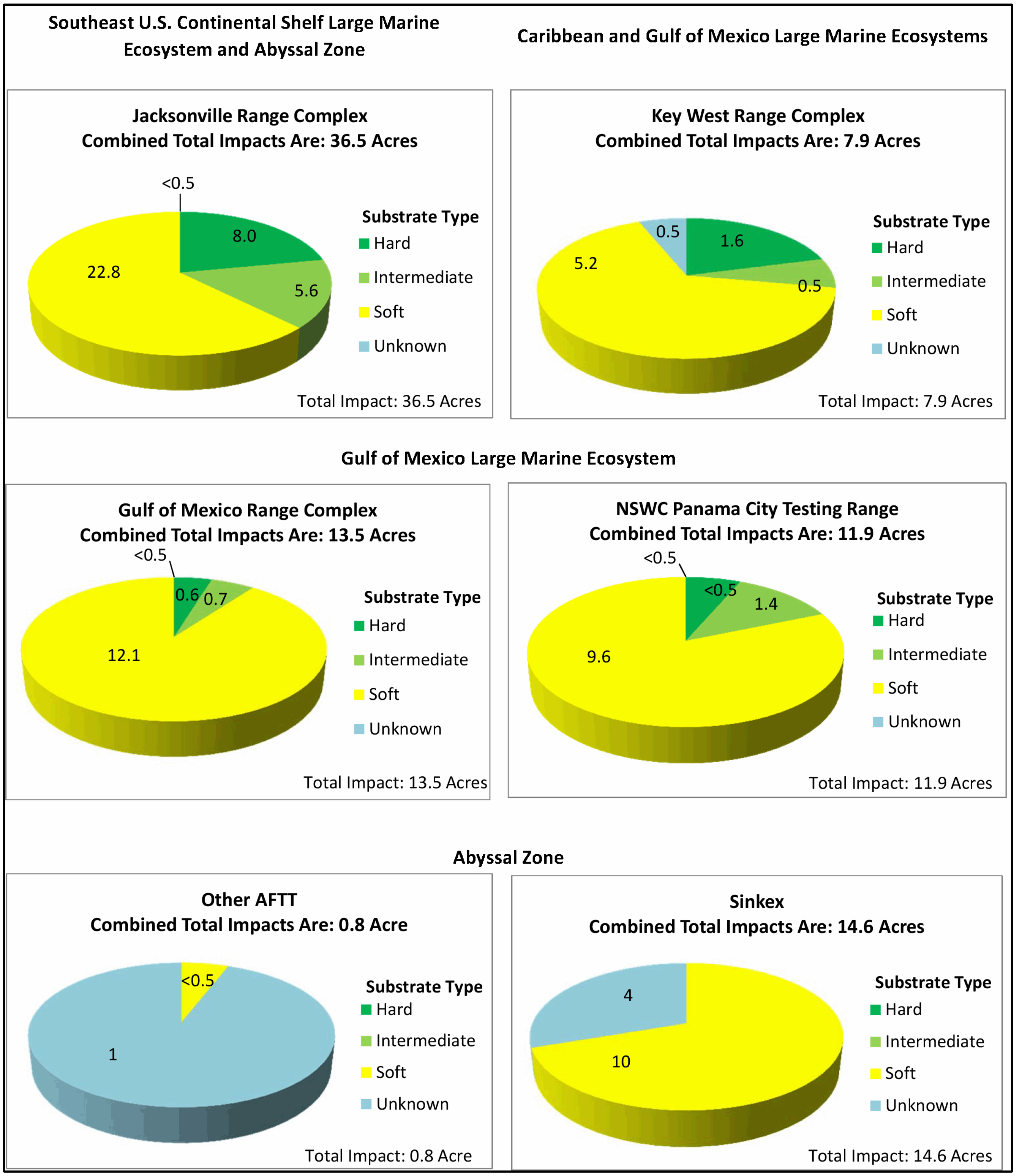


Figure 3.5-17 (Continued): Alternative 1 – Combined Proportional Impact (Acres) from Explosives and Military Expended Materials for Training and Testing Within the Study Area

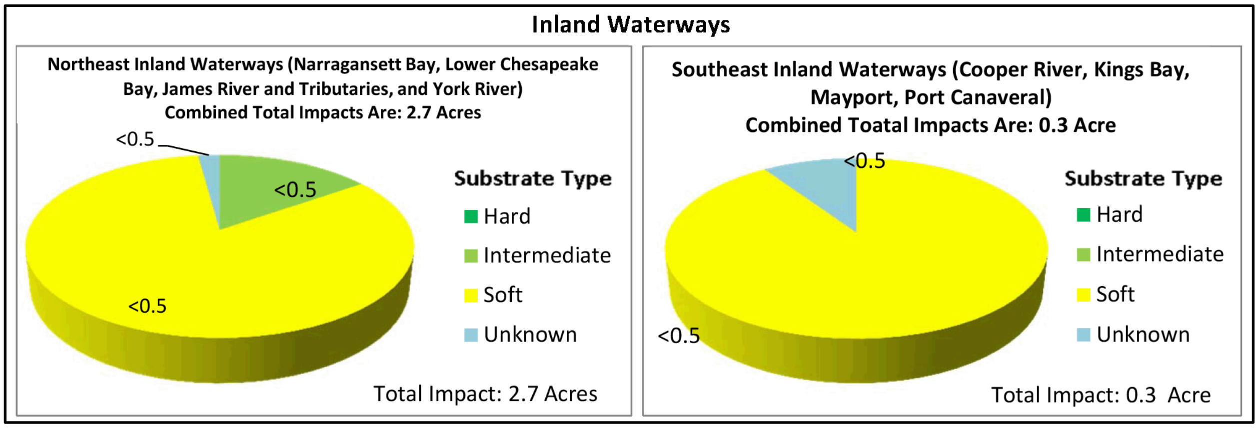


Figure 3.5-17 (Continued): Alternative 1 – Combined Proportional Impact (Acres) from Explosives and Military Expended Materials for Training and Testing Within the Study Area

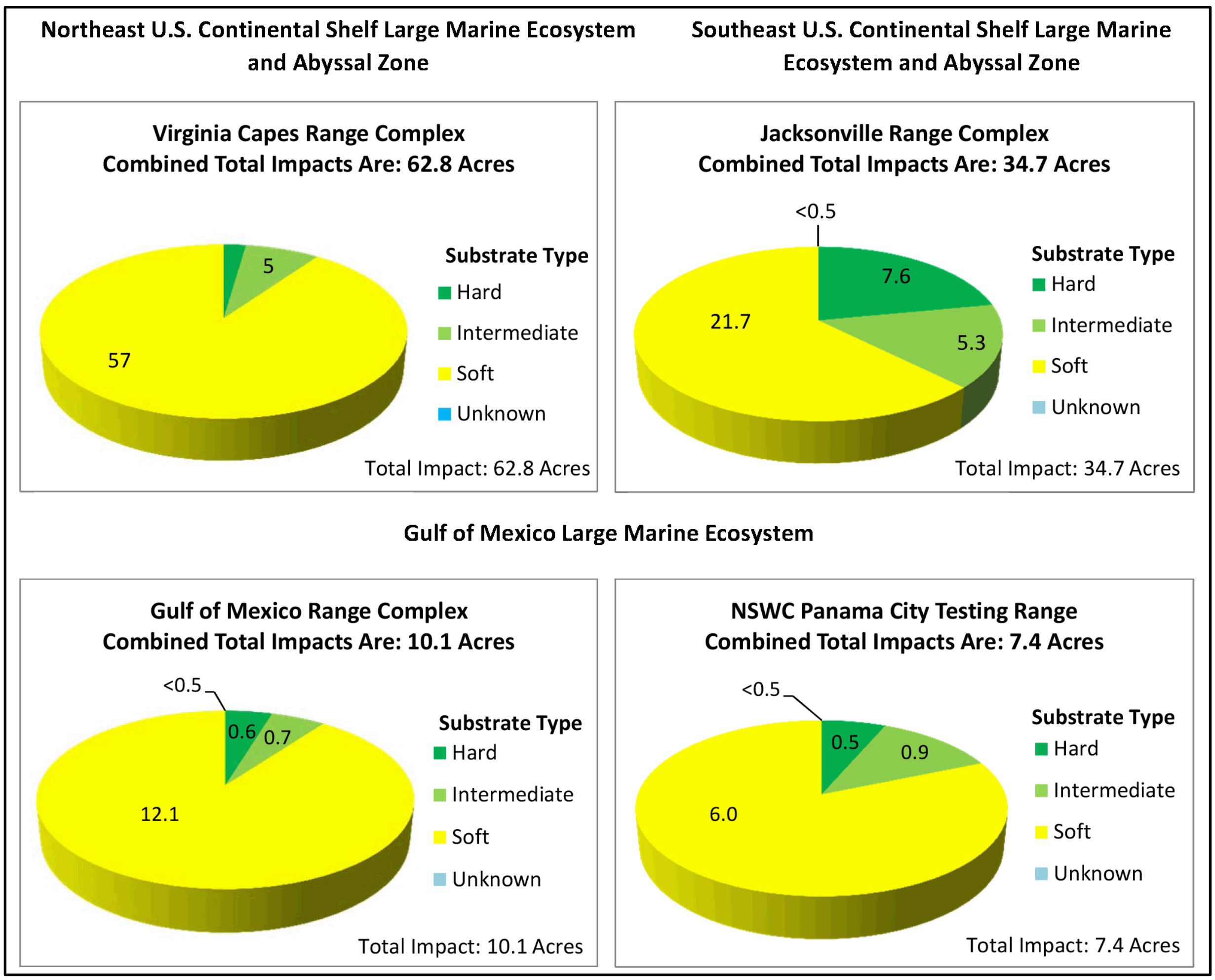


Figure 3.5-18: Alternative 2 – Combined Proportional Impact (Acres) from Explosives and Military Expended Materials for Training and Testing Within the Study Area

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