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APPENDIX A

RELEVANT AND PERTINENT LAWS, REGULATIONS, AND POLICIES

RELEVANT AND PERTINENT LAWS, REGULATIONS, AND POLICIES

A.1 GENERAL

National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190, 42 United States Code [USC] 4347 et seq., as amended); Requires that federal agencies (1) consider the consequences of an action on the environment before taking the action and (2) involve the public in the decision making process for major Federal actions that significantly affect the quality of the human environment. The intent of NEPA is to protect, restore, or enhance the environment through well-informed federal decisions. The Council on Environmental Quality (CEQ) was established under NEPA to implement and oversee federal policy in this process.

Executive Order 12114, 44 *Federal Register* (FR), No. 62; 04-Jan-1979; Environmental Effects Abroad of Major Federal Actions; Activities outside the jurisdiction of the United States, which significantly harm the natural or physical environment, shall be evaluated. An OEIS shall be prepared for major federal actions having significant environmental effects within the global commons (i.e., Antarctica, oceans).

42 USC 4321 et seq.; 40 Code of Federal Regulations (CFR) 1500–1508; 1-July-1988; Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA; Provides regulations applicable to and binding all federal agencies for implementing the procedural provisions of the National Environmental Policy Act of 1969 (NEPA).

Department of Defense (DoD) regulations implementing Executive Order 12114: 32 CFR Part 187, Environmental Effects Abroad of Major Department of Defense Actions.

Department of the Navy regulations implementing NEPA (32 CFR Part 775).

Executive Order 12372; 14-Jul-1982; Intergovernmental Review of Federal Programs; Directs federal agencies to "make efforts to accommodate state and local elected officials' concerns with proposed…direct federal development." It further states, "[f]or those cases where the concerns cannot be accommodated, federal officials shall explain the basis for their decision in a timely manner." The Order requires federal agencies to provide state and local officials the opportunity to comment on actions that could affect their jurisdictions, using state-established consultation processes when possible.

Florida Administrative Code Chap. 62-4; Permits; establishes permitting criteria for air, ground water, waste management, and water quality.

A.2 PHYSICAL RESOURCES

A.2.1 Air

42 USC 7401 et seq.; 40 CFR Parts 50 & 51; Clean Air Act; Dictates that the National Ambient Air Quality Standards (NAAQS) must be maintained nationwide. The Act delegates

authority to state and local agencies to enforce NAAQS and to establish air quality standards and regulations of their own. The adopted state standards and regulations must be at least as restrictive as the federal requirements. The Florida Department of Environmental Protection (FDEP) has the authority to regulate air pollution sources within Florida. Stationary sources must be permitted. Although mobile sources such as aircraft are exempt from air pollution permitting requirements, the operation of these sources must comply with state and federal regulations and the ambient air quality standards.

Florida Statutes Chap. 403, Part I; 1996; Florida Air and Water Pollution Control Act; Regulates air pollution within the state.

Florida Administrative Code Chap. 62-204; 1996; Florida State Implementation Plan, with Ambient Air Quality Standards and PSD Program; Establishes state air quality standards and requirements for maintaining compliance with NAAQS.

Florida Administrative Code Chap. 62-213; 1996; Operation Permits for Major Sources of Air Pollution; Adopted Prevention of Significant Deterioration (PSD) permit program, designed to control the impact of economic growth on areas that are already in attainment.

A.2.2 Water Resources

33 USC 1251 et seq.; 1997-Supp; Clean Water Act (CWA) (Federal Water Pollution Prevention and Control Act, FWPCA); In addition to regulating navigable water quality, the CWA establishes National Pollutant Discharge Elimination System (NPDES) permit program for discharge into surface waters and stormwater control; Army Corps of Engineers permit and state certification for wetlands disturbance; regulates ocean discharge; sewage wastes control; and oil pollution prevention.

40 CFR 131; Clean Water Act; Contains the Water Quality Standards regulation, which provides the basis for the states' water quality standards programs. The purpose of water quality standards is to provide protection of public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act, which includes providing water quality for the protection and propagation of aquatic life, recreation in and on the water, agricultural, industrial, and other purposes.

Florida Statutes Chap. 403, Part I; Florida Air and Water Pollution Control Act; This regulation establishes the regulatory system for water resources in Florida.

Florida Administrative Code Chap. 62-302; 1995; Surface Water Quality Standards; Classifies Florida surface waters by use, Identifies Outstanding Florida Waters.

Florida Administrative Code Chap. 62-4.242(2); 1995; Antidegradation Permitting Requirements; Outstanding Florida Waters; Outstanding National Resource Waters; Equitable abatement; Establishes standards applying to Outstanding Florida Waters.

A.3 NOISE

42 USC 4901 to 4918, Public Law 92-574; 1997-Supp; Noise Control Act of 1972 (NCA); Provides that each federal agency must comply with federal, state, interstate, and local requirements for control and abatement of environmental noise.

49 USC 44715; 1997-Supp; Controlling Aircraft Noise and Sonic Boom; Provides that the Federal Aviation Administration (FAA) will issue regulations in consultation with the USEPA to control and abate aircraft noise and sonic boom.

Executive Order 12088; 1978; Federal Compliance with Pollution Control Standards; Requires the head of each executive agency to take responsibility for ensuring all actions have been taken to prevent, control, and abate environmental (noise) pollution with respect to federal activities.

A.4 BIOLOGICAL RESOURCES

A.4.1 Protected Species

16 USC 1361 et seq.; 1997-Supp; Marine Mammal Protection Act of 1972, as amended (MMPA); Provides for the conservation and management of marine mammals and their habitats.

16 USC 1531–1544; 1997-Supp; Endangered Species Act (ESA); Provides for conservation of wildlife and plants that have been listed as either threatened or endangered. The ESA also outlines the need to protect "critical habitat" of listed species (16 USC 1531).

16 USC 703–712; 1997-Supp; Migratory Bird Treaty Act (MBTA); Provides for the protection of migratory birds through various treaties and conventions between the United States and Canada, Mexico, Japan, and the former Soviet Union.

A.4.2 Protected Habitat and Areas

16 USC 1801–1882; Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act); This regulation requires federal agencies to assess potential impacts to Essential Fish Habitat for commercial fisheries managed by the National Marine Fisheries Service.

33 USC 1901–1912; 1996-Supp; The Act to Prevent Pollution from Ships (APPS); Provides for conservation of marine resources by requiring implementation of and adherence to the International Prevention of Pollution from Ships (MARPOL). The Act controls pollution from ocean-going vessels and in particular, oil tankers. The Act prohibits dumping of plastics anywhere in the marine environment, U.S. lakes, rivers, and bays. In certain areas, the Act restricts disposal of floatable and packing materials at sea and regulates the distance from shore and the types of garbage that may be dumped in U.S. waters.

Executive Order 13158; 26-May-2000; Marine Protected Areas; Provides for the protection of marine protected areas (MPAs). MPAs include "any area of marine environment that has been reserved by federal, state, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." Signed in 2002, this order facilitates the protection

of significant natural and cultural resources within the marine environment through MPA designations. Through the implementation of this program, the federal government funds programs that strengthen the management, protection, and conservation of existing MPAs and establish MPAs to represent diverse U.S. marine ecosystems and cultural resources. Actions that serve to protect these resources include: (1) establishment of new or expanded areas, (2) development of criteria to evaluate effectiveness, (3) identification of user groups, of threats to MPAs, and of ways to negate threats. The Order requires that federal agencies eliminate or reduce activities that negatively affect MPAs. Agencies must prepare public reports that describe actions taken to implement Executive Order 13158.

Executive Order 13089; 11-June-1998; Coral Reef Ecosystems; Provides for the protection of coral reef ecosystems. Signed in 1998, the order requires federal agencies to research, monitor, manage, and restore affected U.S. coral reef ecosystems. U.S. coral reef ecosystems include those species, habitats, and other natural resources associated with coral reefs within maritime areas and zones subject to U.S. jurisdiction or control. This order requires that federal agencies undertake, to the extent practicable by law, only those activities that will not degrade coral reefs. The Order affords that federal agencies work to preserve and restore coral reefs.

Florida Statutes Chaps. 253, 258; 1996; Florida Aquatic Preserves Act; Establishes state aquatic preserves.

Office of the Chief of Naval Operations Instruction (OPNAVINST) 5090.1C revision 3 chapter 24; Provides Navy policy for natural resources management. Part 22-6 outlines actions to be taken for fish and wildlife management and specifically for implementation and compliance with the ESA, the MMPA, the MSA, and the MBTA. Outlines the chain of command and the preparation of Biological Assessments (BA) as well as surveys of endangered species. Provides criteria for a "take" determination under the MMPA and an adverse effect determination to EFH under the MSA. This part also requires implementation of a Bird-Aircraft Strike Hazard (BASH) plan.

A.5 ANTHROPOGENIC ENVIRONMENT

A.5.1 Safety

29 CFR 1910.120; 1996; Occupational Safety and Health Act (OSHA), Chemical Hazard Communication Program; Requires that chemical hazard identification, information, and training be available to employees using hazardous materials and institutes material safety data sheets (MSDS), which provide this information.

DoD Directive Number 6055.9; 1996; Addresses DoD Explosives Safety Board and DoD Component Explosives Safety Responsibilities.

DoD Flight Information Publication; This publication identifies regions of potential hazards resulting from bird aggregations or obstructions, military airspace noise sensitive locations, and defines airspace avoidance measures.

OPNAVINST 5100.23G; Implements Navy policy for adherence to OSHA. Section 0104 provides information on the Navy Occupational Safety and Health (NAVOSH) policy, which includes a general overview of necessary steps to be taken to protect personnel from potential hazards and to control hazardous situations and materials.

A.5.2 Environmental Justice and Risks to Children

Executive Order 12898; 11-Feb-1994; Environmental Justice; Directs federal agencies to achieve environmental justice by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations in the United States and its territories and possessions. The Order creates an Interagency Working Group on Environmental Justice and directs each federal agency to develop strategies within prescribed time limits to identify and address environmental justice concerns. The Order further directs each federal agency to collect, maintain, and analyze information on the race, national origin, income level, and other readily accessible and appropriate information for areas surrounding facilities or sites expected to have a substantial environmental, human health, or economic effect on the surrounding populations, when facilities or sites become the subject of a substantial federal environmental administrative or judicial action and to make such information publicly available.

Executive Order 13045; Supp-18-April-2003; Safety Risks to Children; Mandates that all federal agencies assign a high priority to addressing health and safety risks to children, coordinating research priorities on children's health, and ensuring that their standards take into account special risks to children.

A.5.3 Airspace

49 USC 106 & Subtitle VII; 1997-Supp; Federal Aviation Act of 1958; Created the Federal Aviation Administration (FAA) and establishes administrator with responsibility of ensuring aircraft safety and efficient utilization of the National Airspace System.

14 CFR Part 71; 1997; Federal Aviation Regulation (FAR); Defines federal air routes, controlled airspace, and flight locations for reporting position.

14 CFR Part 73; 1997; Federal Aviation Regulation (SFAR No. 53); Defines and prescribes requirements for special use airspace.

14 CFR Part 91; 1997; Federal Aviation Regulation (FAR); Governs the operation of aircraft within the United States, including the waters within 3 nautical miles (NM) (5.6 kilometers [km]) of the U.S. coast. In addition, certain rules apply to persons operating in airspace between 3 and 12 NM (5.6 and 22 km) from the U.S. coast.

FAA Handbook 7610.4H; Special Military Operations; 1990; Regulates military operations in the National Airspace System.

FAA Handbook 7400.2C; Contains the policy, procedures, and criteria for the assignment, review, modification, and revocation of special use airspace.

FAA Handbook 7400.2E; Contains the policy, procedures, and criteria for the assignment, review, modification, and revocation of special use airspace overlying water (i.e., warning areas). A warning area is airspace of defined dimensions over international waters that contain activity that may be hazardous to nonparticipating aircraft. The term "warning area" is synonymous with the International Civil Aviation Organization (ICAO) term "danger area."

Executive Order 10854; 27-Nov-1959; Extension of the application of the Federal Aviation Act of 1958; Extends the responsibility of the FAA to the overlying airspace of those areas of land or water outside the jurisdictional limit of the United States. Under this Order, airspace actions must be consistent with the requirements of national defense, must not be in conflict with any international treaties or agreements made by the United States, nor be inconsistent with the successful conduct of the foreign relations of the United States. Accordingly, actions concerning airspace beyond the jurisdiction limit (12 NM) require coordination with the FAA, the DoD, and the Department of State.

A.5.4 Hazardous Materials/Solid Waste

42 USC 6901 et seq.; 29-May-2005; Resource Conservation and Recovery Act of 1976 (RCRA); Establishes standards for management of hazardous waste so that water resources are not contaminated: RCRA Corrective Action Program requires cleanup of groundwater that has been contaminated with hazardous constituents.

42 USC 9601 et seq., Public Law 96-510; 11-Dec-1980; Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA); Establishes the emergency response and remediation program for water and groundwater resources contaminated with hazardous substances.

33 USC 1401 et seq.; 1972; Marine Protection, Research, and Sanctuaries Act (MPRSA) 1972 (Ocean Dumping Act), amended in 1988; Provides for the protection of human health and welfare as well as of the marine environment and its wildlife by regulating ocean-dumping activities. Also commonly referred to as the Ocean Dumping Act, the MPRSA provides regulations for transportation and disposal activities within U.S. waters and within foreign waters by U.S. citizens as well as permitting measures required to dispose of materials in the ocean. The regulation gives the U.S. Environmental Protection Agency the power to prohibit the transport of industrial waste for ocean dumping. The Act also promotes research and use of marine sanctuaries.

42 USC 11001–11050; 1995; Emergency Planning and Community Right-to-Know Act (EPCRA); Provides for notification procedures when a release of a hazardous substance occurs; sets up community response measures to a hazardous substance release; and establishes inventory and reporting requirements for toxic substances at all facilities.

42 USC 13101–13109; 1990; Pollution Prevention Act of 1990 (PPA); Establishes source reduction as the preferred method of pollution prevention, followed by recycling, treatment, then disposal into the environment. Establishes reporting requirements to submit with EPCRA reports. Federal agencies must comply.

Executive Order 12856; 3-Aug-1993; Right to Know Laws and Pollution Prevention Requirements; Directs all federal agencies to reduce and report toxic chemicals entering any waste stream; improve emergency planning, response, and accident notification; and encourage clean technologies and testing of innovative prevention technologies. The Order also provides that federal agencies are persons for purposes of the Emergency Planning and Community Right-to-Know Act (SARA Title III), which obliges agencies to meet the requirements of the Act.

Florida Statutes Title 17, Chapter 252; Florida Right-to-Know Act; Outlines the state-level laws pertaining to hazardous waste management.

OPNAVINST 5090.1B Ch-2 chapter 3; Addresses the Navy policy and program instituted to meet the requirements of Executive Orders 12856 and 13101. Provides for prevention of pollution from bases, activities through the lowest feasible life-cycle cost. Requires the use of a planning and assessment process for the Pollution Prevention (P2) program. Requires that Navy personnel take steps to reduce pollution and control hazardous materials.

OPNAVINST 4110.2; Addresses Navy policy on life-cycle analysis for hazardous waste.

A.5.5 Cultural Resources

16 USC 461–467; 1997-Supp; Historic Sites, Buildings and Antiquities Act (HAS); Establishes national policy to preserve for public use historic sites, buildings and objects of national significance. The Secretary of the Interior operates through the National Park Service to implement this national policy.

36 CFR Part 800; 1995; Protection of Historic and Cultural Properties; Sets out the Section 106 process for complying with Sections 106 and 110 of the National Historic Preservation Act (NHPA): the agency official, in consultation with the State Historic Preservation Officer (SHPO), identifies and evaluates affected historic properties for the National Advisory Council on Historic Preservation (the "Advisory Council").

Abandoned Shipwreck Act; 1987; This Act places shipwrecks in state or federal waters under the jurisdiction and title of the federal government, and requires the preservation of shipwrecks and the consideration of actions that could impact them.

Executive Order 11593, 16 USC 470; 13-May-1971; Protection and Enhancement of the Cultural Environment; Instructs federal agencies to identify and nominate historic properties to the National Register of Historic Places, as well as avoid damage to historic properties eligible for National Register.

32 CFR Part 200; 1996; Protection of Archaeological Resources: Uniform Regulations; Provides that no person may excavate or remove any archaeological resource located on public lands or Indian lands unless such activity is conducted pursuant to a permit issued under this Part or is exempted under this Part.

36 CFR Part 60; 1996; Nominations to National Register of Historic Places; Details how the federal agency Preservation Officer is to nominate properties to the Advisory Council for consideration to be included on the National Register.

Florida Statute Title XVIII, Chapter 267; Florida Historical Resources Act; In parallel with the Abandoned Shipwreck Act, this Act governs the administration and protection of cultural resources on state-owned lands. Submerged state lands include the bottoms of navigable streams and rivers, lakes, bays, and adjacent Gulf of Mexico (GOM) and Atlantic sea floors. Excavation or disturbance of cultural resources on state lands requires a permit from the Florida Division of Historical Resources, Bureau of Archeological Research.

DoD Directive 4710.1; Archaeological and Historic Resources Management (AHRM); Establishes policy requirements for archaeological and cultural resource protection and management for all military lands and reservations.

OPNAVINST 5090.1B Ch-2 chapter 23; Part 23-5 provides Navy policy for compliance to cultural resource regulations and for preservation of these resources. The guideline outlines requirements for each regulation and provides information on chain of command and responsible parties for cultural resources within the U.S. Navy.

A.6 COASTAL ZONE MANAGEMENT

15 USC 1451–1465; 1997-Supp; Coastal Zone Management Act of 1972 (CZMA); Provides coastal states with incentives for protection of the various coastal resources including beaches, wetlands, barrier islands, and wetlands. The Act also promotes protection of the associated flora and fauna.

OPNAVINST 5090.1B Ch-2 chapter 28; Provides Navy policy for management of actions in coastal areas where activities are projected to have the potential to create "reasonable foreseeable effects" on the coastal zone and/or its resources. This guideline outlines procedures to develop and submit to the pertinent state the consistency determination of an action. Gives the scope of contents for determinations and provides a general schedule of events. Section 28-5 provides Navy policy for support of programs in state coastal nonpoint source pollution control. Provides general steps, which include research, identification, and enhancement of sensitive coastal areas and its resources, to preserve coastal zones.

APPENDIX B

AIR QUALITY

AIR QUALITY

This appendix presents an overview of the Clean Air Act (CAA) and the State of Alabama and Florida air quality programs. The appendix also discusses emission factor development and calculations including assumptions employed in the air quality analyses presented in the Air Quality sections of Chapters 3 and 4.

B.1 AIR QUALITY PROGRAM OVERVIEW

B.1.1 National Ambient Air Quality Standards

In order to protect public health and welfare, the U.S. Environmental Protection Agency (USEPA) has developed numerical concentration-based standards or National Ambient Air Quality Standards (NAAQS) for six "criteria" pollutants (based on health related criteria) under the provisions of the Clean Air Act Amendments of 1970. There are two kinds of NAAQS: Primary and Secondary standards. Primary standards prescribe the maximum permissible concentration in the ambient air to protect public health including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards prescribe the maximum concentration or level of air quality required to protect public welfare including protection against decreased visibility, damage to animals, crops, vegetation, and buildings (40 Code of Federal Regulations [CFR] 50).

The CAA gives states the authority to establish air quality rules and regulations. These rules and regulations must be equivalent to, or more stringent than, the Federal program. The Division of Air Resource Management within the Florida Department of Environmental Protection (FDEP) administers the state's air pollution control program under authority of the Florida Air and Water Pollution Control Act and the Environmental Protection Act, while the Alabama Department of Environmental Management's (ADEM's) Air Division administers the air pollution control program in Alabama.

Alabama and Florida have adopted the NAAQS as written in the federal regulations (40 CFR 51) except Florida has established a more conservative standard for sulfur dioxide (SO_2). USEPA has set the annual and 24-hour standards for SO_2 at 0.03 parts per million (ppm) (80 micrograms per cubic meter [$\mu g/m^3$]) and 0.14 ppm (365 $\mu g/m^3$) respectively. Florida has adopted the more stringent annual and 24-hour standards of 0.02 ppm (60 $\mu g/m^3$) and 0.1 ppm (260 $\mu g/m^3$) respectively. In addition, Florida has adopted the national 3-hour secondary standard of 0.50 ppm (1,300 $\mu g/m^3$). Federal and State of Florida ambient air quality standards are presented in Table B-1 (Florida Administrative Code [FAC] 62-204.360 [4][b] and 62-204.240 [1][a-b]).

Based on measured ambient air pollutant concentrations, the USEPA designates areas of the United States as having air quality better than (attainment), worse than (nonattainment) the NAAQS, and unclassifiable. Unclassifiable areas cannot be classified on the basis of available information as meeting or not meeting the NAAQS for a particular pollutant and are treated as attainment until proven otherwise. Attainment areas can be further classified as "maintenance" areas. Maintenance areas have previously been classified as nonattainment and have successfully reduced air pollutant concentrations below the standard. Maintenance areas are

under special maintenance plans (SMPs) and must operate under some of the nonattainment area plans to ensure compliance with the NAAQS. SMPs are utilized to ensure that maintenance areas do not return to non-attainment status. All areas of the state are in compliance with the NAAQS.

Table B-1. National and State Ambient Air Quality Standards

Criteria Pollutant	Averaging Time	Federal Primary NAAQS[1,2,3]	Federal Secondary NAAQS[1,2,4]	State Standards
Carbon Monoxide (CO)	8-hour 1-hour	9 ppm (10 mg/m^3) 35 ppm (40 mg/m^3)	No standard No standard	FL/AL: Same As Federal Standard
Lead (Pb)	Quarterly	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	FL/AL: Same As Federal Standard
Nitrogen Dioxide (NO_2)	Annual	0.053 ppm (100 $\mu g/m^3$)	0.053 ppm (100 $\mu g/m^3$)	FL/AL: Same As Federal Standard
Ozone (O_3)	1-hour[5] 8-hour[6]	0.12 ppm (235 $\mu g/m^3$) 0.08 ppm (157 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$) 0.08 ppm (157 $\mu g/m^3$)	FL/AL: Same As Federal Standard
Particulate Matter $\leq$10 Micrometers (PM_{10})	Annual 24-hour[7]	50 $\mu g/m^3$ 150 $\mu g/m^3$	50 $\mu g/m^3$ 150 $\mu g/m^3$	FL/AL: Same As Federal Standard
Particulate Matter $\leq$2.5 Micrometers ($PM_{2.5}$)	Annual 24-hour[8]	15 $\mu g/m^3$ 65 $\mu g/m^3$	15 $\mu g/m^3$ 65 $\mu g/m^3$	FL/AL: Same As Federal Standard
Sulfur Dioxide (SO_2)	Annual 24-hour 3-hour	0.03 ppm (80 $\mu g/m^3$) 0.14 ppm (365 $\mu g/m^3$) No standard	No standard No standard 0.50 ppm (1,300 $\mu g/m^3$)	AL: Same As Federal Standard FL: 0.02 ppm (60 $\mu g/m^3$) 0.10 ppm (260 $\mu g/m^3$) 0.50 ppm (1,300 $\mu g/m^3$)

Source: Florida Department of Environmental Protection, 1996

NAAQS = National Ambient Air Quality Standards; ppm = parts per million by volume; mg/m^3 = milligrams per cubic meter; $\mu g/m^3$ = micrograms per cubic meter

1. National standards (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year.
2. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury
3. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.
4. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
5. The ozone one-hour standard still applies to areas that were designated nonattainment when the ozone eight-hour standard was adopted in July 1997. The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than 1 averaged over a three-year period.
6. The 8-hour ozone standard is attained when the 3-year average of the annual fourth-highest daily maximum 8-hour average is not greater than 0.08 ppm.
7. The PM_{10} 24-hour standard is attained when 99 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.
8. The $PM_{2.5}$ 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.

Each state is required to develop a state implementation plan (SIP) that sets forth how CAA provisions will be imposed within the state. The SIP is the primary means for the implementation, maintenance, and enforcement of the actions needed to attain and maintain the NAAQS within each state and includes control measures, emissions limitations, and other provisions required to attain and maintain the ambient air quality standards. The purpose of the SIP is twofold. First, it must provide a control strategy that will result in the attainment and

maintenance of the NAAQS. Second, it must demonstrate that progress is being made in attaining the standards in each nonattainment area.

Both Alabama and Florida have statewide air quality-monitoring networks that are operated by both state and local environmental programs (ADEM, 2004). Ambient air quality data from these monitors are used to assess the regions air quality in comparison to the NAAQS. The air quality is monitored for carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter and sulfur dioxide. The monitors tend to be concentrated in areas with the largest population densities. Not all pollutants are monitored in all areas. The air quality monitoring network is used to identify areas where the ambient air quality standards are being violated and plans are needed to reduce pollutant concentration levels to be in attainment with the standards, also included are areas where the ambient standards are being met but plans are necessary to ensure maintenance of acceptable levels of air quality in the face of anticipated population or industrial growth.

The end-result of this attainment/maintenance analysis is the development of local and statewide strategies for controlling emissions of criteria air pollutants from stationary and mobile sources. The first step in this process is the annual compilation of the ambient air monitoring results, and the second step is the analysis of the monitoring data for general air quality exceedances of the NAAQS as well as pollutant trends.

The FDEP Northwest District operates monitors in several northwest counties, including Bay, Escambia, Holmes, Leon, Santa Rosa and Wakulla counties. Over the years of record there have been exceedances (pollutant concentration greater than the numerical standard) of a NAAQS. However, there has not been a violation (occurrence of more exceedances of the standard than is allowed within a specified time period) of an ambient standard (FDEP, 2003). Currently, the state of Florida is in attainment for all criteria pollutants. Alabama's air monitoring network includes monitoring stations in Baldwin and Mobile Counties (ADEM, 2004).

B.1.2 New Source Review/Prevention of Significant Deterioration

To ensure that NAAQS are met and maintained a pre-construction permitting program entitled New Source Review was developed. This program is comprised of two separate processes known as Non-attainment New Source Review and Prevention of Significant Deterioration.

As previously mentioned non-attainment areas are areas where one of the listed federal criteria pollutants has not met the NAAQS for that particular region. Major new or modified stationary sources of air emissions must meet more stringent permitting standards so that air quality is not degraded further. Typically, new or modified sources compare their projected emissions with the Significant Emissions Rate (SER) thresholds for the area. These SER thresholds can vary depending on the severity status of the non-attainment area, which can be rated between moderate and severe. Sources that have projected emissions that exceed the non-attainment SER are required to install Lowest Achievable Emissions Rate (LAER) air pollution control technology. Installation of this costly technology helps to reduce the impact of the new or modified source on the regions air quality.

In attainment areas, major new or modified stationary sources of air emissions on and in the area are subject to Prevention of Significant Deterioration (PSD) review to ensure that these sources

are constructed without causing significant adverse deterioration of the clean air in the area. A major new source is defined as one that has the potential to emit any pollutant regulated under the CAA in amounts equal to or exceeding specific major source thresholds: 100 or 250 tons/year based on the source's industrial category. A major modification is a physical change or change in the method of operation at an existing major source that causes a significant "net emissions increase" at that source of any regulated pollutant. Table B-2 provides a tabular listing of the PSD significant emissions rate (SER) thresholds for selected criteria pollutants *(USEPA Draft New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Permitting)*.

The goal of the PSD program is to: 1) ensure economic growth while preserving existing air quality, 2) protect public health and welfare from adverse effects which might occur even at pollutant levels better than the NAAQS, and 3) preserve, protect, and enhance the air quality in areas of special natural recreational, scenic, or historic value, such as national parks and wilderness areas. Sources subject to PSD review are required by the CAA to obtain a permit before commencing construction. The permit process requires an extensive review of all other major sources within a 50-mile radius of the facility and in Class I areas within a 62-mile radius of the facility. Emissions from any new or modified source must be controlled using Best Available Control Technology. The air quality, in combination with other PSD sources in the area, must not exceed the maximum allowable incremental increase identified in Table B-3. Aid dispersion modeling is used to ensure that PSD incremental concentrations are not excluding National parks and wilderness areas that are designated as Class I areas, where any appreciable deterioration in air quality is considered significant. Class II areas are those where moderate, well-controlled industrial growth could be permitted. Class III areas allow for greater industrial development. Currently there are no designated Class III areas in the United States.

Table B-2. Criteria Pollutant Significant Emissions Rate Increases Under PSD Regulations

Pollutant	Significant Emissions Rate (tons/year)
PM 10	15
Total Suspended Particulate (TSP)	25
SO2	40
NOx	40
Ozone (VOC)	40
CO	100

Source: 40 CFR 51

PSD = Prevention of Significant Deterioration; PM_{10} = Particulate Matter $\leq$10 Micrometers; SO_2 = Sulfur Dioxide; NO_x = Nitrogen Oxides; VOC = Volatile Organic Compound; CO = Carbon Monoxide

Table B-3. Federal Allowable Pollutant Concentration Increases Under PSD Regulations

Pollutant	Averaging Time	Maximum Allowable Concentration (μg/m^3)		
		Class I	Class II	Class III
PM_{10}	Annual	4	17	34
	24-hour	8	30	60
SO_2	Annual	2	20	40
	24-hour	5	91	182
	3-hour	25	512	700
NO_2	Annual	2.5	25	50

Source: 40 CFR 51
PSD = Prevention of Significant Deterioration; μg/m^3 = Micrograms per cubic meter; NO_2 = Nitrogen Dioxide; PM_{10} = Particulate Matter ≤10 Micrometers; SO_2 = Sulfur Dioxide;

B.1.3 Conformity Rules

In accordance with Section 176(c) of the Clean Air Act, USEPA promulgated the General Conformity Rule that is codified at 40 CFR 51, Subpart W. The provisions of this rule apply to state review of all federal actions submitted pursuant to 40 CFR 51, Subpart W, and incorporated by reference at Rule 62-204.800, Florida Administrative Code and the Code of Alabama (COA) 335-3-17. The Conformity Rule only affects federal actions occurring in non-attainment areas (areas that do not meet the NAAQS) and maintenance areas (areas that were classified as non-attainment but now are in attainment). Since the Proposed and Alternative Actions are located in attainment areas, the Navy would not need to prepare a conformity determination for the Proposed or Alternative Actions and alternatives. However, the general concept of the conformity rule was used as a criterion although not necessary.

B.1.4 Project Calculations:

Air Operations Emissions

RDT&E air operations at NSWC PCD consist of various activities associated with airplanes or helicopters including the 1UH-1N, SH-60B, MH-53, MH-60S, and Cessna-172. Aircraft operations of concern are those that occur from ground level up to 914 meters (m) (3,000 feet [ft]) above ground level (AGL). The 914 m (3,000 ft) AGL ceiling was assumed as the atmospheric mixing height above which any pollutant generated would not contribute to increased pollutant concentrations at ground level (known as the mixing zone). Typically, all pollutant emissions from aircraft generated above 914 m (3,000 ft) AGL would be excluded from this analysis but to ensure a conservative approach, all emissions are included in the total emissions representations. The aircraft operation of interest within the mixing zone is the landing and takeoff (LTO) cycle. The LTO is characterized by five modes of operation designated as: 1) approach, 2) taxi in, 3) taxi out, 4) takeoff, and 5) climbout.

As previously stated, the LTO cycle is the basis for calculating pollutant emissions. For each mode of operation during an LTO cycle, an aircraft engine operates at a specified power setting and for a specific period (time-in-mode). The pollutant emission rate is a function of the engine's operating mode, the fuel flow rate, and the engine's overall efficiency. Emissions for one complete LTO cycle for a particular aircraft are calculated by knowing the specific engine pollutant emission factors for each mode of operation.

For this EIS, emission factors for most military engines were obtained from the Air Force Institute for Environment, Safety, and Occupational Health Risk Analysis (AFIERA), located at Brooks AFB, Texas, and were based on aircraft engines burning JP-8 fuel (U.S. Air Force, 2002). For those aircraft which engine data was unavailable, the T64-GE-100 was used as a surrogate. Table B-4 presents an example of AFIERA emission factors and aircraft engine performance data for the T64-GE-100 engine, which is used in the MH-53 helicopter. The table lists the various engine power modes, time in each mode, fuel flow, and corresponding pollutant emission factors. Using these data, as well as information on activity levels (i.e., number of sorties/LTO operations), pollutant emissions for each aircraft/organization were calculated by applying the equation below.

$$Emissions = TIM \times FF \times EF \times ENG \times CF$$

Where:

Emissions = Aircraft Emissions (lbs) (for EF in lb/1000 gal fuel)
TIM = Time-in-mode at a specified power setting (hr/operation)
FF = Fuel flow at a specified power setting (gal/hr/engine)
EF = Emission factor for specific engine type and power setting (lb/1000 gallons of fuel used)
ENG = Number of engines on aircraft
CF = Conversion Factor (0.001)

As the equation indicates, emissions were estimated by first calculating total fuel used in each of the different modes with the appropriate emission factor. Total aircraft emissions were calculated by multiplying the resulting quantity times the number of engines on the aircraft. In cases where engine-specific emission factors were unavailable from AFIERA, emission factors published by the USEPA were used in the analyses instead (USEPA, 1999). USEPA emission factors were also based on the quantity of fuel used by each engine type (i.e., pounds of pollutant emitted per 1,000 pounds of fuel used).

TIM for each power setting was developed based on typical mission flow data provided in chapters 1 and 2 of this EIS/OEIS. An assumption ratio was developed for each individual engine setting. This percentage was then extrapolated using total hours of operation to establish a total annual power setting value, which was then the basis of the fuel flow computations for the specific engine power setting and the corresponding emissions factors.

Table B-4. MH-53 Aircraft Emissions Factor Example

Aircraft Type	Engine Type	Power Setting	Fuel flow rate	NO_x	CO	VOC	PM_{10}
MH-53	T64-GE 100	Ground Idle	284	1.62	75.46	27.97	2.36
		75% Normal	1,217	5.49	4.97	0.20	1.97
		Normal	1,714	7.45	1.85	0.06	1.61
		Military	1,882	8.01	2.97	0.29	0.92

NOx = Nitrogen Oxides; CO = Carbon Monoxide; VOC = Volatile Organic Compound;
PM10 = Particulate Matter <10 Micrometers

Table B-5. MH-53 Aircraft, NO_x Emissions Factor Example

Power Setting	Fuel flow rate (lbs/hr)	NO_x Emissions Factors (lbs/1,000lbs of fuel)	Annual Hours of Operation	Percentage of Annual Flight Time in Power Setting	NO_x Emissions per Power Setting (lbs/yr)*
Ground Idle	284	1.62	163	3	2.3
75% Normal	1,217	5.49	163	25	272.3
Normal	1,714	7.45	163	50	1,040.7
Military	1,882	8.01	163	22	540.6
				Total NO_x Emissions	**1,855.9**

lbs = Pounds; lbs/hr = Pounds per Hour; lbs/year = Pounds per Year; NO_x = Nitrogen Oxides
* All emissions factors based on the ratio of 1 lb/1,000 lbs of fuel used.

Below is an example calculation for NO_x emissions for the MH-53. This calculation represents the NO_x emissions from this sole aircraft and does not represent the entire project. The calculation is provided in three steps. To ascertain the entire project emissions, a similar calculation to the example provided below was conducted for each aircraft type and for each pollutant and converted to tons and then compared to the baseline study area. These values were then summed according to the appropriate pollutant to provide the cumulative emissions associated with NSWC PCD aircraft emissions activities.

Example Calculation

The first step is to calculate the amount of time that an aircraft was in a certain engine power setting. Using the information in Table B-5 the following calculation was performed to develop the amount of time an aircraft was in a certain engine power setting.

Total time in Ground Idle = Annual hours of operation (163) × Percentage of Annual Flight Time in Power Setting 3% = 4.89 hours per year in Ground Idle power setting

Total time in 75% Normal = Annual hours of operation (163) × Percentage of Annual Flight Time in Power Setting 25% = 40.75 hours per year in 75% Normal power setting

Total time in Normal = Annual hours of operation (163) × Percentage of Annual Flight Time in Power Setting 50% = 81.5 hours per year in Normal power setting

Total time in Military = Annual hours of operation (163) × Percentage of Annual Flight Time in Power Setting 22% = 35.86 hours per year in Military power setting

The second step is to calculate the annual NO_x emissions per power setting. Using the information in Tables B-4 and B-5, the following calculations are performed for each Power Setting.

Ground Idle

= 4.89 hours per year × 284 lbs of fuel per hour × 1.62 lbs of NO_x / 1000 lbs of fuel used × Number of Engines (3) = 6.9 lbs of NO_x per year

75% Normal

= 40.75 hours per year × 1,217 lbs of fuel per hour × 5.49 lbs of NO_x / 1000 lbs of fuel used × Number of Engines (3) = 816.9 lbs of NO_x per year

Normal

= 81.5 hours per year × 1,714 lbs of fuel per hour × 7.45 lbs of NO_x / 1000 lbs of fuel used × Number of Engines (3) = 3,143.1 lbs of NO_x per year

Military

= 35.86 hours per year × 1,882 lbs of fuel per hour × 8.01 lbs of NO_x / 1000 lbs of fuel used × Number of Engines (3) = 1,621.8 lbs of NO_x per year

The third step is to add the individual power setting emissions, which provides a value of 5,588.7 lbs per year. For comparison to the study area, the 5,588.7 lbs per year was converted to tons by dividing by 2,000 which provides a value of 2.8 tons per year of NO_x emissions for the MH-53 aircraft.

As indicated previously, to ascertain the entire project emissions, a similar calculation to the example provided above was conducted for each aircraft type and for each pollutant and converted to tons. These values were then summed according to the appropriate pollutant to provide the cumulative emissions associated with NSWC PCD aircraft emissions activities.

Sulfur emissions were calculated using fuel usage and assuming that all sulfur in the fuel is converted to SO_x emissions. A published factor of .023% S in the fuels used on the East Coast was used to ascertain Sulfur content.

Surface Operations Emissions

Surface operations consist of activities associated with boat and ship traffic. RDT&E activities at NSWC PCD incorporate a variety of marine craft including the Athena 1, Athena, 2, Research Vessel (R/V) Mr. Offshore, several 4.0 to 7.6 m (13 to 25 ft) outboard motor boats, a 9.1 m (30 ft) rigid hull inflatable boat (RHIB), and 9.8 m (32 ft), 20 m (65 ft), and 21 m (68 ft) inboard diesel vessels. Each of these vessels incorporates different propulsion methods such as marine outboard engines, diesel engines, and gas turbines. Calculations were developed utilizing the propulsion mechanism.

Marine Outboard Engines:

The USEPA has published emissions factors for air pollutants produced by several types of two-stroke and four-stroke outboard engines. The most conservative emission factors (USEPA, 1999a) for two-stroke engines of various horsepower are represented in Table B-6.

Table B-6. USEPA Two-Stroke Outboard Emissions Factors

USEPA Outboard Engine Emissions Factors (grams/hp-hr)			
NO_x	**CO**	**VOC**	**SO_x**
0.018	0.63	0.25	0.00108

USEPA = United States Environmental Protection Agency; hp = Horsepower; hr = Hour; NO_x = Nitrogen Oxides; CO = Carbon Monoxide; VOC = Volatile Organic Compound; SO_x = Sulfur Oxides

Emissions estimates for surface craft utilizing outboard engines were calculated using USEPA AP-42 factors and multiplied by the engine horsepower and hours of operation.

$$Emissions = HP \times HR/YR \times EF \times ENG \times CF$$

Where:

Emissions = Surface craft Emissions (lbs)
HP = Horsepower
HR/YR = Hours per year
EF = Emission factor for specific engine type
ENG = Number of engines
CF = Conversion Factor for pounds to tons per year

Below is an example calculation for NO_x emissions for a Boston Whaler with 100 horse power outboard engine. This calculation represents the NO_x emissions from this surface craft and does not represent the entire project. The calculation is provided in three steps. To ascertain the entire project emissions, a similar calculation to the example provided below was conducted for each surface type and for each pollutant and converted to tons and then compared to the baseline study area. These values were then summed according to the appropriate pollutant to provide the cumulative emissions associated with NSWC PCD surface craft emissions activities.

Example Calculation

NO_x Emissions = horsepower of engine (100 HP) × 345 hours per year × .018 grams (g) of NO_x per horse power –hr × Number of engines (1) × Conversion factor for g to tons (.000001102)

NO_x Emissions = .00068 tons per year of NO_x

Diesel Engines:

Limited data was available for large marine diesel engines. Therefore, USEPA AP-42 emissions factors for industrial reciprocating engines were used to calculate diesel engine emissions. Diesel was assumed to be the primary fuel to ensure an overly conservative approach. A similar

calculation methodology to the outboard engines was employed to ascertain emissions from the diesel engines.

$$Emissions = HP \times HR/YR \times EF \times ENG \times CF$$

Where:

Emissions = Surface craft Emissions (lbs)
HP = Horsepower
HR/YR = Hours per year
EF = Emission factor for specific engine type
ENG = Number of engines
CF = Conversion Factor for pounds to tons per year

Diesel engine emission factors were multiplied by the engines' horsepower and annual hours of operation to ascertain the pounds of pollutant emissions per year. This value was then converted to tons per year value for comparison with the NSWC PCD Study Area total summed emissions on an individual pollutant basis.

Stationary Gas Turbines:

AFIERA emissions factors were utilized to ascertain emissions from stationary gas turbines on the smaller marine craft that are similar to an aero derivative (jet engine) design; since, emissions factors for marine stationary gas turbines were limited. Therefore, the T64-GE-100 emissions factors were chosen as a surrogate for the stationary gas turbines on the LCAC, DDG and the Athena. A calculation methodology similar to the aircraft emissions calculations was instituted to assess emissions from the turbines.

$$Emissions = TIM \times FF \times HR/YR \times EF \times ENG \times CF$$

Where:

Emissions = Surface craft Emissions (lbs)
TIM= Time in mode
FF = Fuel Flow
HR/YR = Hours per year
EF = Gas turbine emission factor
ENG = Number of engines
CF = Conversion Factor for pounds to tons per year
***Normal operation was used as a default for the TIM Power Setting since the operation of the engine does not follow typical power setting scenarios*

Ordnance and Munitions Emissions

TNT was used as a surrogate for mine and explosive activities. Emissions factors (Johnson, 1992 as cited in U.S. Air Force, 1997) for NO_x, SO_x and CO were utilized. These factors were then multiplied by the net weight of the explosive and the number of times that the

explosive was used during a designated time frame. This calculation provides annual pounds per year of emissions, which was converted to tons per year for comparison purposes.

$$Emissions = EXP/YR \times EF \times Net\ Wt \times CF$$

Where:

Emissions = Ordnance Emissions
EXP/YR = Explosives used per year
EF = Emissions factor
Net Wt = Net Weight of explosive
CF = Conversion Factor for pounds to tons per year

Below is an example calculation for NO_x emissions for one explosive type the Mk-6. This calculation represents the NO_x emissions from this particular explosive and does not represent the entire project. To ascertain the entire project emissions, a similar calculation to the example provided below was conducted for each explosive type and for each pollutant and converted to tons, then compared to the baseline study area. These values were then totaled according to the appropriate pollutant to provide the cumulative emissions associated with NSWC PCD surface craft emissions activities.

Example Calculation

NO_x emissions in tons per year for Mk-6 = Explosives used per year (1) × .0172 lbs of NO_x per pound of explosive × Net Weight of explosive (300 lbs) / Conversion factor for lbs to tons (2,000)

B.2 NATIONAL EMISSIONS INVENTORY

The National Emissions Inventory (NEI) is operated under USEPA's Emission Factor and Inventory Group, which prepares the national database of air emissions information with input from numerous State and local air agencies, from tribes, as well as from industry. The database contains information on stationary and mobile sources that emit criteria air pollutants and hazardous air pollutants (HAPs). The database includes estimates of annual emissions, by source, of air pollutants in each area of the country, on an annual basis. The NEI includes emission estimates for all 50 States, the District of Columbia, Puerto Rico, and the Virgin Islands. Emission estimates for an individual point or major sources (facilities), as well as county level estimates for area, mobile and other sources, are available currently for years 1996, 1999, and 2002 for criteria pollutants, and HAPs.

Criteria air pollutants are those for which USEPA has set health-based standards. Four of the six criteria pollutants are included in the NEI database:

- Carbon Monoxide (CO)
- Nitrogen Oxides (NO_x)
- Sulfur Dioxide (SO_2)
- Particulate Matter (PM_{10} and $PM_{2.5}$)

The NEI also includes emissions of Volatile Organic Compounds (VOCs), which are ozone precursors, emitted from motor vehicle fuel distribution and chemical manufacturing, as well as

other solvent uses. VOCs react with nitrogen oxides in the atmosphere to form ozone. The NEI database defines three classes of criteria air pollutant sources:

- Point sources - stationary sources of emissions, such as an electric power plant, that can be identified by name and location. A "major" source emits a threshold amount (or more) of at least one criteria pollutant, and must be inventoried and reported. Many states also inventory and report stationary sources that emit amounts below the thresholds for each pollutant.
- Area sources - small point sources such as a home or office building, or a diffuse stationary source, such as wildfires or agricultural tilling. These sources do not individually produce sufficient emissions to qualify as point sources. Dry cleaners are one example, i.e., a single dry cleaner within an inventory area typically will not qualify as a point source, but collectively the emissions from all of the dry cleaning facilities in the inventory area may be significant and therefore must be included in the inventory.
- Mobile sources - any kind of vehicle or equipment with a gasoline or diesel engine; airplane; or ship.

The main sources of criteria pollutant emissions data for the NEI are:

- For electric generating units - USEPA's Emission Tracking System / Continuous Emissions Monitoring Data (ETS/CEM) and Department of Energy fuel use data.
- For other large stationary sources - state data and older inventories where state data was not submitted.
- For on-road mobile sources - the Federal Highway Administration's (FHWA's) estimate of vehicle miles traveled and emission factors from USEPA's MOBILE Model.
- For non-road mobile sources - USEPA's NONROAD Model.
- For stationary area sources - state data, USEPA-developed estimates for some sources, and older inventories where state or USEPA data was not submitted.

State and local environmental agencies supply most of the point source data. USEPA's Clean Air Market program supplies emissions data for electric power plants.

B.3 REFERENCES

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APPENDIX C

WATER QUALITY

WATER QUALITY

The following table (Table C-1) presents information on water quality for the State of Florida. These standards apply to territorial waters; no water quality criterion exist for non-territorial waters. The Research, Development, Test, and Evaluation (RDT&E) activities that would take place within the Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area off of Alabama would all occur in non-territorial waters. Given the localized and temporary effects coupled with the location of events, water quality standards for the State of Alabama's territorial waters would not apply to this EIS/OEIS.

Table C-1. 62-302.530, Criteria for Surface Water Quality Classifications in Florida Territorial Waters

		Class III: Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Parameter	**Units**	**Predominantly Marine Waters**
(1) Alkalinity	Milligrams (mg)/liter (L) as Calcium Carbonate (CaCO3)	
(2) Aluminum	mg/L	≤ 1.5
(3) Ammonia (unionized)	mg/L as Ammonia (NH3)	
(4) Antimony	Micrograms/L	≤ 4,300
(5) (a) Arsenic (total)	Micrograms/L	≤ 50
(5) (b) Arsenic (trivalent)	Micrograms/L measured as total recoverable Arsenic	≤ 36
(6) Bacteriological Quality (Fecal Coliform Bacteria)	Number per 100 imilliliters (ml) (Most Probable Number [MPN]) or Membrane Filter [MF])	MPN or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.
(7) Bacteriological Quality (Total Coliform Bacteria)	Number per 100 ml (MPN or MF)	≤ 1,000 as a monthly average; nor exceed 1,000 in more than 20% of the samples examined during any month; ≤ 2,400 at any time. Monthly averages (avg) shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period, using either the MPN or MF counts.
(8) Barium	Milligrams/L	
(9) Benzene	Micrograms/L	≤ 71.28 annual avg.
(10) Beryllium	Micrograms/L	≤ 0.13 annual avg.
(11) Biological Integrity	Percent reduction of Shannon-Weaver Diversity Index	The Index for benthic macroinvertebrates shall not be reduced to less than 75% of established background levels as measured using organisms retained by a U.S. Standard No. 30 sieve and collected and composited from a minimum of three natural substrate samples, taken with Ponar type samplers with minimum sampling area of 225 square centimeters (cm2).
(12) BOD (Biochemical Oxygen Demand)		Shall not be increased to exceed values that would cause dissolved oxygen to be depressed below the limit established for each class, and in no case shall it be great enough to produce nuisance conditions.
(13) Boron	Milligrams/L	

Table C-1. 62-302.530, Criteria for Surface Water Quality Classifications in Florida Territorial Waters Cont'd

		Class III: Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Parameter	**Units**	**Predominantly Marine Waters**
(14) Bromates	Milligrams/L	≤ 100
(15) Bromine (free molecular)	Milligrams/L	≤ 0.1
(16) Cadmium	Micrograms/L See Notes (1) and (3).	≤ 9.3
(17) Carbon tetrachloride	Micrograms/L	≤ 4.42 annual avg.
(18) Chlorides	Milligrams/L	Not increased more than 10% above normal background. Normal daily and seasonal fluctuations shall be maintained.
(19) Chlorine (total residual)	Milligrams/L	≤ .01
(20) (a) Chromium (trivalent)	Micrograms/L measured as total recoverable Chromium See Notes (1) and (3).	
(20) (b) Chromium (hexavalent)	Micrograms/L See Note (3).	≤ 50
(21) Chronic Toxicity (see definition in Section 62-302.200(3), Florida Administrative Code [F.A.C.] and also see below, "Substances in concentrations which...")		
(22) Color, etc. (see also Minimum Criteria, Odor, Phenols, etc.)	Color, odor, and taste producing substances and other deleterious substances, including other chemical compounds attributable to domestic wastes, industrial wastes, and other wastes	
(23) Conductance, Specific	Micro-reciprocal ohms (mhos)/cm	
(24) Copper	Micrograms/L See Notes (1) and (3).	≤ 3.7

Table C-1. 62-302.530, Criteria for Surface Water Quality Classifications in Florida Territorial Waters Cont'd

		Class III: Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Parameter	**Units**	**Predominantly Marine Waters**
(25) Cyanide	Micrograms/L	≤ 1.0
(26) Definitions (see Section 62-302.200, F.A.C.)		
(27) Detergents	Milligrams/L	≤ 0.5
(28) 1,1-Dichloroethylene (1,1-dichloroethene)	Micrograms/L	≤ 3.2 annual avg.
(29) Dichloromethane (methylene chloride)	Micrograms/L	≤ 1,580 annual avg.
(30) 2,4-Dinitrotoluene	Micrograms/L	≤ 9.1 annual avg.
(31) Dissolved Oxygen	Milligrams/L	Shall not average less than 5.0 in a 24-hour period and shall never be less than 4.0. Normal daily and seasonal fluctuations above these levels shall be maintained.
(32) Dissolved Solids	Milligrams/L	
(33) Fluorides	Milligrams/L	≤ 5.0
(34) "Free Forms" (see Minimum Criteria in Section 62-302.500, F.A.C.)		
(35) "General Criteria" (see Section 62-302.510, F.A.C. and individual criteria)		
(36) (a) Halomethanes (Total trihalomethanes) (total of bromoform, chlorodibromo-methane, dichlorobromome- thane, and chloroform). Individual halomethanes shall not exceed (b)1. to (b)5. below.	Micrograms/L	
(36) (b) 1. Halomethanes (individual): Bromoform	Micrograms/L	≤ 360 annual avg.
(36) (b) 2. Halomethanes (individual): Chlorodibromo-methane	Micrograms/L	≤ 34 annual avg.

Table C-1. 62-302.530, Criteria for Surface Water Quality Classifications in Florida Territorial Waters Cont'd

		Class III: Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Parameter	**Units**	**Predominantly Marine Waters**
(36) (b) 3. Halomethanes (individual): Chloroform	Micrograms/L	≤ 470.8 annual avg.
(36) (b) 4. Halomethanes (individual): Chloromethane (methyl chloride)	Micrograms/L	≤ 470.8 annual avg.
(36) (b) 5. Halomethanes (individual): Dichlorobromomethane	Micrograms/L	≤ 22 annual avg.
(37) Hexachlorobuta-diene	Micrograms/L	≤ 49.7 annual avg.
(38) Imbalance (see Nutrients)		
(39) Iron	Milligrams/L	≤ 0.3
(40) Lead	Micrograms/L See Notes (1) and (3).	≤ 8.5
(41) Manganese	Milligrams/L	
(42) Mercury	Micrograms/L	≤ 0.025
(43) Minimum Criteria (see Section 62-302. 500, F.A.C.)		
(44) Mixing Zones (See Section 62-4.246, F.A.C.)		
(45) Nickel	Micrograms/L See Notes (1) and (3).	≤ 8.3
(46) Nitrate	Milligrams/L as N	
(47) Nuisance Species		Substances in concentrations that result in the dominance of nuisance species: none shall be present.
(48) (a) Nutrients		The discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in this chapter. Man-induced nutrient enrichment (total nitrogen or total phosphorus) shall be considered degradation in relation to the provisions of Sections 62-302.300, 62-302.700, and 62-4.242, F.A.C.
(48) (b) Nutrients		In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna.
(49) Odor (also see Color, Minimum Criteria, Phenolic Compounds, etc.)	Threshold odor number	Odor producing substances: only in such amounts as will not unreasonably interfere with use of the water for the designated purpose of this classification.

Table C-1. 62-302.530, Criteria for Surface Water Quality Classifications in Florida Territorial Waters Cont'd

		Class III: Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Parameter	**Units**	**Predominantly Marine Waters**
(50) (a) Oils and Greases	Milligrams/L	Dissolved or emulsified oils and greases shall not exceed 5.0.
(50) (b) Oils and Greases		No undissolved oil, or visible oil defined as iridescence, shall be present so as to cause taste or odor, or otherwise interfere with the beneficial use of waters.
(51) Pesticides and Herbicides		
(51) (a) 2,4,5-TP	Micrograms/L	
(51) (b) 2-4-D	Micrograms/L	
(51) (c) Aldrin	Micrograms/L	≤ .00014 annual avg.; 1.3 maximum (max)
(51) (d) Beta-hexachlorocyclohexane (b-BHC)	Micrograms/L	≤ .046 annual avg.
(51) (e) Chlordane	Micrograms/L	≤ .00059 annual avg.; .004 max
(51) (f) Dichlorodiphenyltrichloroethane (DDT)	Micrograms/L	≤ .00059 annual avg.; .001 max
(51) (g) Demeton	Micrograms/L	≤ 0.1
(51) (h) Dieldrin	Micrograms/L	≤ .00014 annual avg.; .0019 max
(51) (i) Endosulfan	Micrograms/L	≤ .0087
(51) (j) Endrin	Micrograms/L	≤ .0023
(51) (k) Guthion	Micrograms/L	≤ .01
(51) (l) Heptachlor	Micrograms/L	≤ .00021 annual avg.; .0036 max
(51) (m) Lindane (g-benzene hexachloride)	Micrograms/L	≤ .063. annual avg.; 0.16 max
(51) (n) Malathion	Micrograms/L	≤ 0.1
(51) (o) Methoxychlor	Micrograms/L	≤ .03
(51) (p) Mirex	Micrograms/L	≤ .001
(51) (q) Parathion	Micrograms/L	≤ .04
(51) (r) Toxaphene	Micrograms/L	≤ .0002

Table C-1. 62-302.530, Criteria for Surface Water Quality Classifications in Florida Territorial Waters Cont'd

		Class III: Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Parameter	**Units**	**Predominantly Marine Waters**
(52) (a) Potential of Hydrogen (pH) (Class I and Class IV Waters)	Standard Units	Shall not vary more than one unit above or below natural background provided that the pH is not lowered to less than 6 units or raised above 8.5 units. If natural background is less than 6 units, the pH shall not vary below natural background or vary more than one unit above natural background. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below background.
(52) (b) pH (Class II Waters)	Standard Units	Shall not vary more than one unit above or below natural background of coastal waters as defined in Section 62-302.520(3)(b), F.A.C., or more than two-tenths unit above or below natural background of open waters as defined in Section 62-302.520(3)(f), F.A.C., provided that the pH is not lowered to less than 6.5 units or raised above 8.5 units. If natural background is less than 6.5 units, the pH shall not vary below natural background or vary more than one unit above natural background for coastal waters or more than two-tenths unit above natural background for open waters. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background of coastal waters or more than two-tenths unit below natural background of open waters.
(52) (c) pH (Class III Waters)	Standard Units	Shall not vary more than one unit above or below natural background of predominantly fresh waters and coastal waters as defined in Section 62-302.520(3)(b), F.A.C. or more than two-tenths unit above or below natural background of open waters as defined in Section 62-302.520(3)(f), F.A.C., provided that the pH is not lowered to less than 6 units in predominantly fresh waters, or less than 6.5 units in predominantly marine waters, or raised above 8.5 units. If natural background is less than 6 units, in predominantly fresh waters or 6.5 units in predominantly marine waters, the pH shall not vary below natural background or vary more than one unit above natural background of predominantly fresh waters and coastal waters, or more than two-tenths unit above natural background of open waters. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background of predominantly fresh waters and coastal waters, or more than two-tenths unit below natural background of open waters.
(52) (d) pH (Class V Waters)	Standard Units	Not lower than 5.0 nor greater than 9.5 except certain swamp waters which may be as low as 4.5.

Table C-1. 62-302.530, Criteria for Surface Water Quality Classifications in Florida Territorial Waters Cont'd

		Class III: Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Parameter	**Units**	**Predominantly Marine Waters**
(53)(a) Phenolic Compounds: Total		Phenolic compounds other than those produced by the natural decay of plant material, listed or unlisted, shall not taint the flesh of edible fish or shellfish or produce objectionable taste or odor in a drinking water supply.
(53) (b) Phenolic Compounds: Total	Micrograms/L	1. The total of all chlorinated phenols, and chlorinated cresols, except as set forth in (c) 1. to (c) 4. below, shall not exceed 1.0 unless higher values are shown not to be chronically toxic. Such higher values shall be approved in writing by the Secretary. 2. The compounds listed in (c) 1. to (c) 6. below shall not exceed the limits specified for each compound.
(53) (c) 1. Phenolic Compound: 2-chlorophenol	Micrograms/L	< 400 See Note (2).
(53) (c) 2. Phenolic Compound: 2,4-dichlorophenol	Micrograms/L	< 790 See Note (2).
(53) (c) 3. Phenolic Compound: Pentachlorophenol	Micrograms/L	≤ 7.9
(53) (c) 4. Phenolic Compound: 2,4,6-trichlorophenol	Micrograms/L	≤ 6.5 annual avg.
(53) (c) 5. Phenolic Compound: 2,4-dinitrophenol	Milligrams/L	≤ 14.26 See Note (2).
(53) (c) 6. Phenolic Compound: Phenol	Milligrams/L	≤ 0.3
(54) Phosphorus (Elemental)	Micrograms/L	≤ 0.1
(55) Phthalate Esters	Micrograms/L	
(56) Polychlorinated Biphenyls (PCBs)	Micrograms/L	≤ .000045 annual avg.; .03 max.

Table C-1. 62-302.530, Criteria for Surface Water Quality Classifications in Florida Territorial Waters Cont'd

		Class III: Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Parameter	**Units**	**Predominantly Marine Waters**
(57) (a) Polycyclic Aromatic Hydrocarbons (PAHs). Total of: Acenaphthylene; Benzo(a)anthracene; Benzo(a)pyrene; Benzo(b)fluoran-thene; Benzo-(ghi)perylene; Benzo(k)fluoranthene; Chrysene; Dibenzo-(a,h)anthracene; Indeno(1,2,3-cd)pyrene; and Phenanthrene	Micrograms/L	≤ .031 annual avg.
(57) (b) 1 (Individual PAHs): Acenaphthene	Milligrams/L	< 2.7 See Note (2).
(57) (b) 2. (Individual PAHs): Anthracene	Milligrams/L	< 110 See Note (2).
(57) (b) 3. (Individual PAHs): Fluoranthene	Milligrams/L	< .370 See Note (2).
(57) (b) 4. (Individual PAHs): Fluorene	Milligrams/L	< 14 See Note (2).
(57) (b) 5. (Individual PAHs): Pyrene	Milligrams/L	< 11 See Note (2).
(58) (a) Radioactive substances (Combined radium 226 and 228)	Picocuries/L	≤ 5
(58) (b) Radioactive substances (Gross alpha particle activity including radium 226, but excluding radon and uranium)	Picocuries/L	≤ 15
(59) Selenium	Micrograms/L	≤ 71
(60) Silver	Micrograms/L See Note (3).	See Minimum criteria in Section 62-302.500(3).
(61) Specific Conductance (see Conductance, Specific, above)		

Table C-1. 62-302.530, Criteria for Surface Water Quality Classifications in Florida Territorial Waters Cont'd

		Class III: Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Parameter	**Units**	**Predominantly Marine Waters**
(62) Substances in concentrations which injure, are chronically toxic to, or produce adverse physiological or behavioral response in humans, plants, or animals		None shall be present.
(63) 1,1,2,2-Tetrachloroethane	Micrograms/L	≤ 10.8 annual avg.
(64) Tetrachloroethylene (1,1,2,2-tetrachloroethene)	Micrograms/L	≤ 8.85 annual avg.
(65) Thallium	Micrograms/L	< 6.3
(66) Thermal Criteria (See Section 62-302.520)		
(67) Total Dissolved Gases	Percent of the saturation value for gases at the existing atmospheric and hydrostatic pressures	≤ 110% of saturation value.
(68) Transparency	Depth of the compensation point for photosynthetic activity	Shall not be reduced by more than 10% as compared to the natural background value.
(69) Trichloroethylene (trichloroethene)	Micrograms/L	≤ 80.7 annual avg.
(70) Turbidity	Nephelometric Turbidity Units (NTU)	≤ 29 above natural background conditions.
(71) Zinc	Micrograms/L See Notes (1) and (3).	≤ 86

APPENDIX D

UNDERWATER AMBIENT SOUND

UNDERWATER AMBIENT SOUND

Ambient sound in the ocean arises from a number of types of sources. These sources may be categorized in a number of ways. For example, some noise arises from natural sources: wind action on the sea surface, rain or hail striking the sea surface, seismic activity, and various types of biologics. Others are related to human activity: industrial operations on-shore, commercial (and military) ship traffic, seismic profiling for oil exploration, and oil drilling.

Another way of categorizing these noise sources is into sources that persist over time versus sources that are intermittent. The following discussion is organized along those lines. The first subsection addresses the two noise sources, wind and commercial shipping, that are prevalent at virtually all open ocean locations at all times. It begins with predictions of the average ambient noise level across the entire Naval Surface Warfare Center (NSWC) Panama City Division (PCD) Study Area. Particular attention is paid to four sites that are representative of the variability that is seen across the NSWC PCD Study Area. Next, temporal fluctuations of wind and shipping noise are provided.

The second subsection deals with the most significant of the intermittent noise sources. The potential locations of these sources, the frequency band in which they dominate, and the range of noise levels they might produce are discussed. In the final subsection, all data (measured and modeled) due to persistent and intermittent noise source are summarized by a spectral plot that characterizes the bounds of the noise field within the NSWC PCD Study Area.

D.1 PERSISTENT SOURCES OF AMBIENT NOISE

Noise sources that tend to dominate the ambient field for extended periods of time, and are likely to be found in most locations (of operational interest), have been the primary focus of measurement and modeling efforts sponsored by the Navy. In open oceans, the primary persistent noise sources tend to be commercial shipping and wind action on the sea surface.

Surface ships generate noise via a number of mechanisms, the most important being propeller blade cavitations. This broadband noise reaches a maximum source spectrum level in the band 40-100 Hz of 180 dB (re 1 micropascal) or more.

At any given time, there are approximately 20,000 large commercial vessels at sea. Since these sources' most significant component is below a few hundred Hertz and since propagation is most favorable at those frequencies (particularly in deep water), surface ships can often be heard at distances greater than 100 kilometers (km) (54 miles [mi]). Thus, at many deep-water locations, it is not unusual for the low-frequency noise field to be influenced by contributions from tens or even hundreds of surface ships.

What is commonly known as wind noise is generated by a number of mechanisms related to wind. The interaction between capillary waves driven by local wind action on the sea surface is one mechanism that has been postulated. However, the clear correlation between the onset of white caps and a rapid increase in noise level suggests that the primary mechanism is related to

the breaking of waves. This breaking process causes the formation of vast numbers of bubbles that oscillate at their formation and thereby produce sound.

Although wind noise is present at all frequencies, it tends to dominate above 250 Hz. At the higher frequencies, attenuation works against wind noise propagating to great distances. Thus, unlike shipping noise, wind noise tends to be locally generated and not particularly sensitive to environmental factors that affect propagation. The one notable exception to this rule is that shallow-water wind noise tends to be several dB higher than deep-water wind noise for comparable wind speeds.

The following subsections address the contributions of commercial shipping and wind to the noise field in the region of interest. The discussion begins with a review of noise measurements that have been made in this region. To complete this picture, and to investigate temporal variations, the measurement data are followed by results obtained from a widely used ambient noise model.

D.1.1 Average Ambient Noise Estimates

Beginning in the 1980s, the Office of Naval Research sponsored the development of the Ambient Noise Directionality Estimation System (ANDES) (Renner, 1995). ANDES was initially designed to predict the average spatial properties of the noise field. These results are best viewed as averages over enough time for the nearby surface ships to transit through the transmission loss (TL) field and adequately sample its variations. Normally this is considered to be around several hours.

Although not a designated Navy Standard, ANDES itself is a collection of Navy-Standard sub-models for propagation and boundary losses, and environmental databases, including shipping. This, coupled with the fact that ANDES is widely used throughout the anti-submarine warfare (ASW) community, effectively makes ANDES a *de facto* standard.

Ambient noise in the 10-250 Hz is typically dominated by contributions from commercial ship traffic. To understand the geographic dependence of average ambient noise at these frequencies, one needs to understand the distribution of surface ship traffic. Tank ships and cargo carriers are the most prevalent types of commercial ships in the Gulf of Mexico (GOM). Most of this traffic is to or from one of the following major ports: Tampa, Pascagoula, New Orleans, Galveston, and Corpus Christi. Very little of this traffic transits between these ports. Rather, the majority of the traffic is to or from these ports to other ports outside the GOM via the two primary entry points to the GOM, the Florida Straits and the Yucatan Channel.

The most complete description of historical shipping distributions is given by HITS (Historical Temporal Shipping) database (U.S. Navy, 1993). Figure D-1 provides the HITS shipping densities for its most prevalent class of ship (denoted as merchants) in the area of interest. The major shipping lane connecting New Orleans (and nearby ports) and the Florida Straits clearly is the dominant feature in this figure.

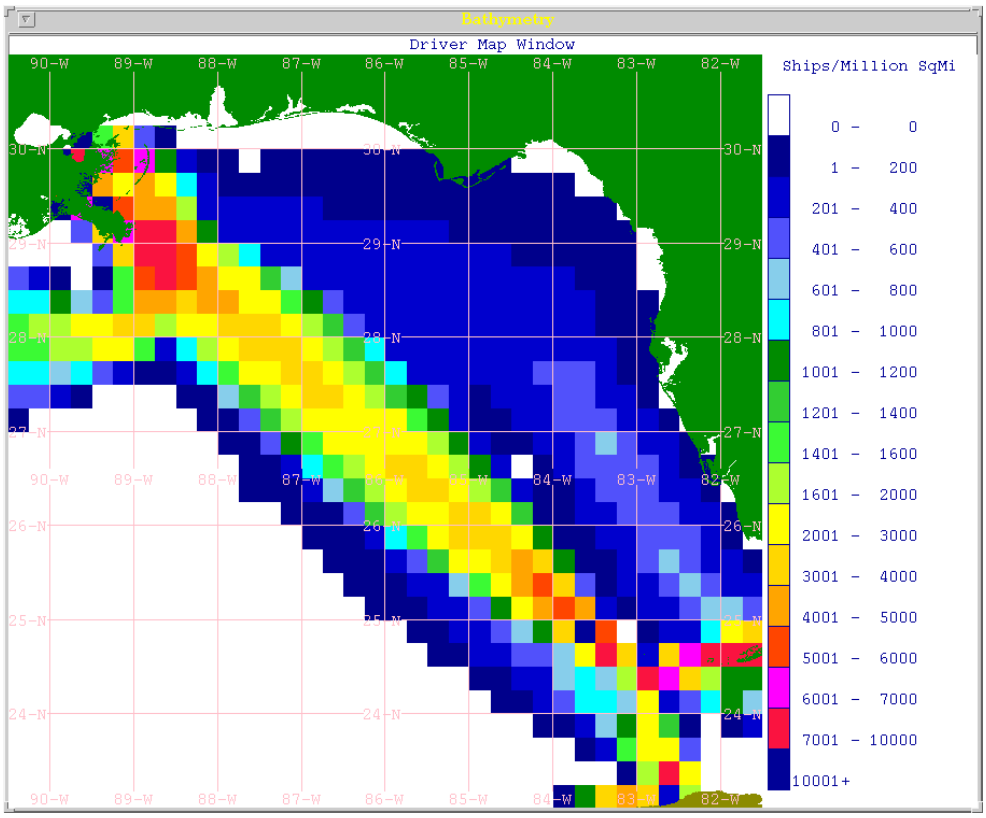


Figure D-1. HITS Merchant Shipping Densities

To understand the spatial variability of low-frequency noise in this region, four representative sites have been selected. These sites are intended to represent the various combinations of the two most significant factors in determining the low-frequency noise level.

- Environment (or more specifically, water depth)
- Source distribution (that is, shipping density)

The four sites are identified and described in Table D-1 below.

Table D-1. Selected Sites for ANDES Modeling

Site	Location	Environment	Source Distribution
A	27 N 86 W	Deep Water	High Shipping
B	24-30 N 87 W	Deep Water	Low Shipping
C	29 N 88 W	Shallow Water	High Shipping
D	28 N 84 W	Shallow Water	Low Shipping

ANDES = Ambient Noise Directionality Estimation System; N = North; W = West

For each of these sites, ANDES was used to generate average noise spectra for winter and summer conditions. In all cases, the predicted noise level is for a receiver located at a depth of 20 m (66 feet) (average noise levels in this region vary only slightly over the depths of interest) in the presence of 15 knots (17 mph) of wind. These winter spectra are presented in Figure D-2; summer spectra are virtually identical to the winter spectra at all sites. As expected, high-frequency noise (above 300-400 Hz) is relatively insensitive to site location. Equally

anticipated is the high spatial variability in the low-frequency noise. Noise levels increase as either the water depth increases (improving propagation) or the shipping density increases. Note that the peak noise level at 40 Hz varies from a low of 69 dB at Site D to a high of 96 dB at Site A.

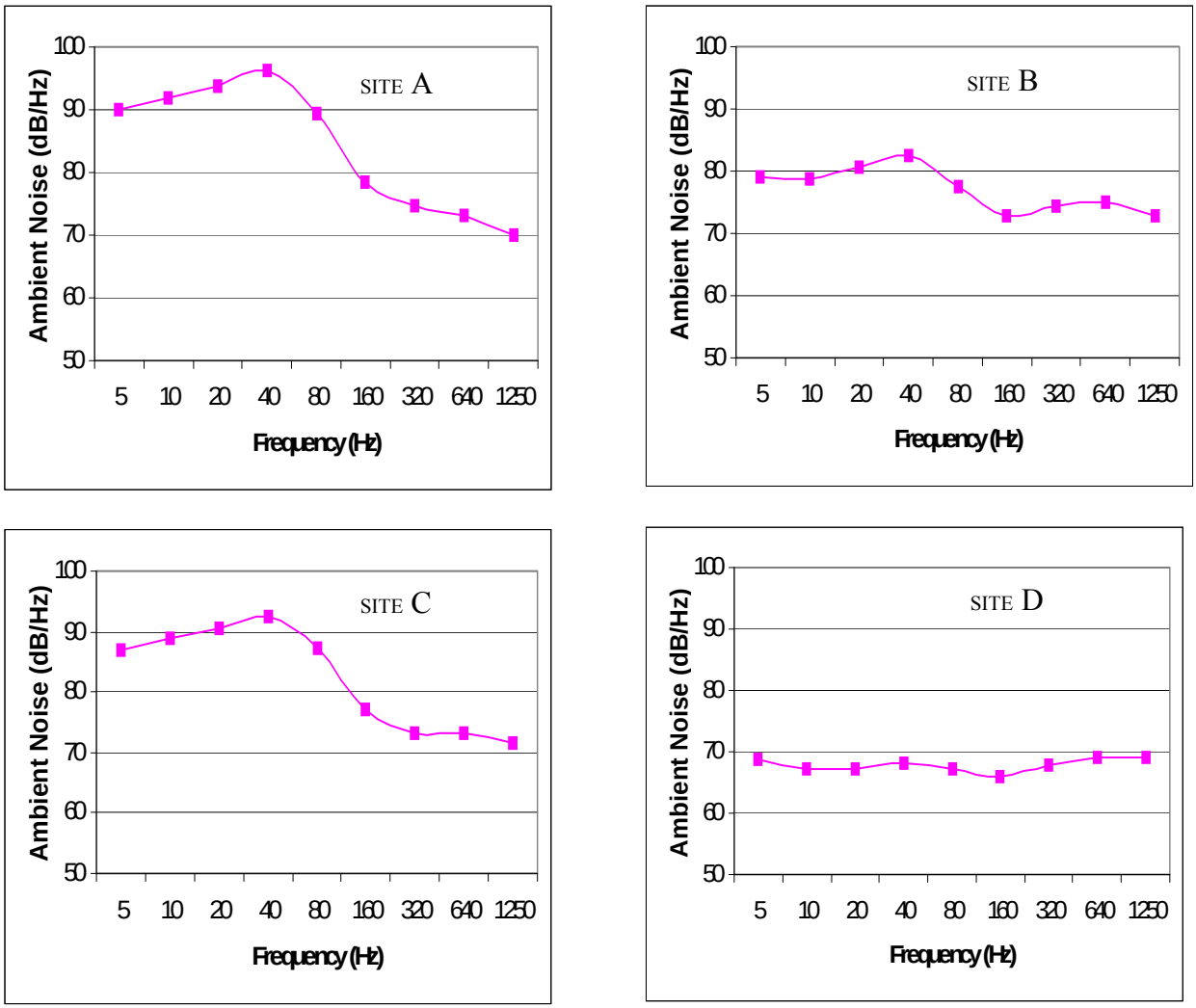


Figure D-2. Noise Spectra for Four Representative Sites

In order to provide a comprehensive picture of the ambient noise field throughout the region of influence, average winter noise levels were generated throughout the area using ANDES. These results, again for a receiver at a depth of 20 m (66 ft), are presented at two frequencies, 60 Hz (shipping dominated) and 240 Hz (wind dominated), in Figure D-3 and Figure D-4. The location of the dominant shipping lane to the port of New Orleans is clearly visible in the 60-Hz data. Noise levels diminish slowly at this frequency as the receiver is moved away from the shipping lane in the direction of deep water. However, as the receiver moves out of the shipping lane and into shallow water, noise levels diminish more rapidly. Both of these effects are due to the relative efficiency of low-frequency propagation in deep water versus shallow water. At 240 Hz, noise levels tend to vary less as wind noise begins to dominate.

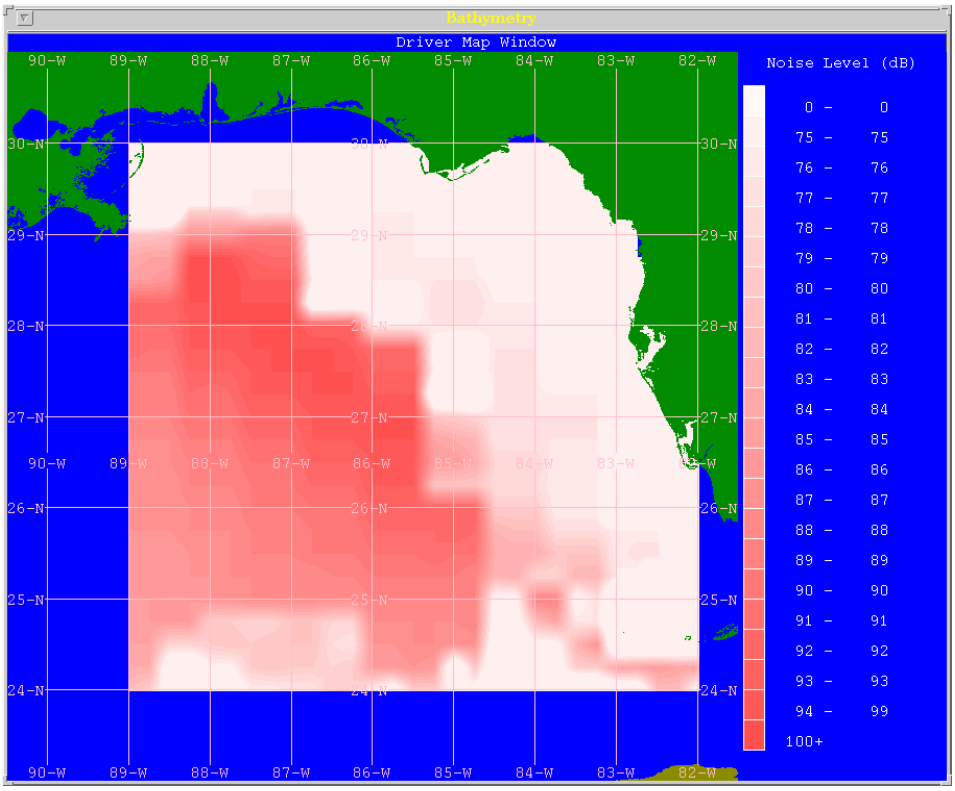


Figure D-3. 60-Hz Ambient Noise Levels

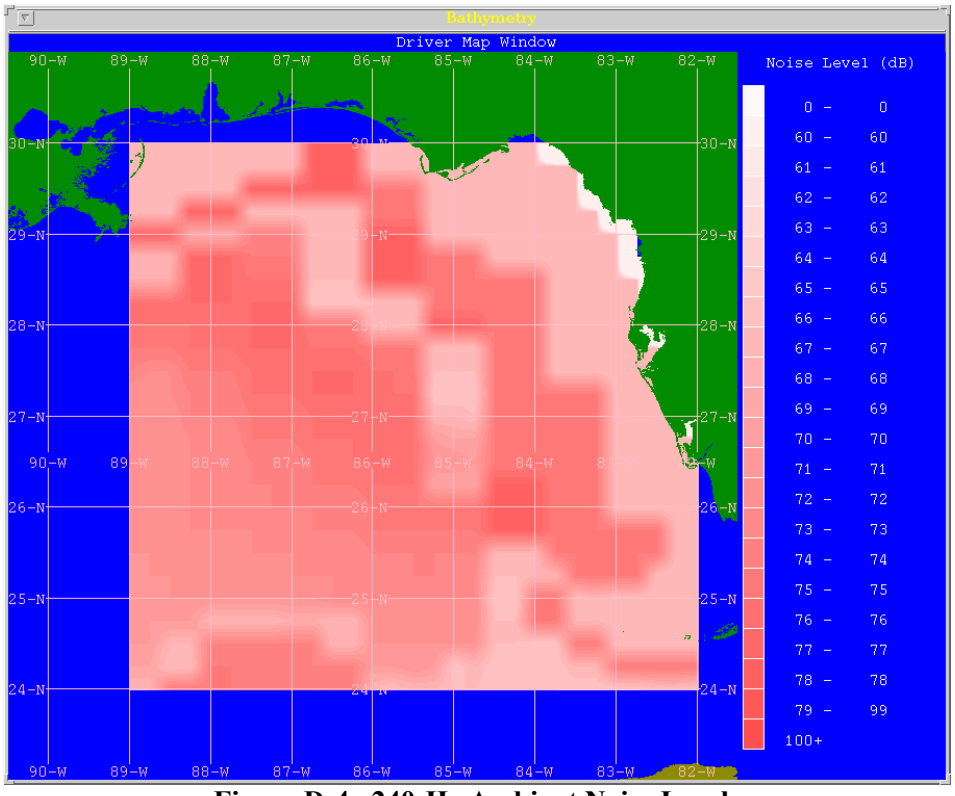


Figure D-4. 240-Hz Ambient Noise Levels

D.1.2 Temporal Fluctuation Estimates

Although shipping and wind noise have been categorized as persistent sources, this is not to suggest that either is constant over time. Both fluctuate over time due to changes in source distribution and propagation loss. These fluctuations occur over several different time scales; of particular interest here are seasonal variations and variations over time scales of a few minutes to a few hours. Seasonal variations for this region are negligible as mentioned in the previous subsection; this section focuses upon fluctuations over a period of minutes to hours.

At low frequencies, the movement of ships (particularly those close to the receiver) causes the largest fluctuations in the ambient noise level. In addition to predicting average noise level, ANDES can also be used to quantify the magnitude of these fluctuations.

Fluctuations in low-frequency shipping noise are clearly a function of the proximity of the receiver site to a major shipping lane. Referring back to the four sites identified in the previous subsection, we would expect to see more frequent and larger fluctuations at Site A (located within the major shipping lane to New Orleans) than at Site B (which is located outside that lane). The magnitude and frequency of fluctuations also depends upon the number of ships that are making significant contributions to the noise field. In shallow water, where propagation is often less favorable, only ships near the receiver are important. Accordingly then, shallow water sites "see" fewer ships and hence the movement of one ship in close proximity to the receiver can have dramatic effects upon the noise. Again referring back to the four representative sites, we would expect to see larger fluctuations at shallow water Sites C and D than at deep water sites A and B.

These conjectures are supported by predicted ambient noise time series shown in Figure D-5 for the four representative sites. Each is a ten-hour time series, sampled every five minutes, of the noise spectrum level at 60 Hz during the winter. As expected, a major shipping lane, A, has the most frequent swings in noise level, while sites C and D have the largest fluctuations.

In addition to fluctuations due to the movement of nearby ships, ambient noise may vary due to changes in wind speed. These variations are most noticeable at frequencies where wind noise is the dominant component (typically above 250 Hz). In that upper frequency band, ambient noise varies with wind speed as defined in Figure D-6 below.

D.2 INTERMITTENT SOURCES OF AMBIENT NOISE

To this point, the discussion of ambient noise levels (both modeled and measured) has focused on noise from the two types of sources that tend to always be present, wind and shipping. While these may fluctuate in time and space, they almost always are major contributors to the total field. In the absence of all transient (or intermittent) sources, the minimum noise levels attributable to wind and shipping tend to form the lower boundary on the ambient noise level.

At varying times and/or in certain locations, there are additional sources of noise that may dominate certain portions of the spectrum. Primary among these are: (1) industrial noise generated by oil production (exploration and drilling), (2) noise generated by various species of marine animals, and (3) noise due to rain or hail striking the sea surface. By and large, it is

impossible to forecast the exact time and location of these noise sources, much less the actual noise levels they produce.

Figure D-5. 60-Hz Ambient Noise Time Series

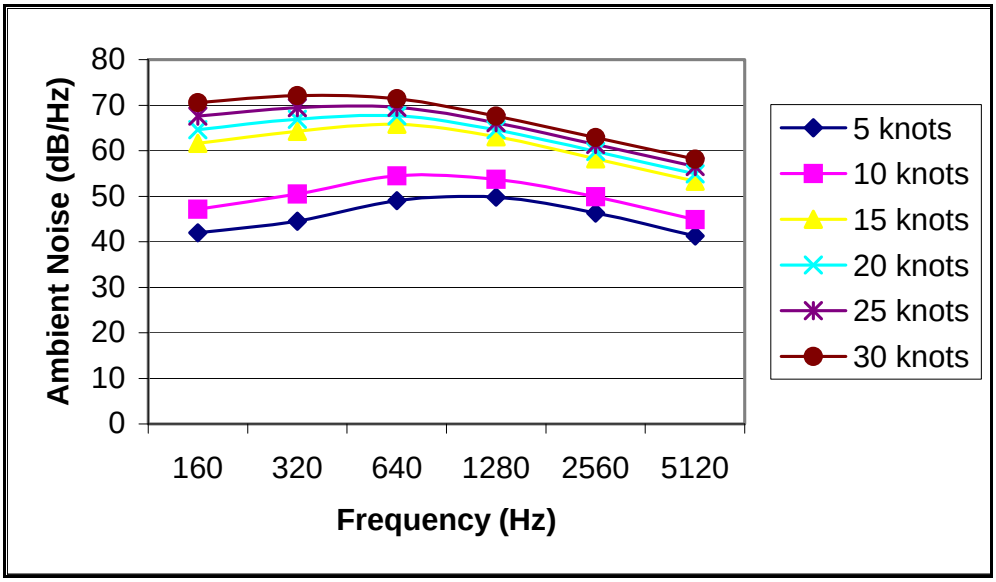


Figure D-6.. Ambient Noise Variation With Wind Speed (Source: Renner, 1995)

Despite this limitation, there is sufficient information on transient noise sources to identify areas in which these sources may be prevalent. It is also possible to estimate likely upper limits for these sources when they are present. This approach is taken in the following subsections.

D.2.1 Oil Production

The oil industry has been actively prospecting and drilling in the GOM. Both activities are the source of considerable underwater sound. Yet, despite this, little quantitative information is available concerning the noise levels generated by these activities. It is known that seismic exploration primarily employs very low-frequency sources and that these exercises can easily dominate the low-frequency noise field at some range. On the other hand, oil rigs produce noise throughout the frequency domain.

Recently, economic and political factors have not been favorable to offshore oil exploration and production. Nonetheless, oil production continues in the GOM, particularly along the shelf off the coast of Louisiana and eastern Texas. This activity most likely can be detected acoustically in those areas. The NSWC PCD study area does not include any activities related to the oil industry.

D.2.2 Biologics

Many species of marine life are known to contribute to the underwater noise field over a very wide frequency envelope. These vocalizations range from low-frequency grunts and moans to very high frequency chirps, whines, and clicks. Marine species that produce these sounds belong to one of three major classes: the crustacea (shellfish), marine mammals, and fish. What follows is a summary of the contributions that species in these classes make to the underwater ambient

noise. More detailed analyses can be found in Sections 3.4.3 Invertebrates, 3.4.4 Fish, 3.4.7 Marine Mammals, and 4.3 Biological Resources.

Among the crustacea, the primary noise makers are snapping shrimp. Snapping shrimp are generally found in warmer waters, such as in the GOM, and are typically limited to water depths of less than 60 meters (m) (197 feet). They can generate noises that peak somewhere between 3-10 kHz. Most other crustacea (other shrimp species, crabs, sea urchins, and barnacles) can produce noise in the same frequency as the snapping shrimp; however, little is known about the actual noise levels that these species produce.

More well-known sources of underwater sounds come from marine mammal species. The sounds generated by these mammals tend to be quite loud, and at low frequencies are equivalent to the sounds of the biggest commercial ships. The various types of sounds marine mammals can produce include moans from species such as a blue whale that are in the 300-1000Hz range, gargle-like sounds from bowhead whales in the 300-1000 Hz range, and clicks from sperm whales and various dolphins in the 5150 kHz range (Cummings and Holliday, 1987; Cummings and Thompson, 1971; Whitehead and Weilgart, 1990; Thompson et al., 1992).

Certain fish species can also be the source of mid- to high-frequency noise, particularly in shallow waters. The croaker, or drumfish, produces a croaker-like noise that often escalates to a chorus, due to the number of individual fish that are simultaneously vocalizing. This chorus can peak around 1 kHz, which is more than 30 dB above the background level. Noise from another type of chorus has been observed in the evening, often lasting for several hours following sunset (Cato, 1978). The most significant contribution from this chorus was measured in the band from 400-4000 Hz, with a peak usually around 2 kHz.

D.2.3 Rain

Rain produces noise in much the same manner as does wind. Countless water droplets striking the sea surface produce impulsive sound; however, it is the fluctuation of the bubble formed by the droplets rupturing the sea surface and encapsulating a volume of air that apparently is the dominant source of sound. Rain noise differs from wind noise in that its peak contribution to the field occurs at a slightly higher frequency, typically between 1-3 kHz. Even at moderate rain rates, the noise generated at these frequencies can easily exceed contributions from wind.

While the rain noise mechanism has been well studied, actual measurements of rain noise differ by 10 dB or more for similar rain rates. A conservative estimate of noise levels due to various rates provided by ANDES is presented in Figure D-7.

D.3 BOUNDS ON AMBIENT NOISE

Summarizing ambient noise levels over a region as large and diverse as the NSWC PCD Study Area is best achieved by providing upper and lower bounds on the ambient noise spectrum with the understanding that spatial and temporal factors play a role in determining exactly where the actual noise spectrum falls between those bounds. The lower bound on average noise level is defined at the low frequencies by shipping noise in regions outside the shipping lanes. At high frequencies, the lower bound is defined by wind noise at low wind speeds. From this lower

bound, average noise levels increase as either the shipping density or the wind speed increases with the upper bound defined by areas of high shipping and under high wind conditions.

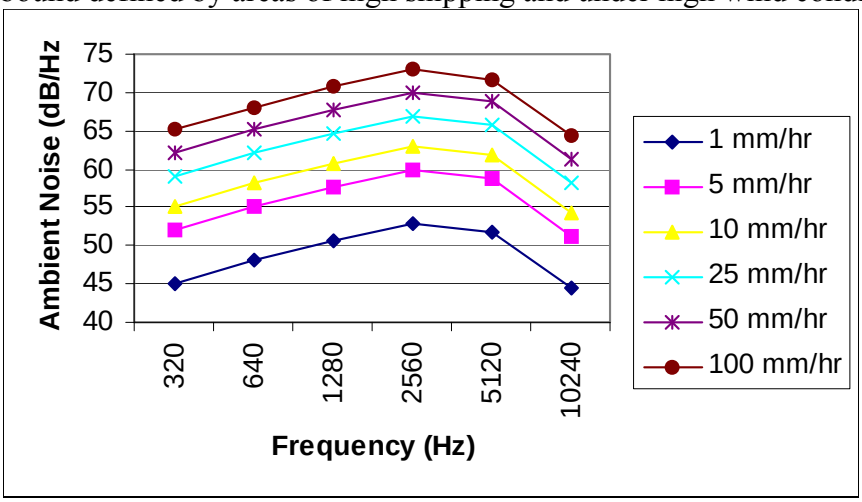


Figure D-7. Ambient Noise Variation With Rain Rate (Renner, 1995)

Intermittent sources of ambient noise can significantly exceed the upper bound of average ambient noise levels. The passage of a surface ship very close to the receiver can raise low-frequency noise levels by 10 dB or more. The onset of rain raises high-frequency noise levels by 10 dB or more. Finally, biologics of various types can raise noise levels near 20 Hz (due to marine mammals), in the range of a few kHz (due to crustaceans and fish), and in the tens to hundreds of kHz (again due to marine mammals). While the occurrence of biologic noise is limited in time and location, when it is present it can produce noise levels that are as much as 30 dB greater than background levels. The spectra presented in Figure D-8 illustrate the variability due to all of these potential noise sources.

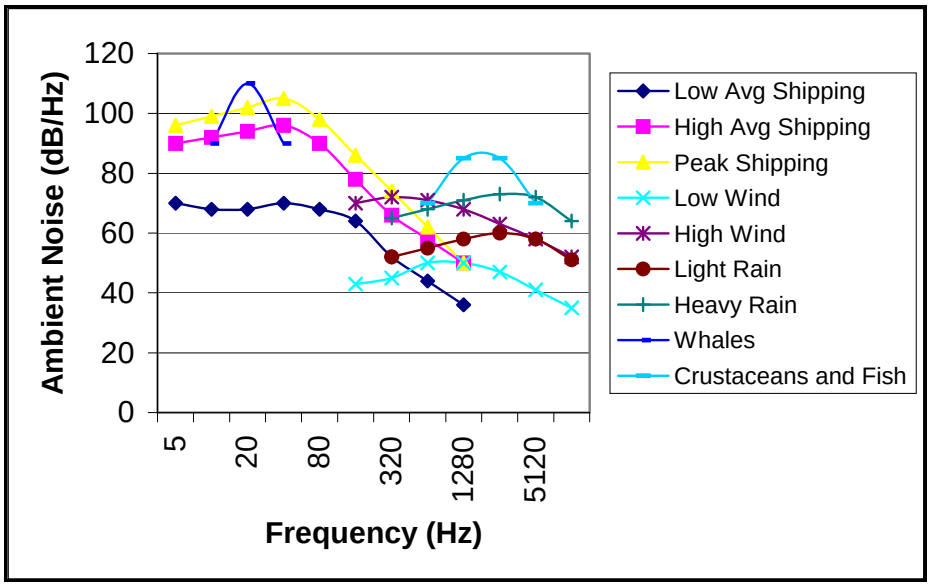


Figure D-8. Ambient Noise Level Bounds in the Region of Influence

D.4 REFERENCES

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APPENDIX E

GEOGRAPHIC DESCRIPTION OFENVIRONMENTAL PROVINCES

GEOGRAPHIC DESCRIPTION OF ENVIRONMENTAL PROVINCES

Propagation loss ultimately determines the extent of the zone of effect (ZOE) for a particular source activity. In turn, propagation loss as a function of range responds to a number of environmental parameters:

- Water depth
- Sound speed variability throughout the water column
- Bottom geo-acoustic properties, and
- Wind speed

Due to the importance that propagation loss plays in Anti-Submarine Warfare (ASW), the Navy has over the last four to five decades invested heavily in measuring and modeling these environmental parameters. The result of this effort is the following collection of global databases of these environmental parameters, most of which are accepted as standards for all Navy modeling efforts.

- Water depth – Digital Bathymetry Data Base Variable Resolution (DBDBV)
- Sound speed – Generalized Digital Environmental Model (GDEM)
- Bottom loss – Low-Frequency Bottom Loss (LFBL), Sediment Thickness Database, and High-Frequency Bottom Loss (HFBL), and
- Wind speed – U.S. Navy Marine Climatic Atlas of the World

This section provides a discussion of the relative impact of these various environmental parameters. These examples then are used as guidance for determining environmental provinces (that is, regions in which the environmental parameters are relatively homogenous and can be represented by a single set of environmental parameters) within the NSWC PCD Study Area.

E.1 IMPACT OF ENVIRONMENTAL PARAMETERS

Within a typical operating area, bathymetry is the environmental parameter that tends to vary the most. It is not unusual for water depths to vary by an order of magnitude or more, resulting in a significant impact upon the ZOE calculations. Bottom loss can also vary considerably over typical operating areas, but its impact upon ZOE calculations tends to be limited to waters on the continental shelf and the upper portion of the slope. Generally, the primary propagation paths in deep water from the source to most of the ZOE volume do not involve any interaction with bottom. In shallow water, particularly if the sound velocity profile directs all propagation paths to interact with the bottom, bottom loss variability can play a large role.

The spatial variability of the sound speed field is generally small over operating areas of typical size. The presence of a strong oceanographic front is a noteworthy exception to this rule. To a lesser extent, variability in the depth and strength of a surface duct can be of some importance. In the mid latitudes, seasonal variation often provides the most significant variation in the sound

speed field. For this reason, both summer and winter profiles are modeled for each selected environment.

E.2 ENVIRONMENTAL PROVINCING METHODOLOGY

The underwater acoustic environment can be quite variable over ranges in excess of 10 kilometers (km) (6.2 miles [mi]). For the Naval Surface Warfare Center, Panama City Division (NSWC PCD) Research, Development, Test, and Evaluation (RDT&E) applications, ranges of interest are often sufficiently large as to warrant the modeling of the spatial variability of the environment. In the propagation loss calculations, each of the environmental parameters is allowed to vary (either continuously or discretely) along the path from acoustic source to receiver. In such applications, each propagation loss calculation is conditioned upon the particular locations of the source and receiver.

On the other hand, the range of interest for marine animal harassment by most naval activities is more limited. This reduces the importance of the exact location of source and marine animal, and makes the modeling required more manageable in scope.

In lieu of trying to model every environmental profile that can be encountered in an operating area, this effort utilizes a limited set of representative environments. Each environment is characterized by a fixed water depth, sound velocity profile, and bottom loss type. The operating area is then partitioned into homogeneous regions (or provinces) and the most appropriately representative environment is assigned to each. This process is aided by some initial provincing of the individual environmental parameters. The Navy-standard high-frequency bottom loss database in its native form is globally partitioned into nine classes. (Low-frequency bottom loss is likewise provinced in its native form, although it is not considered in this selection of environmental provinces. The sources for which low-frequency bottom loss would be of interest have limited impact ranges thus rendering bottom loss of little consequence in this analysis.) The Navy-standard sound velocity profiles database is also available as a provinced subset. Only the Navy-standard bathymetry database varies continuously over the world's oceans. However, even this environmental parameter is easily provinced by selecting a finite set of water depth intervals. "Octave-spaced" intervals (10, 20, 50, 100, 200, 500, 1,000, 2,000, and 5,000 meters [m] or 33, 66, 164, 328, 656, 1,640, 3,281, 6,562, and 16,404 feet [ft]) provide an adequate sampling of water depth dependence.

ZOE volumes are then computed using propagation loss estimates derived for the representative environments. Finally, a weighted average of the ZOE volumes is taken over all representative environments; the weighting factor is proportional to the geographic area spanned by the environmental province.

The selection of representative environments is subjective. However, the uncertainty introduced by this subjectivity can be mitigated by selecting more environments and by selecting the environments that occur most frequently over the operating area of interest.

As discussed in the previous subsection, ZOE estimates are most sensitive to water depth. Unless otherwise warranted, at least one representative environment is selected in each

bathymetry province. Within a bathymetry province, additional representative environments are selected as needed to meet the following requirements:

- In shallow water (less than 1,000 m [3,281 ft]), bottom interactions occur at shorter ranges and more frequently, thus significant variations in bottom loss need to be represented.
- Surface ducts provide an efficient propagation channel that can greatly influence ZOE estimates. Variations in the mixed layer depth need to be accounted for if the water is deep enough to support the full extent of the surface duct.

Depending upon the size and complexity of the operating area, the number of environmental problems tends to range from 5 to 20.

E.2.1 Description of Environmental Provinces Used in Acoustic Modeling

This section describes the representative environmental provinces selected for the entire NSWC PCD Study Area. The narrowband sources described in Appendix M are, for the most part, deployed throughout the NSWC PCD Study Area. The broadband sources are primarily limited to portions of the continental shelf. For all of these provinces, the average winter wind speed is 14 knots (16 miles per hour [mi/hr]) and the average summer wind speed is 9 knots (10 mi/hr).

The NSWC PCD Study Area contains a total of 16 distinct environmental provinces. These represent the various combinations of eight bathymetry provinces, one Sound Velocity Profile (SVP) provinces, three LFBL geoacoustic provinces, and two HFBL classes. The bathymetry provinces represent depths ranging from 5 m (16 ft) to more than a kilometer (0.6 miles). Nearly three-fourths of the NSWC PCD Study Area is located on the continental shelf in waters less than 200 m (656 ft). The distribution of the bathymetry provinces over the entire NSWC PCD Study Area is provided in Table E-1.

Table E-1. Distribution of Bathymetry Provinces in the NSWC PCD Study Area

Province Depth (m) (ft)	Frequency of Occurrence
5 (16)	3.03 %
10 (33)	3.00 %
20 (66)	12.48 %
40 (131)	16.88 %
80 (262)	14.21 %
160 (525)	23.63 %
320 (1,050)	22.39 %
640 (2,100)	4.38 %

m = meters; ft - feet

A single SVP province includes the entire NSWC PCD Study Area. The seasonal variation is somewhat limited in its dynamic range, as might be expect given that the range is located in temperate waters. The winter profile's surface sound speed profile is about 25 meters per second (m/s) (56 mi/hr) slower than the summer profile, as depicted in Figure E-1, and features a 50-m (164-ft) surface duct.

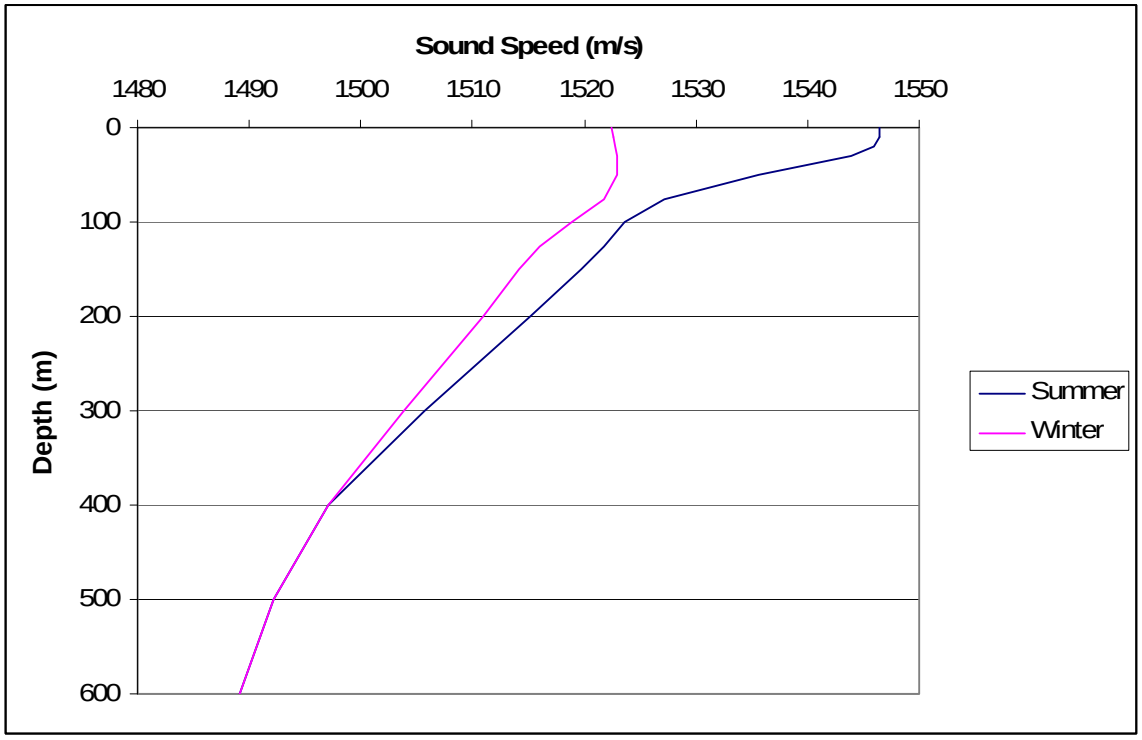


Figure E-1. Winter and Summer SVPs in the NSWC PCD Study Area

The two HFBL classes represented in the NSWC PCD Study Area are low-loss bottom (class 2, typically found in shallow water) and high-loss bottom (class 8). The distribution presented in Table E-2 indicates that the high-loss bottom dominates.

Table E-2. Distribution of Sound Speed Provinces in the NSWC PCD Study Area

HFBL Class	Frequency of Occurrence
2	28.97 %
8	71.03 %

The variation in sound speed profiles among the three provinces is quite minimal; indeed, due to the tropical location even the seasonal variability is quite small. This is illustrated in Figure E-1, which displays the upper 1,000 m (3,281 ft) of the winter and summer profiles.

The three LFBL provinces represented in the NSWC PCD Study Area have densities ranging from coarse sand to clayey silt. Their distribution is identified in Table E-3.

Table E-3. Distribution of Low-Frequency Bottom Loss Classes in the NSWC PCD Study Area

HFBL Class	Frequency of Occurrence
Coarse Sand	66.39
Fine Sand	7.27
Clayey Silt	26.34

Table E-4. Distribution of Environmental Provinces in the NSWC PCD Study Area

Environmental Province	Water Depth (m) (ft)	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
1	5 (16)	2	0	0.2 secs	3.03 %
2	10 (33)	2	0	0.2 secs	3.00 %
3	20 (66)	2	0	0.2 secs	12.48 %
4	40 (131)	2	0	0.2 secs	14.44 %
5	80 (262)	2	– 49*	0.57 secs	0.46 %
6	320 (1050)	2	0	0.95 secs	4.54 %
7	640 (2100)	2	– 49*	0.2 secs	4.37 %
8	40 (131)	2	– 49*	0.2 secs	2.36 %
9	80 (262)	2	13	0.2 secs	12.13 %
10	160 (525)	2	13	0.2 secs	14.20 %
11	320 (1050)	2	13	0.2 secs	0.01 %
12	40 (131)	8	– 49*	0.2 secs	0.08 %
13	80 (262)	8	0	0.2 secs	1.62 %
14	160 (525)	8	0	0.2 secs	9.43 %
15	320 (1050)	8	0	0.2 secs	17.83 %
16	640 (2100)	8	0	0.2 secs	0.01 %

* Negative numbers indicate provinces that were developed as part of the Shallow-Water Upgrade to the LFBL database. These provinces are primarily limited to water depths between 50-800 m (164–2,625 ft) in the Gulf of Mexico (GOM), but do not necessarily cover all such areas.

The logic for consolidating the environmental provinces focuses upon water depth, using bottom type as secondary differentiating factors. The first consideration is to ensure that all eight bathymetry provinces are represented. Environmental provinces that occur in less than one percent of the NSWC PCD Study Area are consolidated with similar provinces (using water depth first and then HFBL as the rules for consolidation). Next, any remaining small province that has a reasonable proxy (that is, the same water depth and HFBL province) is consolidated with its comparable province. This results in the following mapping of raw environmental provinces into an initial subset in Table E-5.

Table E-5. Initial Subset of Provinces

Raw Province	Subset Province
5	9
8	4
11	6
12	4
16	7

The resulting distribution of the eleven environmental provinces used to model the narrowband sources in the NSWC PCD Study Area modeling is described in Table E-6. The percentages given in the preceding table indicate the frequency of occurrence of each environmental province across all three Warning Areas in the NSWC PCD Study Area.

Table E-6. Distribution of Environmental Provinces in the NSWC PCD Study Area

Environmental Province	Water Depth (m) (ft)	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
1	5 (16)	2	0	0.2 secs	3.03 %
2	10 (33)	2	0	0.2 secs	3.00 %
3	20 (66)	2	0	0.2 secs	12.48 %
4	40 (131)	2	0	0.2 secs	16.88 %
6	320 (1,050)	2	0	0.95 secs	4.55 %
7	640 (2,100)	2	– 49*	0.2 secs	4.38 %
9	80 (262)	2	13	0.2 secs	12.59 %
10	160 (525)	2	13	0.2 secs	14.20 %
13	80 (262)	8	0	0.2 secs	1.62 %
14	160 (525)	8	0	0.2 secs	9.43 %
15	320 (1,050)	8	0	0.2 secs	17.83 %

* Negative numbers indicate provinces that were developed as part of the Shallow-Water Upgrade to the LFBL database. These provinces are primarily limited to water depths between 50-800 meters in the GOM, but do not necessarily cover all such areas

Finally, all explosive sources are limited to environmental provinces that are situated on the continental shelf. The MK-58 line array is restricted even further to just the surf zone (nominally taken to be at a water depth of 2 m [6 ft]). This limits the modeling to a single environment that is identical to province 1 with the exception that the water depth is only 2 m (6 ft). The remaining mines are restricted to regions that are outside the 22 km (12 nautical mile [NM]) territorial limit. The 4.5 kilogram (kg) (10 pounds [lbs]) mines are detonated in water depths ranging from 30 m to 305 m (100 to 1,000 ft); 34 kg (75 lbs) mines in water depths ranging from 46 m to 61 m (150 to 200 ft); 200 kg (440 lbs) mines in water depths less than 100 m (328 ft); and 272 kg (600 lbs) mines in water depths ranging from 37 to 46 m (120 to 150 ft). The distribution of the environments used for each of these explosives is provided in Table E-7.

Table E-7. Distribution of Environmental Provinces for Explosive Sources in the NSWC PCD Study Area

Environmental Province	10# Mine	75# Mine	440# Mine	600# Mine	M-58 Line Charge
1 (2 m deep)	0.00 %	0.00 %	0.00 %	0.00 %	100.00 %
4	21.89 %	100.00 %	54.29 %	100.00 %	0.00 %
6	5.90 %	0.00 %	0.00 %	0.00 %	0.00 %
9	16.33 %	0.00 %	40.50 %	0.00 %	0.00 %
10	18.42 %	0.00 %	0.00 %	0.00 %	0.00 %
13	2.10 %	0.00 %	5.21 %	0.00 %	0.00 %
14	12.23 %	0.00 %	0.00 %	0.00 %	0.00 %
15	23.13 %	0.00 %	0.00 %	0.00 %	0.00 %

APPENDIX F

SUPPORTING INFORMATION FOR BIOLOGICAL RESOURCES

SUPPORTING INFORMATION FOR BIOLOGICAL RESOURCES

F.1 MARINE HABITATS

F.1.1 Special Biological Resource Areas

Florida Middle Grounds

The Florida Middle Grounds lie between three bodies of water: the Gulf Loop Current, west Florida estuarine waters, and the Florida Bay waters (Chew, 1955; Smith et al., 1975; USEPA, 1994). It is the most biologically developed live bottom in the eastern GOM and is the northernmost extent of coral reefs in the GOM (Rezak and Bright, 1981). These live bottoms are able to support a variety of species because of the intrusion of the Loop Current and its high organic productivity.

Sargassum Community

Sargussum can be described as a generally planktonic macroalgae or brown algae (seaweed). *Sargussum* originates in the Sargasso Sea, a region of the Central Atlantic. The Sargasso Sea is in the middle of the Atlantic Ocean and covers some 3 million square kilometers (km^2) (873,543 million square nautical miles [NM^2]) between the West Indies and the Azores. It is encircled by the Gulf Stream and the North Equatorial Current. This causes the oval-shaped sea to move in a slow, clockwise drift. The Sargasso Sea is also known as "the floating desert" (Florida Department of Environmental Protection [FDEP], 2007). Tiny air bladders keep the *Sargassum* afloat. It can form streamers that stretch for miles along the boundaries between water masses, or it can form big yellow and brown "mats" that cover large areas of the surface. Strong currents around the Sargasso Sea can carry *Sargassum* around the world. *Sargassum* is commonly found in the beach drift near *Sargassum* beds where they are also known as Gulfweed (FDEP, 2007).

Thick masses of *Sargassum* provide an environment for a distinctive and specialized group of marine biota, many of which are not found elsewhere in the world (Science and the Sea, 2007). Specifically, planktonic *Sargassum* serves as a temporary habitat for four species of sea turtle hatchlings, as well as larval and juvenile stages of over 100 fish species. Fish are attracted to the drifting algal mats for a number of reasons, including use as a foraging area, for protection from larger predators, as a spawning ground, and as a nursery habitat. The habitat created by *Sargassum* aggregations also supports a diverse and highly adapted resident assemblage of marine organisms such as fungi, micro- and macro-epiphytes, hydroids, and crustaceans.

In addition, *Sargassum* provides food and shelter to juvenile sea turtles. Sea turtle hatchlings are known to associate with pelagic *Sargassum* habitat during their "lost years" when they drift along with the planktonic mats. This association is thought to play a vital role in the life of young turtles. Any *Sargassum* mats drifting at sea have the potential to host young sea turtles, since both are found with currents and can travel for long distances from their points of origin.

The presence of *Sargassum* is transient (temporary), unpredictable, and dependent on prevailing surface currents. Aggregations of *Sargassum* can be found throughout tropical areas of the

world and are often the most obvious macrophyte in nearshore areas where *Sargassum* beds often occur near coral reefs. The plants grow subtidally and attach to coral, rocks, or shells in moderately exposed or sheltered rocky or pebble areas. In some cases (e.g., the Sargasso Sea), there are floating populations of *Sargassum* (FDEP, 2007).

The Gulf of Mexico (GOM) is second to the Sargasso Sea in the quantity of *Sargassum* present in the area. Moreover, the Florida Keys and its smaller islands are well known for their high levels of *Sargassum* covering their shores (FDEP, 2007).

F.2 FISH

F.2.1 Eastern GOM

Over 550 species of fish are found in the GOM. These fish are taxonomically and ecologically diverse. Some species are economically important and support recreational and commercial fisheries. Only one species, the Gulf sturgeon (threatened status), is considered under the ESA and has been reported to occur in the eastern GOM.

The eastern GOM also includes a variety of habitats that, in turn, support a wide diversity of fish. The key habitat features include coral reefs off southern Florida, a broad continental shelf off western Florida, submarine canyons (DeSoto and Mississippi), a major river delta (Mississippi) extending into the GOM as part of Louisiana, and deepwater areas beyond the continental shelf. Physiographic and oceanographic features of the environment (e.g., salinity, primary productivity, bottom type, and currents) affect the distribution, abundance, and diversity of fish in the GOM. The abundance and distribution of fish occurring in the eastern GOM are affected not only by their physical environment but also by the habitat available to them.

Table F-1 summarizes the habitats and associated features and functions found within the NSWC PCD Study Area and provides examples of fish assemblages that occur within each habitat type.

Table F-1. Typical Fish Assemblages in the NSWC PCD Study Area

Habitat Type	Area Found	Examples of Fish Supported
Reef	Includes Florida Keys coral reefs	Triggerfish Jacks Wrasses Snapper Tilefish Grouper Surgeonfish Parrotfish Damselfish
Sea floor	Areas of vertical relief	Seabass Damselfish Porgis Snapper
Open water	Open water of the GOM	Coastal migratory pelagic fish: Mackerel Cobia Cero Little tuny Dolphin (genus *Coryphaena*) Bluefish Pelagic offshore fish: Atlantic spadefish Tomtate Gray snapper Blue angelfish, Belted sandfish Cubbyu White grunt

Source: REEF, 2001

F.2.2 Threatened and Endangered Fish

Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)

Subadult and adult Gulf sturgeons may be found in the nearshore marine waters within close proximity to the boundary of the eastern GOM, particularly along the northern GOM. The Gulf sturgeon in this area has been observed 1.9 kilometers (km) (1 nautical mile [NM]) from shore (Ross et al., 2002). Gulf sturgeons have been observed off the Suwannee River area as far as 16.7 km (9 NM) from shore (USFWS and NMFS, 2003). The Gulf sturgeon is not expected to be present in the testing areas since it is a coastal inhabitant.

Gulf Sturgeon Critical Habitat

Critical habitat was designated for the Gulf sturgeon in March 2003. In the Final Rule for the designation of critical habitat for the Gulf sturgeon, seven primary constituent elements are identified.

- Abundant food items within riverine habitats for larval and juvenile life stages, and within estuarine and marine habitats for adult and subadult life stages.

- Riverine spawning sites with suitable substrate.
- Riverine aggregation areas (resting, holding, or staging areas).
- Proper stream flow regime for all life stages.
- Adequate water quality for all life stages.
- Adequate sediment quality for all life stages.
- Safe and unobstructed migratory pathways for passage within and between riverine, estuarine, and marine habitats.

Critical habitat for the Gulf sturgeon is composed of 14 geographic areas, or units. The units collectively encompass almost 2,800 km (1,511 NM) of river and over 6,000 km2 (1,747 square nautical miles [NM^2]) of estuarine and marine habitat (Figure F-1). Critical habitat is delineated along Panama City's coastal waters of the GOM and extends from the mean high water line to 1.6 km (0.9 [mi]) offshore.

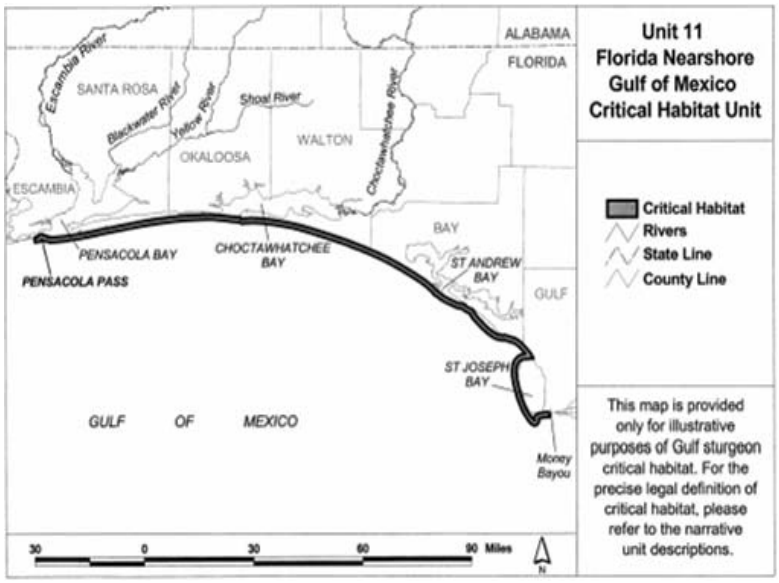


Figure F-1. Critical Habitat for the Gulf Sturgeon in the GOM

Smalltooth Sawfish (*Pristis pectinata*)

The smalltooth sawfish was listed under the ESA on 6 April 2003 following NMFS announcement on 1 April 2003 of a final determination for this species (NMFS, 2006).

The smalltooth sawfish is one of two sawfish species in the waters of the United States. Once common throughout the GOM from Texas to Florida, their current distribution ranges primarily throughout peninsular and southern Florida. They are only commonly found in the Everglades and in shallow areas with mangrove forests in Florida Bay and the Florida Keys, as well as off southern Florida. They reside typically within 1.9 km (1 NM) of land in estuaries, shallow banks, sheltered bays, and river mouths with sandy and muddy bottoms. Occasionally, they are found offshore on reefs or wrecks and over hard or mud bottoms. The smalltooth sawfish feed on fish

and crustaceans, using their long flat snouts to stun and kill their prey. Very little is known about their life history in Florida.

This shark relative was not highly targeted for direct commercial takings but was frequently entangled in fishing nets and caught in shrimp trawls. Once entangled, this sawfish has little chance for successful release. A study by C.A. Simpfendorfer (2000) suggests that the complete recovery of this species will take decades and possibly centuries due to their population size and slow reproductive potential. Habitat degradation has also contributed to their demise. Smalltooth sawfish cannot be "taken" in Florida (or Louisiana) (NMFS, 2006).

The smalltooth sawfish is not expected to be present within the testing areas because its current distribution is limited to peninsular Florida, and it is only rarely found offshore.

F.3 ESSENTIAL FISH HABITAT (EFH)

The following is presented for the purpose of interpreting the definition of essential fish habitat (NMFS, 2004). Figure F-2 through Figure F-7 depict EFH in the NSWC PCD Study Area.

The Magnuson-Stevens Act established the requirement to describe and identify EFH in each fishery management plan. EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. "Waters" include aquatic areas and their associated physical, chemical, and biological properties. "Substrate" includes sediment underlying the waters. Federal agencies must consult with NMFS on any proposed federal action that may adversely affect EFH.

The FMCs classify EFH for temperate and subtropical-tropical managed species in terms of five basic lifestages: (1) Eggs, (2) Larvae, (3) Juveniles, (4) Adult, and (5) Spawning Adult. Eggs are those individuals that have been spawned but not hatched and are completely dependent on the egg's yolk for nutrition. Larvae are individuals that have hatched and can capture prey, while Juveniles are those individuals that are not sexually mature but possess fully formed organ systems that are similar to adults. Adults are sexually mature individuals that are not necessarily in spawning condition. Finally, spawning adults are those individuals capable of spawning.

Although the individual lifestage terms and definitions are the same as those defined by the FMCs, NMFS categorizes the lifestages of managed tuna, swordfish, and billfish somewhat differently, resulting in three categories that are based on common habitat usage by all lifestages in each group: (1) Spawning Adults, Eggs, and Larvae; (2) Juveniles and Subadult; and (3) Adult. Subadults are those individuals just reaching sexual maturity. The category of Spawning Adult, Eggs, and Larvae is associated with spawning location and the circulation patterns that control the distribution of the eggs and larvae.

NMFS uses a different lifestage classification system for sharks; the system bases the lifestage combinations on the general habitat shifts that accompany each developmental stage. The three resulting categories are: (1) Neonate and Early Juvenile (including newborns and pups less than one year old), (2) Late Juvenile and Subadult (age one to adult), and (3) Adult (sexually mature sharks). In Amendment 1 to the Fisheries Management Plan for the Atlantic Tunas, Swordfish, and Sharks, the first two lifestages were modified as follows: the Neonate and Early

Juvenile category was renamed "Neonate," which primarily includes neonates and small young-of-the-year sharks; and the Late Juveniles and Subadults category was renamed "Juveniles," which includes all immature sharks from young to late juveniles.

EFH has been designated for all 26 fish species managed by the GMFMC and for 20 of the highly migratory species managed by NMFS within the eastern GOM. In the GOM, designations are divided into estuarine and marine waters. Marine waters include all waters and substrates (mud, sand, rock, hard bottom, and associated biological communities) from the shore to the EEZ boundary; this includes all coral habitats, sub-tidal vegetation (seagrass and algal beds), and adjacent intertidal vegetation (wetlands and mangroves). In addition to the species listed in Table F-2, corals and *Sargassum* are also included as EFH.

Table F-2. Managed Species for Which Essential Fish Habitat Has Been Identified in the Eastern GOM

Invertebrates	Highly Migratory Fish	Fish
Brown Shrimp	Blue Marlin	Black Grouper
Pink Shrimp	White Marlin	Bluefish
Royal Red Shrimp	Sailfish	Cero
Stone Crab	Swordfish	Cobia
Spiny Lobster	Bluefin Tuna	Dolphin (Mahi)
White Shrimp	Skipjack Tuna	Gag Grouper
	Yellowfin Tuna	Greater Amberjack
	Blacktip Shark	Gray Snapper
	Bull Shark	Gray Triggerfish
	Dusky Shark	King Mackerel
	Silky Shark	Lesser Amberjack
	Tiger Shark	Lane Snapper
	Atlantic Sharpnose Shark	Little Tunny
	Longfin Mako Shark	Red Drum
	Blacknose Shark	Red Grouper
	Bonnethead Shark	Red Snapper
	Finetooth Shark	Scamp
	Oceanic Whitetip Shark	Spanish Mackerel
	Sandbar Shark	Tilefish
	Scalloped Hammerhead Shark	Vermillion Snapper
	Spinner Shark	Yellowtail Snapper

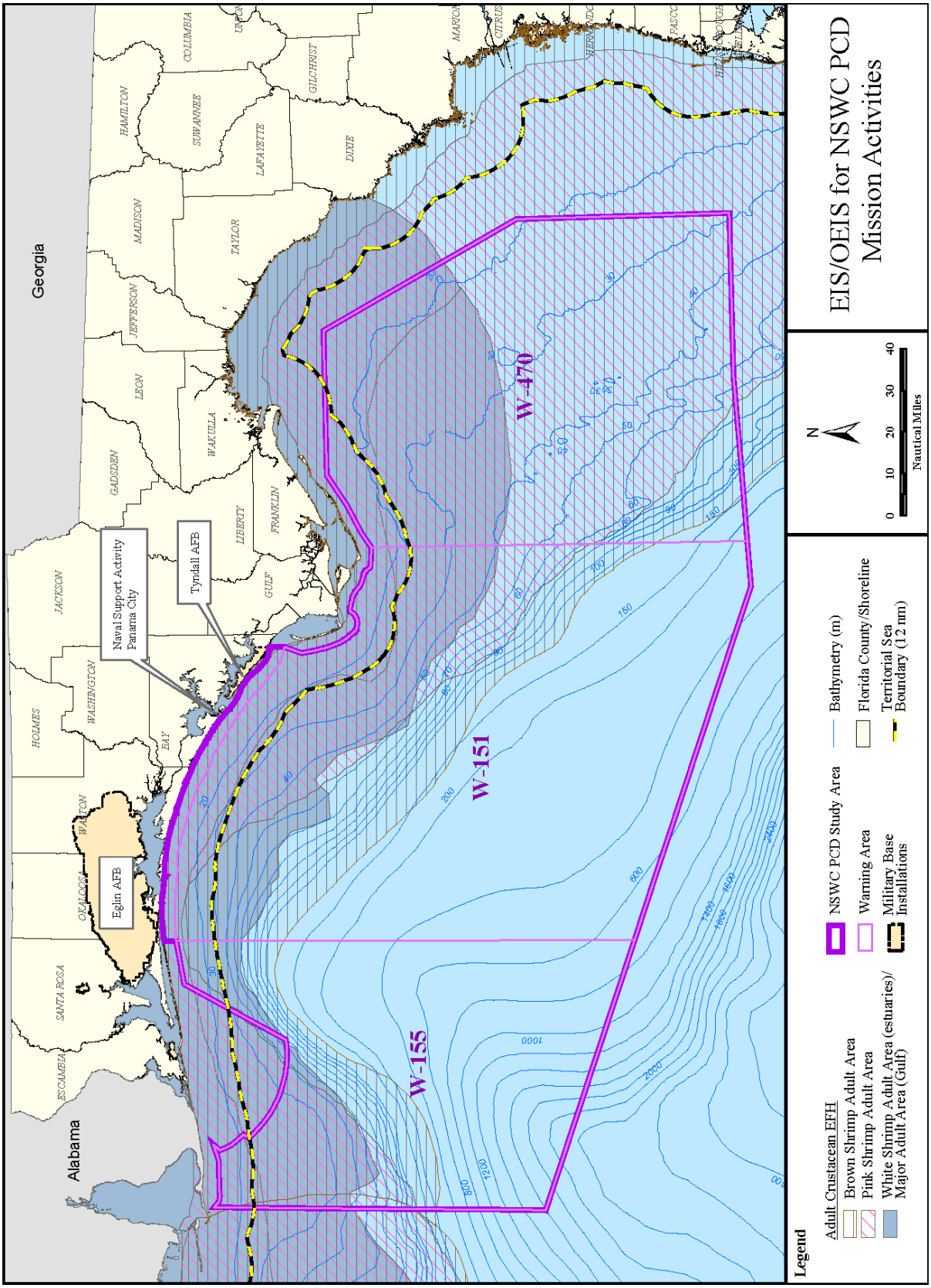


Figure F-2. Essential Fish Habitat for Adult Crustaceans in the GOM

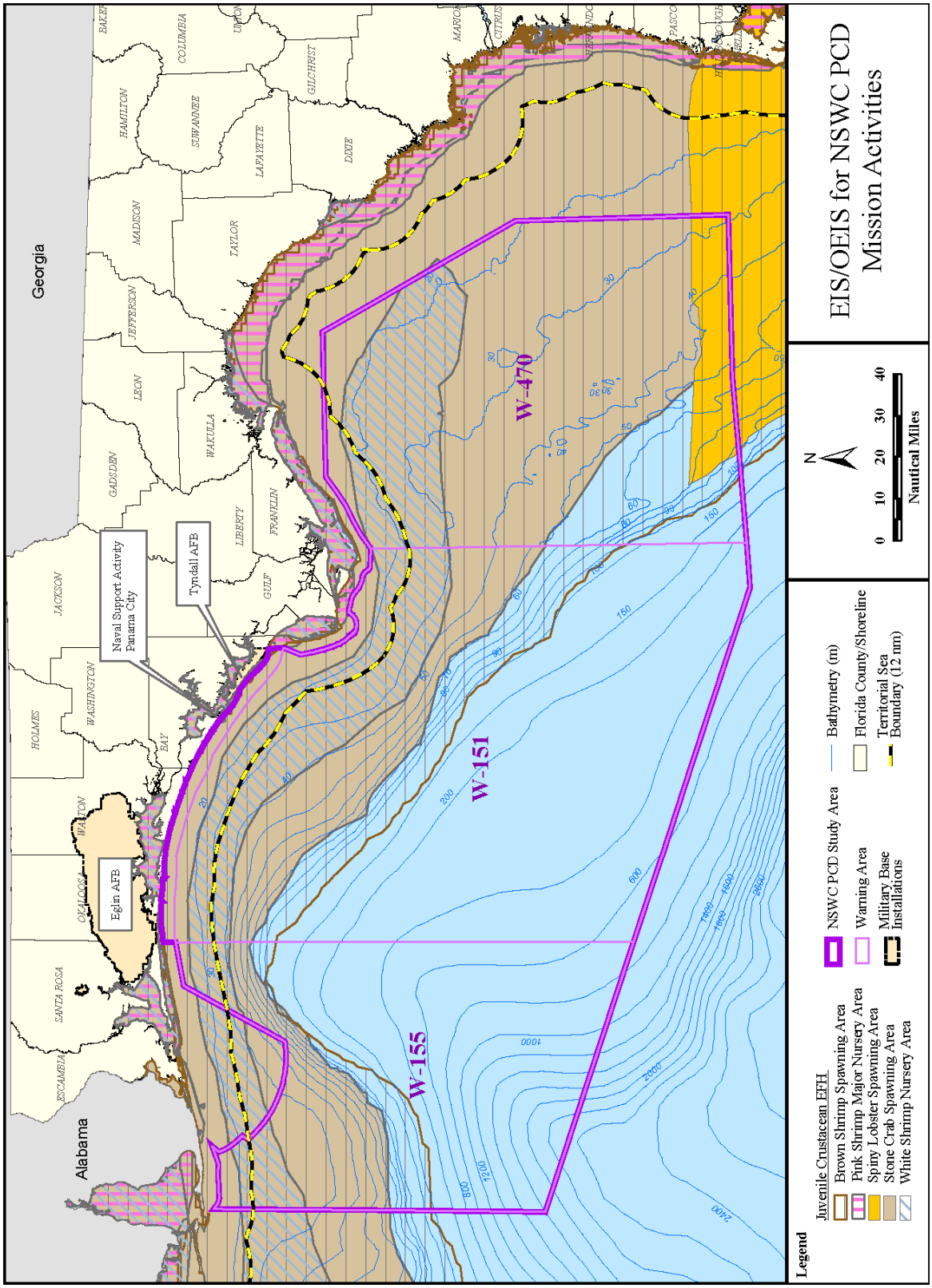


Figure F-3. Essential Fish Habitat for Juvenile Crustaceans

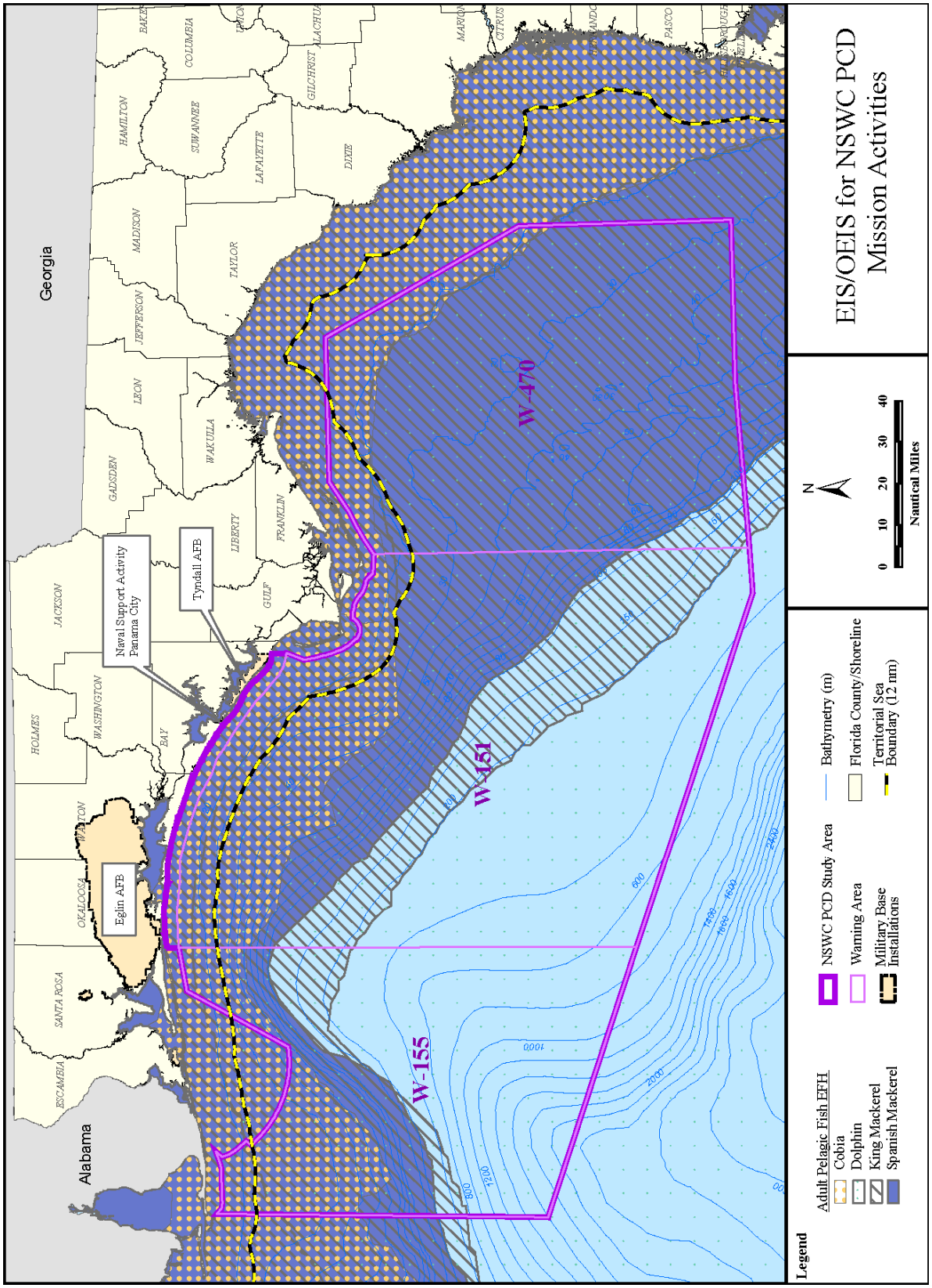


Figure F-4. Essential Fish Habitat for Selected Adult Pelagic Fish in the GOM

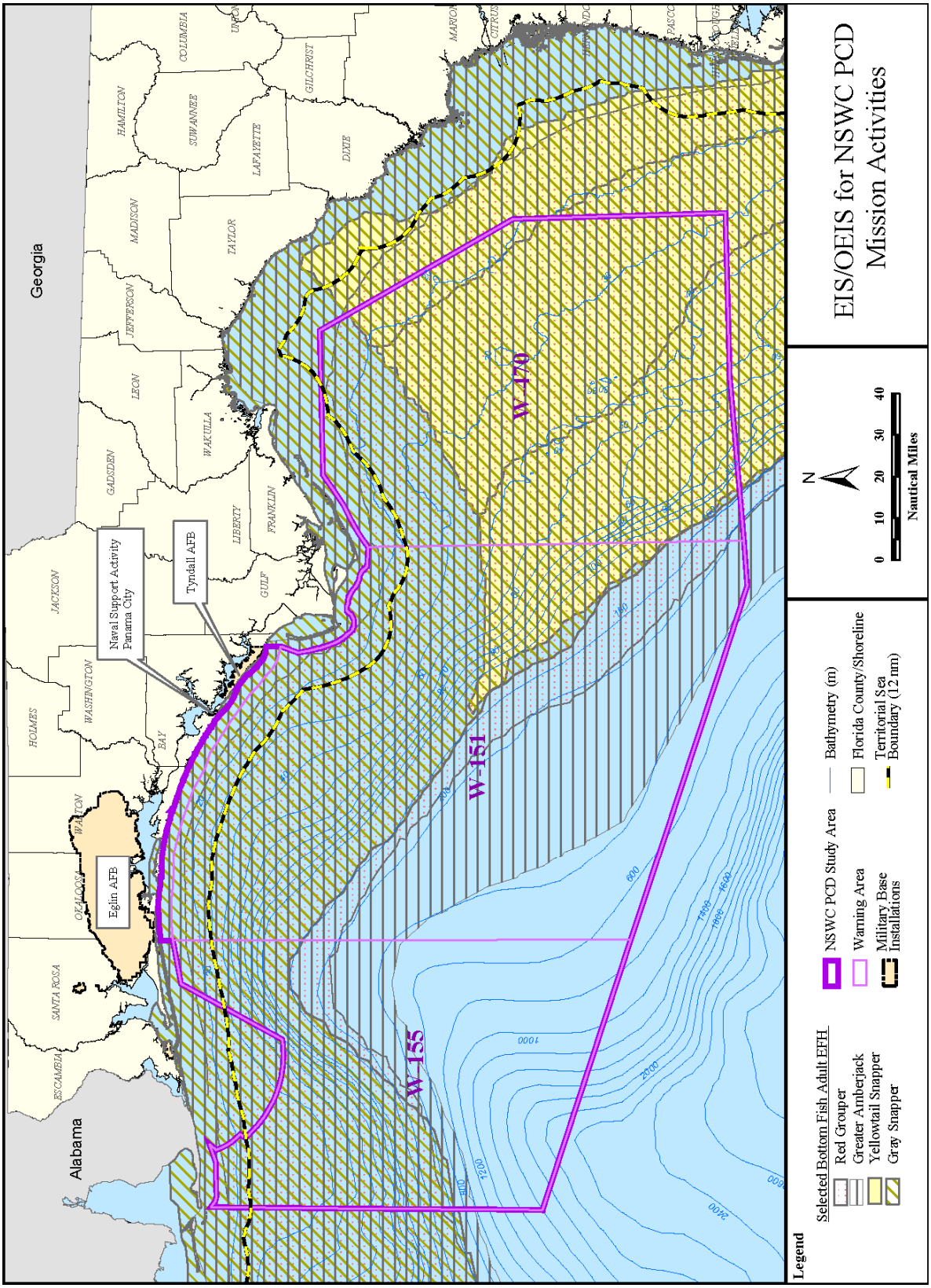


Figure F-5. Essential Fish Habitat for Selected Adult Bottom Fish in the GOM, Group A

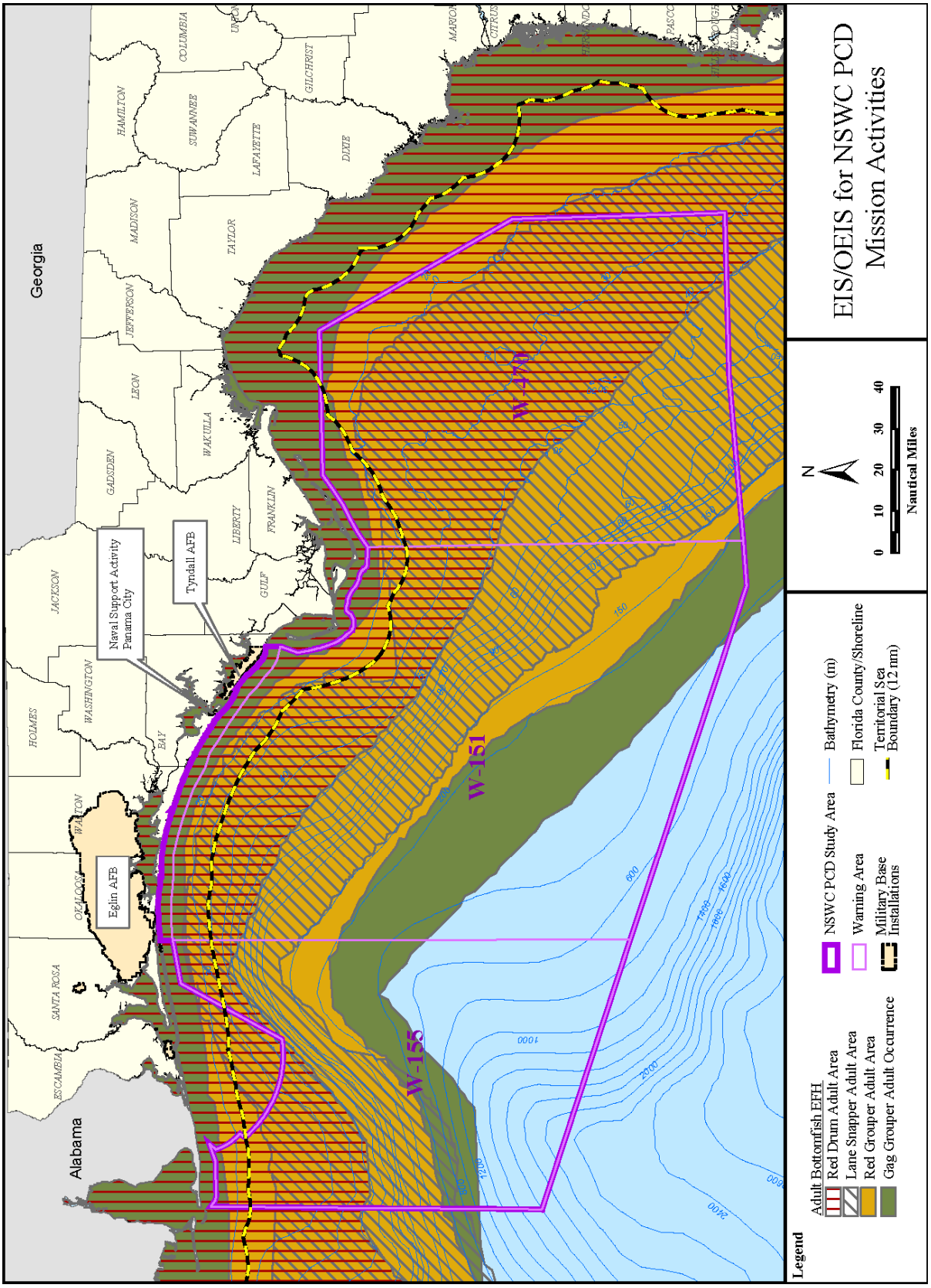


Figure F-6. Essential Fish Habitat for Selected Adult Bottom Fish in the GOM, Group B

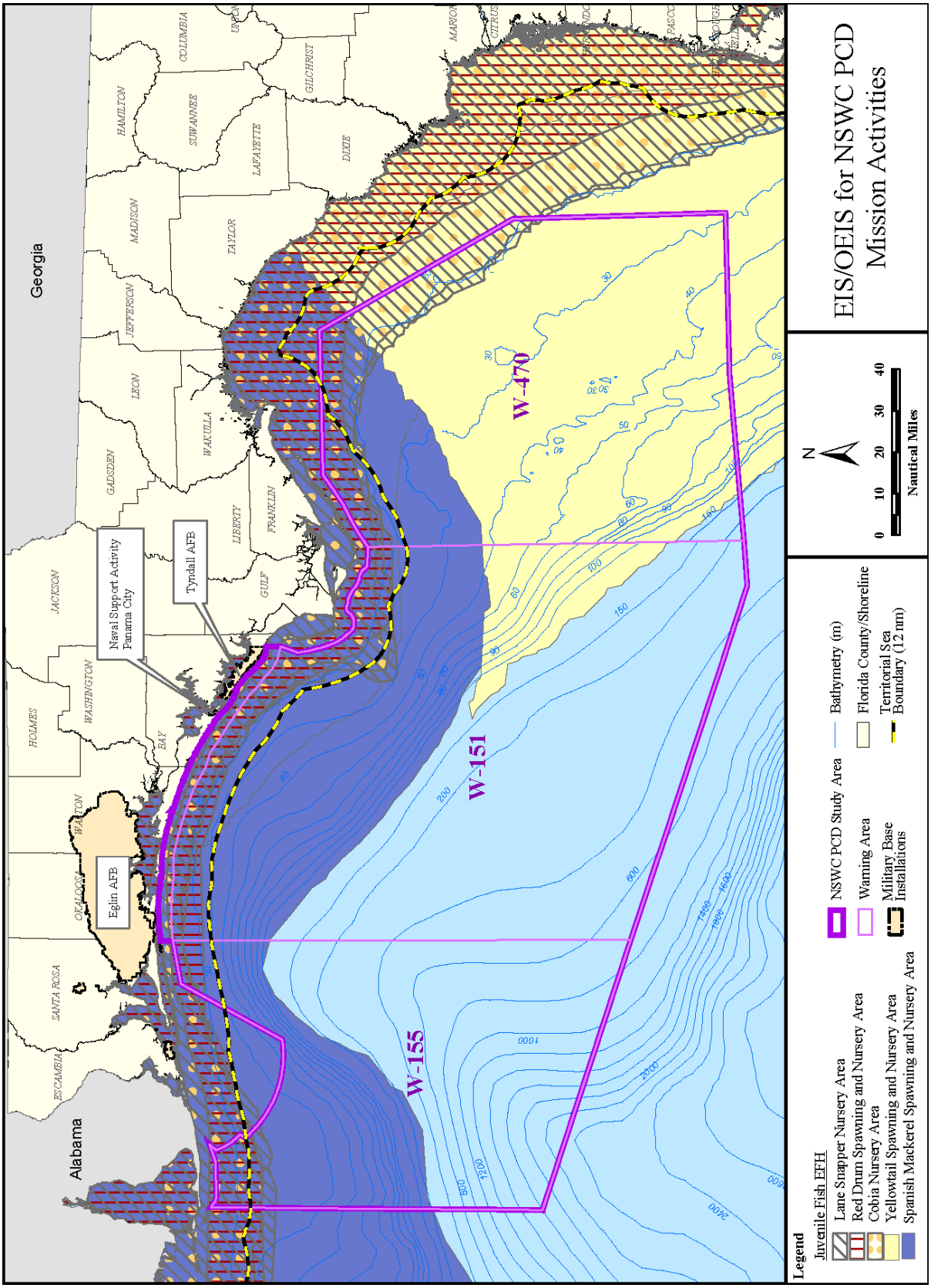


Figure F-7. Essential Fish Habitat for Selected Juvenile Fish in the GOM

F.4 BIRDS

F.4.1 Threatened and Endangered Birds

Wood Stork (*Mycteria Americana*)

The largest North American wading bird, the wood stork, has been on the endangered species list since 1984. This indicator species was once more abundant in Florida, in particular southern Florida, than anywhere else on the continent (FWC, 2003a). The wood stork can be found in tropical and subtropical zones with distinct wet and dry seasons. The bird generally stands almost 0.9 meters (m) (3 feet [ft]) tall and has a wingspan of over 1.5 m (4.9 ft). Their feeding habit is unique because wood storks use their beak to push through the water column and grab fish. Therefore, they are most effective during the year when water levels are falling and fish are concentrated (FWC, 2003a). The dark, non-feathered head, stout bills, and black trimmed white bodies distinguish the species. They nest from coastal South Carolina to northern Argentina. Northern Florida maintains a high proportion of nesting individuals (FWC, 2003a). The wood stork builds nests high in the tops of mangroves and cypress as well as on artificial platforms like power poles and channel markers. Generally the wood stork reaches sexual maturity by age four. Females lay two to five eggs in a two- to three-day period. At nine weeks, young are mature enough to leave the nest. The lack of food because of wetland drainage and development has hastened the demise of the species. Estimates are poor because not all individuals nest every year. It is now believed that about 11,000 adults can be found in the United States (FWC, 2003a).

Bald Eagle (*Haliaeetus leucocephalus*)

Original population estimates of bald eagles in the continental United States range from 75,000 to 100,000 nesting individuals. However, in 1963, the National Audubon Society surveyed the lower 48 states and located only 417 active bald eagle nests. The species made an impressive comeback after the banning of DDT in the early 1970s. Currently, 5,478 nesting pairs are estimated in the lower 48 states (FWC, 2003a). The bald eagle was officially down-listed from endangered to threatened in the lower 48 states in August 1995, and in 1999 the USFWS proposed to de-list the bald eagle in the coterminous United States altogether. If de-listed under the ESA, the bald eagle will still be protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

The Florida Panhandle had 59 active nests in the 1997–98 nesting season (Florida Game and Fresh Water Fish Commission, now the Florida Fish and Wildlife Fish Conservation Commission [FWC], 1994). This number has risen to 66 known active nests in the Panhandle for the 2001-02 nesting season (FWC, 2003a). Florida supports the largest number of breeding bald eagles, as well as 70 percent of the occupied nesting territories, in the southeastern United States (FWC, 2003b). In Bay County, seven nests have been documented with only one pair not returning in 2002 (FWC, 2003b).

Bald eagles nest when they reach four years of age. They are territorial and exhibit a strong affinity for a nest site once a nest has been established. It is common for a breeding pair to rebuild damaged or lost nests in the same tree or in an adjacent tree. The nesting period in the southeast United States extends from 1 October to 15 May with most nests completed by the end

of November. Eagles typically lay between one and three eggs with an incubation period of 34–36 days. In northwest Florida, most successful eggs are laid by mid-February. A nesting pair typically produces one to three fledglings, but usually only one fledgling will survive. The quality and amount of forage resources heavily influence fledgling survival. The fledging period has been documented to last from 70 to 98 days. Eagles forage on fish and on carrion.

Piping Plover (*Charadrius melodus*)

The piping plover (*Charadrius melodus*) is a shorebird that inhabits coastal sandy beaches and mudflats. This species has experienced major declines over its entire range, followed by some recovery. Some regional declines are still occurring. Strong threats related primarily to human activity, disturbance by humans, predation, and development pressure are pervasive threats along the Atlantic coast (USFWS, 1996). It is listed as a result of historic hunting pressure and loss and degradation of habitat (USFWS, 2001a).

Piping Plover Critical Habitat

In August 2001, critical habitat was designated for wintering populations of piping plovers. The designated piping plover critical habitat consists of 137 coastal areas from North Carolina to Texas. According to the USFWS ruling, the primary constituent elements for piping plover wintering habitat are those components essential for foraging, sheltering, and roosting, and the physical features necessary for maintaining the natural processes that support these habitat components. These elements are found in coastal areas that support intertidal beaches and flats, and associated dune systems and flats above annual high tide. In Florida, over 340 km (211 mi) of shoreline and over 11,000 hectares (42 square miles [mi^2]) of land area are designated as critical wintering habitat. In Bay County, the Shell and Crooked islands are areas with critical habitat for piping plovers. The designation is over 1,759 hectares (6.8 mi^2) of habitat, primarily in two areas: Tyndall Air Force Base and St. Andrews State Recreation Area (USFWS, 2001a).

The USFWS has identified several activities that may potentially have adverse effects on piping plover critical habitat. Such activities may include dredging and dredge spoil placement; seismic exploration; construction and installation of facilities, pipelines, and roads associated with oil and gas development, oil spills and oil spill clean-up; construction of dwellings, roads, marinas, and other structures; staging of equipment and materials; beach nourishment, stabilizations and cleaning; all-terrain vehicular activity; storm water and wastewater discharge; sale, exchange, or lease of federal land that contains suitable habitat that is likely to result in the habitat being degraded; marsh restoration; and military maneuvers. Human disturbance is considered less of an issue in wintering areas, as piping plovers are not necessarily tied to specific beach sites even though they may return to the same beach for wintering each year. Human disturbance to areas designated as piping plover breeding sites are considered more sensitive.

F.5 MARINE MAMMALS

North Atlantic Right Whale (*Eubalaena glacialis*)

Description – North Atlantic right whales are 9 to 17 m (30 to 56 ft) long with a stout body shape. The head is covered with irregular, whitish patches called "callosities" that assist

researchers in individual identification. North Atlantic right whales feed on zooplankton, particularly large calanoid copepods such as *Calanus*. Feeding behavior has been observed in all of the northern high-use areas such as Cape Cod Bay, the Bay of Fundy, the Great South Channel, and Roseway Basin in the western North Atlantic but has not been observed on the calving grounds or during migration. Until recently, right whales in the North Atlantic and North Pacific were classified together as a single species referred to as the "northern right whale." Genetic data indicate that these two populations represent separate species: the North Atlantic right whale (*Eubalaena glacialis*) and the North Pacific right whale (*Eubalaena japonica*).

Status – The North Atlantic right whale is the world's most endangered large whale species, and is classified as endangered under the ESA. This species is presently declining in number and is considered to be reproductively dysfunctional. The western stock of the North Atlantic right whale is a strategic stock because the average annual fishery-related mortality and serious injury exceeds potential biological removal (PBR).

A review of the photo-identification recapture database in October 2005 indicated that 306 individually recognized whales were known to be alive during 2001 (Waring et al., 2007). Therefore, the latest minimum population estimate for the western North Atlantic stock of right whales is estimated at 306 individuals.

Distribution – North Atlantic right whales occur in subpolar to temperate waters, primarily in continental shelf waters between Florida and Nova Scotia. Right whales might be seen anywhere off the Atlantic U.S. throughout the year and typically follow a well-defined seasonal migratory pattern. This species is most often found in very shallow, nearshore waters and in cooler sea surface temperatures inshore of a mid-shelf front winter calving grounds. High whale densities can extend more northerly than the current defined boundary of the calving critical habitat in response to interannual variability in regional sea surface temperatures distribution.

Eighty-four percent of right whales found in the mid-Atlantic are sighted between December and April, with peaks in December, March, and April. Further, Knowlton et al. (2002) reviewed mid-Atlantic right whale sightings and survey efforts and reported that 94.1 percent of the right whale sightings were within 55 km (30 NM) of the coast, 63.8 percent were within 18.5 km (10 NM) of the coast, and 80 percent of all tagged animal sightings occurred within 55 km (30 NM) of land. Knowlton et al. (2002) also noted the majority of sightings greater than 55 km (30 NM) from the coast occur off New York and southern New England (i.e., at the northern extent of the range of the study). While there may be concern that the Knowlton study has a data bias in that a larger effort was put forth in the nearshore region, such concern does not seem to be warranted, as an extensive offshore study effort was conducted, and both the satellite tag data and the effort data show these animals seem to prefer nearshore waters (Knowlton et al., 2002). In addition, Hain and Kenney (2005) concurred with Knowlton that a majority of right whale sightings occur within 55 km (30 NM) of the shore.

Most northern right whale sightings follow a well-defined seasonal migratory pattern through several consistently utilized habitats. It should be noted, however, that some individuals may be sighted in these habitats outside the typical time of year and that migration routes are poorly known (there may be a regular offshore component). The population migrates as two separate components, although some whales may remain in the feeding grounds throughout the winter.

Pregnant females and some juveniles migrate from the feeding grounds to the calving grounds off the southeastern United States in late fall to winter. The cow-calf pairs return northward in late winter to early spring. The majority of the right whale population leaves the feeding grounds for unknown habitats in the winter but returns to the feeding grounds coinciding with the return of the cow-calf pairs. Some individuals as well as cow-calf pairs can be seen through the fall and winter on the feeding grounds with feeding observed.

During the spring through early summer, northern right whales are found on feeding grounds off the northeastern United States and Canada. Individuals may be found in Cape Cod Bay in February through April and in the Great South Channel east of Cape Cod in April through June. Right whales are found throughout the remainder of summer and into fall (June through November) on two feeding grounds in Canadian waters. The peak abundance is in August, September, and early October. The majority of summer/fall sightings of mother/calf pairs occur east of Grand Manan Island (Bay of Fundy), although some pairs might move to other unknown locations. Jeffreys Ledge appears to be important habitat for right whales, with extended whale residences; this area appears to be an important fall feeding area for right whales and an important nursery area during summer. The second feeding area is off the southern tip of Nova Scotia in the Roseway Basin between Browns, Baccaro, and Roseway Banks. The Cape Cod Bay and Great South Channel feeding grounds are formally designated as critical habitats under the ESA.

During the winter (as early as November and through March), northern right whales may be found in coastal waters off North Carolina, Georgia, and northern Florida. The waters off Georgia and northern Florida are the only known calving ground for western northern right whales; it is formally designated as a critical habitat under the ESA. Calving occurs from December through March. On January 1, 2005, the first observed birth on the calving grounds was reported. The majority of the population is not accounted for on the calving grounds, and not all reproductively active females return to this area each year.

Radio-tagged animals have made extensive movements, sometimes traveling from the Gulf of Maine into deeper waters off the continental shelf. Mate et al. (1997) tagged one male that traveled into waters with a bottom depth of 4,200 m (13,780 ft). Long-distance movements as far north as Newfoundland, the Labrador Basin, southeast of Greenland, Iceland, and Arctic Norway have been documented. One individually identified right whale was documented to make a two-way trans-Atlantic migration from the East Coast to a location in northern Norway. A female northern right whale was tagged with a satellite transmitter and tracked to nearly the middle of the Atlantic where she remained for a period of months.

The coastal waters of the Carolinas are suggested to be a migratory corridor for the right whale. The Southeast U.S. Coast Ground, consisting of coastal waters between North Carolina and northern Florida, was mainly a winter and early spring (January-March) right whaling ground during the late 1800s. The whaling ground was centered along the coasts of South Carolina and Georgia. An examination of sighting records from all sources between 1950 and 1992 found that wintering right whales were observed widely along the coast from Cape Hatteras, North Carolina, to Miami, Florida. Sightings off the Carolinas were comprised of single individuals that appeared to be transients. These observations are consistent with the hypothesis that the coastal waters of the Carolinas are part of a migratory corridor for the right whale. Knowlton et

al. (2002) analyzed sightings data collected in the mid-Atlantic from northern Georgia to southern New England and found that the majority of right whale sightings occurred within approximately 56 km (30 NM) from shore. Until better information is available on the right whale's migratory corridor, it has been recommended that management considerations are needed for the coastal areas along the mid-Atlantic migratory corridor within 65 km (35 NM) from shore.

The following three areas occur in U.S. waters and were designated by NMFS as critical habitat in June 1994 (NMFS, 1994):

- Coastal Florida and Georgia (Sebastian Inlet, Florida, to the Altamaha River, Georgia),
- The Great South Channel, east of Cape Cod, and
- Cape Cod and Massachusetts Bays.

The northern critical habitat areas serve as feeding and nursery grounds, while the southern area from the mid-Georgia coast extending southward along the Florida serves as calving grounds. The waters off Georgia and northern Florida are the only known calving ground for western North Atlantic right whales. The physical features correlated with the distribution of right whales in the southern critical habitat area provide an optimum environment for calving. For example, the bathymetry of the inner and nearshore-middle shelf area minimizes the effect of strong winds and offshore waves, limiting the formation of large waves and rough water. The average temperature of critical habitat waters is cooler during the time right whales are present due to a lack of influence by the Gulf Stream and cool freshwater runoff from coastal areas. NMFS theorizes the water temperatures provide an optimal balance between offshore waters that are too warm for nursing mothers to tolerate, yet not too cool for calves that may only have minimal fatty insulation.

During January and February, there is a possible southward shift in whale distribution toward warmer sea surface temperatures in the region monitored by the early warning system (i.e., Right Whale Sighting Advisory System). However, in the relatively warmer and southernmost survey zone (nearshore waters of Florida), right whales concentrate in the northern, cooler portion. Warm Gulf Stream waters appear to represent a thermal limit (both southward and eastward) for right whales.

Diving Behavior – Dives of 5 to 15 min or longer have been reported, but can be much shorter when feeding. Foraging dives in the known feeding high-use areas are frequently very near the bottom of the water column. The average depth of a right whale dive is strongly correlated with both the average depth of peak copepod abundance and the average depth of the bottom mixed layer's upper surface. Right whale feeding dives are characterized by a rapid descent from the surface to a particular depth between 80 and 175 m (262 to 574 ft), remarkable fidelity to that depth for 5 to 14 min and then rapid ascent back to the surface. Longer surface intervals have been observed for reproductively active females and their calves. The longest tracking of a right whale is of an adult female, which migrated 1,928 km (1,198 miles) in 23 days (mean=3.5 km/hr, or 2.2 miles/hr) from 40 km (25 miles) west of Browns Bank (Bay of Fundy) to Georgia.

Acoustics and Hearing – North Atlantic right whales produce a variety of sounds, including moans, screams, gunshots, blows, upcalls, downcalls, and warbles, that are often linked to specific behaviors. North Atlantic right whale sound production rates (duration of calls and interval between calls) are also highly variable. Most of these sounds range in frequency from 0.02 to 15 kHz (dominant frequency range from 0.02 to <2 kHz; durations typically range from 0.01 to multiple seconds) with some sounds having multiple harmonics. Source levels for some of these sounds have been measured as ranging from 137 to 192 dB re 1 μPa-m rms. In certain regions (i.e., northeast Atlantic), preliminary results indicate that right whales vocalize more from dusk to dawn than during the daytime.

Vocalization rates of North Atlantic right whales are also highly variable, and individuals have been known to remain silent for hours. Right whales commonly produce calls in a series of 10 to 15 calls lasting 5 to 10 minutes, followed by silence lasting an hour or more; some individuals do not call for periods of at least four hours. Frequencies of these vocalizations are between 50 and 500 Hz; typical sounds are in the 300 to 600 Hz range with up- and down-sweeping modulations, with lower (<200 Hz) and higher (>900 Hz) frequency sounds being relatively rare. Source levels have been estimated only for pulsive calls of North Atlantic right whales, which are 172 to 187 decibels with a reference pressure of one micropascal at one meter (dB re 1 μPa-m).

Morphometric analyses of North Atlantic right whale inner ears estimates a hearing range of approximately 0.01 to 22 kHz, based on established marine mammal models. Exposure to short tones and down sweeps, ranging in frequency from 0.5 to 4.5 kHz, induced an alteration in behavior (received levels of 133 to 148 dB re 1 μPa-m), but exposure to sounds produced by vessels (dominant frequency range of 0.05 to 0.5 kHz) did not produce any behavioral response (received levels of 132 to 142 dB re 1 μPa-m).

Occurrence in NSWC PCD Study Area – There is a low or unknown occurrence of right whales in the GOM. However, there are five confirmed records for the GOM; all of them occurred in winter and spring, including one stranding on the Texas coast in 1972. Three of the sightings were of cow-calf pairs. One pair seen in late January 2004 off Miami, Florida and in mid-March to early April off the Florida Panhandle was later resighted in June in waters off Cape Cod. More recently, a cow-calf pair was photographed in Corpus Christi Bay off southern Texas and sighted a few weeks later off Long Boat Key, Florida. These records are probably of extralimital strays from the wintering grounds off the southeastern U.S. The highly endangered status of the North Atlantic right whale, however, necessitates an extremely conservative determination of this species' occurrence in this area. There is a low or unknown occurrence of right whales east of the vicinity of the Mississippi River Delta from the 10-m (33-ft) isobath into deeper waters. The predicted occurrence reflects the known distribution of sightings off the U.S. Atlantic coast. Sightings have been recorded throughout the year off the southeastern U.S., so it is possible that any of those individuals could accidentally make their way into the GOM during any part of the year. In stock assessment reports, National Oceanic and Atmospheric Administration (NOAA) Fisheries does not include right whales among those species having populations or stocks in the northern GOM.

Humpback whale (*Megaptera novaeangliae*)

Description – Humpback whale adults are 11 to 16 m (36 to 53 ft) in length and are more robust or less streamlined than other rorquals (any large streamlined baleen whale with a small pointed dorsal fin and grooves running longitudinally on the throat). Humpbacks use a wide variety of behaviors to feed on various small, schooling prey including krill and fish. The principal fish prey species in the western North Atlantic are sand lance (*Ammodytes americanus*), herring (family *Clupidae*), and capelin (*Millotus villoses*).

Status – Humpback whales are classified as endangered under the ESA, and therefore, considered to be a strategic stock under the MMPA. An estimated 11,570 humpback whales occur in the entire North Atlantic, which includes an estimated 902 humpback whales (minimum of 647 animals) that comprise the Gulf of Maine stock (Waring et al., 2007). A considerable amount of information has been gathered on humpback biology, especially on their feeding and calving grounds, since 1970 (Lowry et al., 2007).

Distribution – Humpback whales are found in all of the world's oceans, generally on their high-latitude feeding grounds, which are located from south of New England to northern Norway, from spring through fall and in the tropics where calving occurs during the winter, with migration occurring between the two areas. In the North Atlantic Ocean, humpbacks are found from the Caribbean Sea and Cape Verde Islands to Greenland, Iceland, and northern Norway. Most humpback whale sightings are in nearshore and continental shelf waters; however, humpback whales frequently travel through deep water during migration. During the winter, most of the North Atlantic population of humpback whales is believed to migrate south to calving grounds in the West Indies region. Routes taken during southbound and northbound migrations are not known. Recently there has been an increasing occurrence of humpbacks, which appear to be primarily juveniles, during the winter along the U.S. Atlantic coast from Florida north to Virginia.

In the North Atlantic Ocean, humpbacks are found from spring through fall on feeding grounds that are located from south of New England to northern Norway. The Gulf of Maine is one of the principal summer feeding grounds for humpback whales in the North Atlantic. The largest numbers of humpback whales are present from mid-April to mid-November. Feeding locations off the northeastern United States include Stellwagen Bank, Jeffreys Ledge, the Great South Channel, the edges and shoals of Georges Bank, Cashes Ledge, Grand Manan Banks, the banks on the Scotian Shelf, the Gulf of St. Lawrence, and the Newfoundland Grand Banks. Distribution in this region has been largely correlated to prey species and abundance, although behavior and bottom topography are factors in foraging strategy. Humpbacks typically return to the same feeding areas each year.

The distribution and abundance of sand lance are important factors underlying the distribution patterns of the humpback whale. Changes in diets and feeding preferences are likely caused by changes in prey distribution and/or in the relative abundance of different prey species (sand lance and herring). Feeding most often occurs in relatively shallow waters over the inner continental shelf and sometimes in deeper waters. Large multi-species feeding aggregations (including humpback whales) have been observed over the shelf break on the southern edge of Georges Bank and in shelf break waters off the U.S. mid-Atlantic coast.

During the winter, most of the North Atlantic population of humpback whales is believed to migrate south to calving grounds in the West Indies region. Due to the temporal difference in occupancy of the West Indies between individuals from different feeding areas, coupled with sexual differences in migratory patterns, Stevick et al. (2003) suggested the possibility that there are reduced mating opportunities between individuals from different high-latitude feeding areas. The calving peak is January through March, with some animals arriving as early as December and a few not leaving until June. The mean sighting date in the West Indies for individuals from the United States and Canada is February 16 and 15, respectively.

Apparently, not all Atlantic humpback whales migrate to the calving grounds, since some sightings (believed to be only a very small proportion of the population) are made during the winter in northern habitats. The sex/age class of nonmigratory animals remains unclear. A small number of individuals remain in the Gulf of Maine during winter; however, it is not known whether these few sightings represent winter residents or either late-departing or early-arriving migrants.

Diving Behavior – Humpback whale diving behavior depends on the time of year. In summer, most dives last less than 5 minutes (min); those exceeding 10 min are atypical. In winter (December through March), dives average 10 to 15 min; dives of greater than 30 min have been recorded. Although humpback whales have been recorded to dive as deep as about 500 m, on the feeding grounds they spend the majority of their time in the upper 120 m of the water column. Recent research revealed that humpbacks are usually only a few meters below the water's surface while foraging. Humpback whales on the wintering grounds can dive deeply; dives have been recorded deeper than 100 m (328 ft).

Acoustics and Hearing – Humpback whales are known to produce three classes of vocalizations: (1) "songs" in the late fall, winter, and spring by solitary males; (2) sounds made within groups on the wintering (calving) grounds; and (3) social sounds made on the feeding grounds.

The best-known types of sounds produced by humpback whales are songs, which are thought to be breeding displays used only by adult males. Singing is most common on breeding grounds during the winter and spring months, but is occasionally heard outside breeding areas and out of season. Humpback song is an incredibly elaborate series of patterned vocalizations which are hierarchical in nature. There is geographical variation in humpback whale song, with different populations singing different songs, and all members of a population using the same basic song. However, the song evolves over the course of a breeding season, but remains nearly unchanged from the end of one season to the start of the next.

Social calls are from 50 Hz to over 10 kHz, with the highest energy below 3 kHz. Female vocalizations appear to be simple, while the male song is complex and changes between seasons. Components of the song range from under 20 Hz to 4 kHz and occasionally 8 kHz, with source levels of 144 to 174 dB re 1 µPa m, with a mean of 155 dB re 1 µPa-m. High-frequency harmonics of humpback songs have been recorded out to 13.5 kHz, and source levels between 171 and 189 dB re 1 µPa-m. Songs have also been recorded on feeding grounds. The main energy lies between 0.2 and 3.0 kHz, with frequency peaks at 4.7 kHz.

Feeding calls, unlike song and social sounds, are highly stereotyped series of narrow-band trumpeting calls. They are 20 Hz to 2 kHz, less than 1 sec in duration, and have source levels of 162 to 192 dB re 1 µPa-m. The fundamental frequency of feeding calls is approximately 500 Hz.

No tests on humpback whale hearing have been made. A humpback whale audiogram has been constructed using a mathematical model based on the internal structure of the ear. The predicted audiogram indicates sensitivity to frequencies from 700 Hz to 10 kHz, with maximum relative sensitivity between 2 and 6 kHz. Recent information on the songs of humpback whales suggests that their hearing may extend to frequencies of at least 24 kHz and source levels of 151-173 dB re 1µPa (Au et al. 2006).

Occurrence in the NSWC PCD Study Area – Humpback whales found in the GOM are likely strays, having made their way into the GOM during the breeding season or on their return migration northward. In the whaling days, humpback whales were occasionally hunted near the Florida Keys. Based on sightings, strandings, and life history parameters, there is a low or unknown occurrence of humpback whales in the NSWC PCD Study Area east of the Mississippi River Delta during fall, winter, and spring from the shore, over the continental shelf, and into waters with a bottom depth greater than 3,000 m (9,842.5 ft). This takes into consideration that humpback whales migrate to calving grounds in the Caribbean during the fall and making return migrations to the feeding grounds much further north during the spring. During the summer, humpback whales should occur further north on their feeding grounds and are, therefore, not expected anywhere in the NSWC PCD Study Area. Humpback whales have been sighted quite close to shore off the western coast of Florida, as well as in waters seaward of the continental shelf break. In February 2004, an individual was sighted off the west coast of Florida. This individual was identified as "Fingerpaint," a humpback whale known to inhabit the Gulf of Maine. Fingerpaint was resighted in September later that year in the Gulf of Maine. These sighting patterns match nearshore and offshore sightings of humpback whales off the U.S. Atlantic coast and in the Caribbean.

Sei Whale (*Balaenoptera borealis*)

Description – Adult sei whales can grow to 18 m (59 ft) in length; they are extremely similar in appearance to Bryde's whales and difficult to differentiate at sea or even when stranded on the beach. The taxonomy of the baleen whale group formerly known as sei and Bryde's whales is currently confused and highly controversial. Sei whales feed by "gulping" and "skimming." In the North Atlantic, the major prey species are *Calanus finmarchicus* (copepod), *Meganyctiphanes norvegica* (krill), and *Thysanoessa inermis* (krill).

Status – The sei whale is listed as endangered under the ESA and as a depleted and strategic stock under the MMPA. The International Whaling Commission (IWC) recognizes three sei whale stocks in the North Atlantic: Nova Scotia, Iceland-Denmark Strait, and the Northeast Atlantic. The Nova Scotia Stock occurs in U.S. Atlantic waters. A minimum population size for sei whales in the U.S. Atlantic EEZ is unknown, and there are no recent abundance estimates for the sei whale Nova Scotia Stock (Waring et al., 2006). There has been no directed research program on sei whales in the U.S. since 1970, and information is limited to survey sighting reports, stranding records, and a handful of isolated studies (Lowry et al., 2007).

Distribution – Sei whales have a worldwide distribution, but are found primarily in cold temperate to subpolar latitudes, rather than in the tropics or near the poles. They are found in all oceans but are more restricted to midlatitude temperate waters than other rorquals. In the northwestern Atlantic Ocean, sei whales occur primarily in deep water from Georges Bank north to Davis Strait. The distribution of the Nova Scotia stock might extend along the U.S. coast to at least North Carolina. Sei whales are not common in U.S. Atlantic waters, and are uncommon in most tropical regions. Sei whales are also known for occasional sudden increases in occurrence in areas followed by disappearances for sometimes decades.

Sei whales spend the summer months feeding in the subpolar higher latitudes and return to the lower latitudes to calve in winter. There is some evidence from whaling catch data of differential migration patterns by reproductive class, with females arriving at and departing from feeding areas earlier than males. For the most part, the location of winter breeding areas remains a mystery. Peak abundance in U.S. waters occurs in spring (mid-March through mid-June), primarily around the edges of Georges Bank. Sei whales appear to prefer regions of steep bathymetric relief, such as the continental shelf break or submarine canyons. These areas are often the location of persistent hydrographic features, which may be important factors in concentrating prey.

Like other rorquals, the sei whale undertakes long migrations during spring and fall. The hypothesis is that the Nova Scotia stock moves from spring feeding grounds on or near Georges Bank, to the Scotian Shelf in June and July, eastward to perhaps Newfoundland and the Grand Banks in late summer, then back to the Scotian Shelf in fall, and offshore and south in winter. In the western North Atlantic Ocean, sei whales occur primarily from Georges Bank north to Davis Strait (northeast Canada, between Greenland and Baffin Island). Peak abundance in U.S. waters occurs from winter through spring (mid-March through mid-June), primarily around the edges of Georges Bank. The distribution of the Nova Scotia stock might extend along the U.S. coast at least to North Carolina. As noted by Reeves et al. (1999), reports in the literature from any time before the mid-1970s are suspect because of the frequent failure to distinguish sei from Bryde's whales, particularly in tropical to warm-temperate waters where Bryde's whales are generally more common than sei whales.

Diving Behavior – There are no reported diving depths or durations for sei whales.

Acoustics and Hearing – Sei whale vocalizations have been recorded only on a few occasions. They consist of paired sequences (0.5 to 0.8 sec, separated by 0.4 to 1.0 sec) of 7 to 20 short (4 milliseconds [msec]) frequency modulated sweeps between 1.5 and 3.5 kHz; source level is not known. These mid-frequency calls are distinctly different from low-frequency tonal and frequency swept calls recently recorded in the Antarctic; the average duration of the tonal calls was 0.45±0.3 sec, with an average frequency of 433±192 Hz and a maximum source level of 156±3.6 dB re 1 µPa-m. While no data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Occurrence in NSWC PCD Study Area – There are only five reliable sei whale records for the GOM, three of which are from strandings in eastern Louisiana and one from the Florida Panhandle. Sei whales are uncommon in most tropical regions, and based on the scarcity of

records for this species in the GOM, this species is not expected to occur in the GOM. Any sightings would be considered extralimital for this species.

Fin Whale (*Balaenoptera physalus*)

Description – The fin whale is the second-largest whale species, with adults reaching 24 m (79 ft) in length. Fin whales feed on a wide variety of small, schooling prey (especially herring, capelin, and sand lance), including squid and crustaceans (krill and copepods). Fin whales are the dominant large cetacean species in all seasons in the northwestern North Atlantic Ocean with the largest standing stock. Fin and sei whales are very similar in appearance, resulting in some confusion about the distribution of both species.

Status – There have been very few studies of fin whales in U.S. waters since 1970, and information on abundance, population dynamics, and trends is very limited (Lowry et al., 2007). The fin whale is listed as endangered under the ESA and, therefore, is considered to be a strategic stock under the MMPA. The best estimate of abundance for western North Atlantic fin whales is 2,814, but this number is underestimated because the data are not corrected for animals missed while diving (Waring et al., 2007). It is more likely that 5,000 to 6,000 fin whales occur off the eastern U.S.

Distribution – Fin whales are broadly distributed throughout the world's oceans, usually in temperate to polar latitudes and less commonly in the tropics. In general, fin whales are more common north of about 30ºN than they are in tropical zones. The overall range of fin whales in the North Atlantic extends from the GOM/Caribbean and Mediterranean north to Greenland, Iceland, and Norway. Fin whales are the dominant large cetacean species in all seasons in the North Atlantic and have the largest standing stock and food requirements. The fin whale is also the most common whale species acoustically detected with Navy deepwater hydrophone arrays in the North Atlantic.

Fin whales are believed to follow the typical baleen whale migratory pattern, with a population shift north into summer feeding grounds and south for the winter. However, the location and extent of the wintering grounds are poorly known. Peak acoustic detections of fin whales occurred in winter throughout the deep water of the North Atlantic, supporting the widely-held hypothesis about their migration. A definite southward movement of the species was detected in the fall with a northward shift in spring; the endpoints of most of the migration routes in the northwestern Atlantic were Newfoundland/Labrador and from south of Bermuda into the West Indies. Migration routes are otherwise unknown. Fin whales are not completely absent from northeast U.S. continental shelf waters in winter, indicating that not all members of the population conduct a full seasonal migration. Additional information on reproductive areas and seasons for this species is not available.

Diving Behavior – Fin whales typically dive for 5 to 15 min, separated by sequences of 4 to 5 blows at 10 to 20 sec intervals. Significant differences can be seen in blow intervals, dive times, and blows per hour between surface feeding and non-surface-feeding fin whales. Fin whales may dive to 97.8 m (321 ft) with a duration of 6.3 min when foraging (feeding) and to 59.2 m (194 ft) with a duration of 4.2 min when not foraging. Fin whale dives have been documented to exceed 150 m (492 ft), coinciding with the diel migration of krill.

Acoustics and Hearing – Fin and blue whales produce calls with the lowest frequency and highest source levels of all cetaceans. Infrasonic, pattern sounds have been documented for fin whales. Fin whales produce a variety of sounds with a frequency range up to 750 Hz. The long, patterned 15 to 30 Hz vocal sequence is most typically recorded; only males are known to produce these. The most typical fin whale sound is a 20 Hz infrasonic pulse (actually an FM sweep from about 23 to 18 Hz) with durations of about 1 sec and can reach source levels of 184 to 186 dB re 1 µPa-m (maximum up to 200). It was recently suggested that these long, patterned vocalizations might function as male breeding displays, much like those that male humpback whales sing. The source depth, or depth of calling fin whales, has been reported to be about 49 m (161 ft). While no data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Occurrence in NSWC PCD Study Area – Throughout the year, there is a low or unknown occurrence of fin whales east of the Mississippi River Delta from the continental shelf break to the 2,000 m (6,562 ft) isobath. This is based on the distribution of year-round records of either strandings or sightings. During the summer, fin whales should be found on their feeding grounds further north off the northeastern United States; however, there are sighting records in the NSWC PCD Study Area during this time of year. The GOM might represent a part of the range of a low-latitude fin whale population in the northwestern Atlantic or that a small relict population is resident in this area. However, it is more likely that these records might be extralimital and that these fin whale individuals are simply accidental occurrences.

Blue Whale (*Balaenoptera musculus*)

Description – Blue whales are the largest living animals; adults in the Northern Hemisphere reach 22.9 to 28 m (75.1 to 91.9 ft) in length. Blue whales feed primarily on euphausiids (krill).

Status – Blue whales are classified as endangered under the ESA and, therefore, are considered to be a strategic stock. At least two discrete populations are found in the North Atlantic. One ranges from West Greenland to New England and is centered in eastern Canadian waters; the other is centered in Icelandic waters and extends south to northwest Africa. There are no current estimates of abundance for the North Atlantic blue whale population. The 308 recognizable individuals from the Gulf of St. Lawrence area are considered to be a minimum population estimate for the western North Atlantic stock (Waring et al., 2007).

Distribution – Globally, blue whales are primarily found in deep, offshore waters and are rare in shallow, shelf waters. Blue whales are distributed from the ice edge to the subtropics in both hemispheres. Stranding and sighting data suggest that the blue whale's original range in the Atlantic extended south to Florida, the GOM, the Cape Verde Islands, and the Caribbean Sea. Researchers using the Navy's integrated undersea surveillance system have been able to detect blue whales throughout the open North Atlantic Ocean south to at least the Bahamas, suggesting that North Atlantic blue whales may comprise a single stock. Blue whales are often sighted in the waters off eastern Canada, with the majority of recent records from the Gulf of St. Lawrence. The blue whale rarely occurs in the U.S. Atlantic Exclusive Economic Zone (EEZ), which may represent the limits of its feeding range. Sightings in the Gulf of Maine and U.S. EEZ have been made in late summer and early fall (August and October). The winter range of most rorquals

(blue, fin, sei, and minke whales) is hypothesized to be in offshore waters. Acoustic data support the hypothesis of an offshore wintering habitat. Information on reproductive areas and seasons for this species is not available.

Diving Behavior – Blue whales spend greater than 94% of their time below the water's surface. Blue whales can dive to an average of 140 m (459 ft) and for 7.8 min when foraging and to 67.6 m (222 ft) and for 4.9 min when not foraging. However, dives deeper than 300 m (984 ft) have been recorded from tagged individuals.

Acoustics and Hearing – Blue and fin whales produce calls with the lowest frequency and highest source levels of all cetaceans. Sounds are divided into two categories: short-duration or long-duration. Blue whale vocalizations are typically long, patterned, low-frequency sounds with durations up to 36 seconds repeated every 1 to 2 min. Their frequency range is 12 to 400 Hz, with dominant energy in the infrasonic range of 12 to 25 Hz. These long, patterned, infrasonic call series are sometimes referred to as "songs." The short-duration sounds are transient, frequency-modulated calls that have a higher frequency range and shorter duration than song notes and often sweep down in frequency. Short-duration sounds appear to be common; however, they are underrepresented in the literature. These short-duration sounds are <5 sec in duration and are high-intensity, broadband (858±148 Hz) pulses. Source levels of blue whale vocalizations are up to 188 dB re 1 μPa-m. During the Magellan II Sea Test (at-sea exercises designed to test systems for antisubmarine warfare) off the coast of California in 1994, blue whale vocalization source levels at 17 Hz were estimated in the range of 195 dB re 1 μPa-m. Blue whale sounds in the North Atlantic have been confirmed to have different characteristics (i.e., frequency, duration, and repetition) than those recorded in other parts of the world. Blue whales appear to have the highest calling rates when prey was closest to the surface during its vertical migration. While no data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Occurrence in NSWC PCD Study Area – There are only two reliable records for blue whales in the GOM; both are strandings. This is one of the rarest cetacean species in the GOM. The blue whale is not expected to occur in the NSWC PCD Study Area.

Bryde's Whale (*Balaenoptera edeni*)

Description – The Bryde's whale is a medium-sized baleen whale. Adults can be up to 15.5 m (51 ft) in length, but there is a smaller "dwarf" species that rarely reaches over 10 m (33 ft) in length. Bryde's whales can be easily confused with sei whales; however, closer examination reveals them to have a number of distinctive characteristics. It is not clear how many species of Bryde's whales there are, but genetic analyses suggest the existence of at least two species. The taxonomy of the baleen whale group formerly known as sei and Bryde's whales is currently confused and highly controversial.

Status – The best estimate of abundance for Bryde's whales within the Northern GOM Stock is 40, with a minimum population size estimate of 25 whales (Waring et al., 2006). It has been suggested that the Bryde's whales found in the GOM may represent a resident stock, but there is no information on stock differentiation (Waring et al., 2006). The NOAA Stock Assessment

Report provisionally considers the GOM population a separate stock from the Atlantic Ocean stock(s).

Distribution – The Bryde's whale is found in tropical and subtropical waters, generally not moving poleward of 40° in either hemisphere. In the Atlantic, Bryde's whales are distributed in the Gulf of Mexico and Caribbean Sea south to Cabo Frio, Brazil. Long migrations are not typical of Bryde's whales although limited shifts in distribution toward and away from the equator in winter and summer, respectively, have been observed. Most sightings in the GOM have been made in the DeSoto Canyon region and off western Florida. Additional information on reproductive areas and seasons for this species is not available.

Diving Behavior – Bryde's whales are lunge-feeders, feeding feeding primarily on fish, but they also take small crustaceans. Bryde's whales might dive as long as 20 min.

Acoustics and Hearing – Bryde's whales produce low frequency tonal and swept calls similar to those of other rorquals. Calls vary regionally, yet all but one of the call types have a fundamental frequency below 60 Hz. They last from 0.25 sec to several seconds; and they are produced in extended sequences. While no data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Occurrence in NSWC PCD Study Area – Bryde's whales found in the GOM may represent a resident stock. Bryde's whales are not frequently sighted in the GOM, although they are observed more frequently than any other species of baleen whale in this region. Nothing is known of their movement patterns in this area, and strandings are scattered throughout the coast of the Gulf. Therefore, there is a low or unknown occurrence of Bryde's whale from the shelf break to the 2,000-m (6,562-ft) isobath throughout most of the NSWC PCD Study Area.

Bryde's whales are expected to occur year-round in an area encompassing the DeSoto Canyon and an area off western Florida, from the shelf break to the 2,000-m (6,562-ft) isobath, based on the fact that most sightings were made in this region during dedicated cetacean surveys. Also considered was the likelihood that Bryde's whale movements are taking place in oceanic waters in this area.

Minke Whale (*Balaenoptera acutorostrata*)

Description – The minke whale is the smallest balaenopterid species in the western North Atlantic, with adults reaching lengths of just over 9 m (29.5 ft). The western North Atlantic is important feeding habitat for this species, where minke whales feed primarily on schooling fish such as sand lance, capelin, herring, and mackerel.

Status – In the North Atlantic, there are four recognized populations: Canadian East Coast, West Greenland, Central North Atlantic, and Northeastern North Atlantic. Minke whales off the eastern United States are considered to be part of the Canadian East Coast stock, which inhabits the area from the eastern half of the Davis Strait out to 45ºW and south to the Gulf of Maine. The best available abundance estimate for minke whales is 2,998 animals. Minimum population size for the Canadian East Coast stock of minke whales is unknown, but has been estimated at 2,559 individuals (Waring et al., 2007).

Distribution – Minke whales are distributed in polar, temperate, and tropical waters. They are less common in the tropics than in cooler waters. This species is most abundant in New England waters rather than the mid-Atlantic. Off eastern North America, the minke whale generally occupies waters over the continental shelf, including inshore bays and estuaries. Minke whales may occur in greater concentrations in the western, northern, and eastern perimeter of the Gulf of Maine, the Bay of Fundy, and along the southern Nova Scotian coast. However, based on whaling catches and surveys worldwide, there is a deep-ocean component to the minke whale's distribution. The southernmost sighting was of one individual offshore of the mouth of the Chesapeake Bay, in waters with a bottom depth of 3,475 m (11,401 ft).

There appears to be a strong seasonal component to minke whale distribution. Spring and summer are periods of relatively widespread and common minke whale occurrence off the northeastern U.S. In the summer months, minke whales occur primarily over the continental shelf and slope in waters from the Bay of Fundy and the Scotian Shelf the to the southern map extent. During fall in New England waters, there are fewer minke whales but during early winter (January and February), the species appears to be largely absent from this area. However, there are occasional observations in the western Gulf of Maine and in waters southeast of Cape Cod. Minke whales off the U.S. Atlantic Coast apparently migrate offshore and southward in winter. Minke whales are known to occur during the winter months (December through March) in the western North Atlantic from Bermuda to the West Indies. There are only stranding records available to indicate minke whale occurrence in the GOM. Additional information on reproductive areas and seasons for this species is not available.

Diving Behavior – A general surfacing pattern of minke whales has been described, consisting of about four surfacings interspersed by short-duration dives averaging 38 sec. After the fourth surfacing, there was a longer duration dive ranging from approximately 2 to 6 min.

Acoustics and Hearing – Recordings of minke whale sounds indicate the production of both high and low-frequency sounds (range: 0.06 to 20 kHz). Minke whale sounds have a dominant frequency range of 0.06 to greater than 12 kHz, depending on sound type. Two basic forms of pulse trains have been identified: a "speed-up" pulse train (dominant frequency range: 0.2 to 0.4 kHz) with individual pulses lasting 40 to 60 msec, and a less common "slow-down" pulse train (dominant frequency range: 50 to 0.35 kHz) lasting for 70 to 140 ms. Source levels for this species have been estimated to range from 151 to 175 dB re 1 μPa-m. Source levels for some minke whale sounds have been calculated to range from 150 to 165 dB re 1 μPa-m. In the Southern Hemisphere, a complex and stereotyped sound sequence was recorded ("star-wars vocalization") that spanned a frequency range of 50 Hz to 9.4 kHz. Broadband source levels between 150 and 165 dB re 1 μPa-m were calculated. "Boings," recently confirmed to be produced by minke whales and suggested to be a breeding call, consist of a brief pulse at 1.3 kHz, followed by an amplitude-modulated call with greatest energy at 1.4 kHz, with slight frequency modulation over a duration of 2.5 sec. While no empirical data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Occurrence in NSWC PCD Study Area – There are only stranding records available to indicate minke whale occurrence in the GOM. During fall, winter, and spring, there is a low or unknown

occurrence of minke whales east of the Mississippi River Delta from the 30-m (98-ft) isobath and moving into deeper waters. Taken into consideration were the known distribution and seasonality of sighting records along the Atlantic U.S. and in the Caribbean and the seasonality and distribution of stranding records in the GOM. Minke whales have also been detected by passive acoustic means in the southern portion of the western North Atlantic during the fall, winter, and spring. Minke whales are not expected anywhere in the eastern GOM in summer. These whales should occur further north on feeding grounds.

Sperm Whale (*Physeter macrocephalus*)

Description – The sperm whale is the largest toothed whale species. Adult females can reach 12 m (39 ft) in length, while adult males measure as much as 18 m (59 ft) in length. Sperm whales prey on large mesopelagic squid and other cephalopods as well as demersal fish and occasionally benthic invertebrates.

Status – Sperm whales are classified as endangered under the ESA, although they are globally not in any immediate danger of extinction. They are considered a strategic stock. The sperm whale population in the northern GOM as a stock is considered to be distinct from the U.S. Atlantic stock. Genetic analyses, coda vocalizations, and population structure support this. In the GOM, the best abundance estimate for sperm whales is 1,349, with a minimum population estimate of 1,114. There has been no directed research program on sperm whales in the U.S. since 1970, and information is limited to survey sighting reports, stranding records, and a handful of isolated studies (Lowry et al., 2007). Abundance information, population dynamics, and trends are extremely limited for sperm whale populations in U.S. waters (Lowry et al., 2007).

Distribution – Sperm whales are found from tropical to polar waters in all oceans of the world between approximately 70°N and 70°S. Females use a subset of the waters where males are regularly found. Females are normally restricted to areas with SST greater than approximately 15°C (59°F), whereas males, and especially the largest males, can be found in waters as far poleward as the pack ice with temperatures close to 0°. The thermal limits on female distribution correspond approximately to the 40° parallels (50° in the North Pacific; Whitehead, 2003). Photo-identification data analyzed by Jaquet et al. (2003) revealed that seven female sperm whales moved into the Gulf of California from the Galápagos Islands, traveling up to 3,803 km (2,052 NM); these are among the longest documented movements for female sperm whales.

Sperm whales are the most-frequently sighted whale seaward of the continental shelf off the eastern United States. In Atlantic EEZ waters, sperm whales appear to have a distinctly seasonal distribution. In winter, sperm whales are primarily concentrated east and northeast of Cape Hatteras. However, in spring, the center of concentration shifts northward to off Delaware and Virginia and is generally widespread throughout the central MAB and southern Georges Bank. Summer distribution is similar to spring but also includes the area northeast of Georges Bank and into the Northeast Channel region as well as shelf waters south of New England. Fall sperm whale occurrence is generally south of New England over the continental shelf, with a remaining contingent over the continental shelf break in the MAB. Despite these seasonal shifts in concentration, no movement patterns affect the entire stock. Although concentrations shift

depending on the season, sperm whales are generally distributed in Atlantic EEZ waters year-round.

Sperm whales show a strong preference for deep water (from the continental shelf break seaward). Sperm whale concentrations have been correlated with high productivity and steep bottom topography. Off the eastern United States, sperm whales are found in regions of pronounced horizontal temperature gradients, such as along the edges of the Gulf Stream and warm-core rings. In the GOM, the region of the Mississippi River Delta has been recognized for high densities of sperm whales and appears to represent an important calving and nursery area for these animals. Body sizes for most of the sperm whales seen off the mouth of the Mississippi River range from 7 to 10 m (23 to 33 ft), which is the typical size for females and younger animals. On the basis of photo-identification of sperm whale flukes and acoustic analyses, it is likely that some sperm whales are resident to the GOM. Tagging data demonstrated that some individuals spend several months at a time in the Mississippi River Delta and the Mississippi Canyon for several months, while other individuals move to other locations the rest of the year. Most tagged sperm whales in the GOM show a strong preference for the waters of the continental slope and canyon regions, while several individuals go offshore into waters with a bottom depth greater than 3,000 m (9,843 ft). Spatial segregation between the sexes was noted one year by Jochens et al. (2006); females and immatures showed high site fidelity to the region south of the Mississippi River Delta and Mississippi Canyon and in the western Gulf, while males were mainly found in the DeSoto Canyon and along the Florida slope.

Diving Behavior – Sperm whales forage during deep dives that routinely exceed a depth of 400 m (1,312 ft) and 30 min duration. Sperm whales are capable of diving to depths of over 2,000 m (656 ft) with durations of over 60 min. Male sperm whales spend up to 83 percent of daylight hours underwater. In contrast, females spend prolonged periods of time at the surface (1 to 5 hours daily) without foraging. An average dive cycle consists of about a 45 min dive with a 9 min surface interval. The average swimming speed is estimated to be 0.7 m/sec (1.6 miles per hour [mi/hr]). Dive descents are about 9 to 11 min at a rate of 1.2 to 1.52 m/sec (2.7 to 3.40 mi/hr), and ascents average 11.8 min at a rate of 1.4 m/sec (3.1 mi/hr).

Acoustics and Hearing – Sperm whales typically produce short-duration (<30 ms), repetitive broadband clicks used for communication and echolocation. These clicks range in frequency from 0.1 to 30 kHz, with dominant frequencies between the 2 to 4 kHz and 10 to 16 kHz ranges. When sperm whales are socializing, they tend to repeat series of group-distinctive clicks (codas), which follow a precise rhythm and may last for hours. Codas are shared between individuals of a social unit and are considered to be primarily for intra-group communication. Recent research in the South Pacific suggests that in breeding areas the majority of codas are produced by mature females. Coda repertoires have also been found to vary geographically and are categorized as dialects, similar to those of killer whales. For example, significant differences in coda repertoire have been observed between sperm whales in the Caribbean and those in the Pacific. Furthermore, the clicks of neonatal sperm whales are very different from those of adults. Neonatal clicks are of low-directionality, long-duration (2 to 12 ms), and low-frequency (dominant frequencies around 0.5 kHz) with estimated source levels between 140 and 162 dB re 1 µPa-m root mean square (rms) and are hypothesized to function in communication with adults. Source levels from adult sperm whale's highly directional (possible echolocation), short (100 µs) clicks have been estimated up to 236 dB re 1 µPa-m rms. Creaks (rapid sets of clicks)

are heard most frequently when sperm whales are engaged in foraging behavior in the deepest portion of their dives with intervals between clicks and source levels being altered during these behaviors. It has been shown that sperm whales may produce clicks during 81 percent of their dive period; specifically, 64 percent of the time during their descent phases. In addition to producing clicks, sperm whales, in some regions like Sri Lanka and the Mediterranean Sea, have been recorded making what are called trumpets at the beginning of dives just before commencing click production.

The anatomy of the sperm whale's inner and middle ear indicates an ability to best hear high frequency to ultrasonic frequency sounds. They may also possess better low-frequency hearing than other odontocetes, although not as low as many baleen whales. The auditory brainstem response (ABR) technique used on a stranded neonatal sperm whale indicated it could hear sounds from 2.5 to 60 kHz with best sensitivity to frequencies between 5 and 20 kHz.

Occurrence in NSWC PCD Study Area – Sperm whales in the GOM aggregate along the continental slope in or near the perimeter of cyclonic (cold-core) eddies. The area of the Mississippi River Delta might represent an important calving and nursery area for sperm whales. On the basis of photo-identification of sperm whale flukes and acoustic analyses, it is likely that some sperm whales are resident to the GOM.

The sperm whale is expected to occur from the continental shelf break to the 3,000 m (9,843 ft) isobath. There is a concentrated occurrence that encompasses the area off the Mississippi River Delta, and the influences of this river, between the continental shelf break and approximately the 1,000 m (3,281 ft) isobath. This is an area that has been recognized for high densities of sperm whales and represents a habitat where they can be predictably found. Sperm whales in this area appear to have affinity for cyclonic (cold-core) eddies. In fact, the largest numbers of encounters with sperm whales appeared to shift in response to shifts in distribution of eddies.

There is a low or unknown occurrence of sperm whales in waters with a bottom depth greater than 3,000 m (9,843 ft), which reflects the fact that there has been comparatively little survey effort in waters this deep, yet there have been confirmed sightings of sperm whales. Occurrence is assumed to be the same throughout the year. Body sizes for most of the sperm whales seen off the mouth of the Mississippi River range from 7 to 10 m (23 to 32.8 ft), which is a typical size for females and younger animals. The area of the Mississippi River Delta might represent an important calving and nursery area for sperm whales. On the basis of photo-identification of sperm whale flukes and acoustic analyses, it is likely that some sperm whales are resident to the GOM.

Pygmy and Dwarf Sperm Whales (*Kogia breviceps* and *Kogia sima*)

Description – There are two species of *Kogia*: the pygmy sperm whale and the dwarf sperm whale. They are difficult to distinguish from one another, and sightings of either species are often categorized as *Kogia* species (sp). The difficulty in identifying pygmy and dwarf sperm whales is exacerbated by their avoidance reaction toward ships and change in behavior toward approaching survey aircraft. Based on the cryptic behavior of these species and small group sizes (much like that of beaked whales), as well as similarity in appearance, it is difficult to identify these whales to species in sightings at sea. Pygmy and dwarf sperm whales reach body

lengths of around 3 and 2.5 m (9.8 and 8.2 ft), respectively. *Kogia* feed on cephalopods and, less often, on deep-sea fish and shrimp. Zooplankton is likely part of the diet of one or more of the common prey species of *Kogia*.

Status – Total numbers of pygmy sperm whales off the U.S. or Canadian Atlantic coast are unknown, although estimates from selected regions of the habitat do exist for select time periods. Because *Kogia breviceps* and *Kogia sima* are difficult to differentiate, estimated abundances include both species of *Kogia*. The GOM population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). The best abundance estimate for both *Kogia* species in the Western North Atlantic stock is 395, with a minimum population estimate of 285. For pygmy and dwarf sperm whales in the Northern GOM, the best abundance estimate is 742 animals with a minimum population of 584. The western North Atlantic stock of the pygmy sperm whale is a strategic stock because the 1996 to 2000 estimated average annual fishery-related mortality to pygmy sperm whales exceeded PBR.

Distribution – Both *Kogia* species have a worldwide distribution in tropical and temperate waters. In the western Atlantic Ocean, *Kogia* sp. (specifically, the pygmy sperm whale) are documented as far north as the northern Gulf of St. Lawrence, as far south as Colombia (dwarf sperm whale), and as far west as Texas in the GOM. Worldwide, both species of *Kogia* generally occur in waters along the continental shelf break and over the continental slope. Data from the GOM suggest that *Kogia* may associate with frontal regions along the shelf break and upper continental slope, since these are areas with high epipelagic zooplankton biomass. A satellite-tagged, rehabilitated pygmy sperm whale released off the Atlantic coast of Florida remained along the continental slope and the western edge of the Gulf Stream during the time of the tag's operation. Dwarf sperm whales may have a more oceanic distribution than pygmy sperm whales and/or dive deeper during feeding bouts, based on hematological and stable-isotope data. Information on the reproductive areas and seasons for these species are not available.

Diving Behavior – Whales of the genus *Kogia* make dives of up to 25 min. Median dive times of around 11 min are documented for *Kogia.* A satellite-tagged pygmy sperm whale released off Florida was found to make long nighttime dives, presumably indicating foraging on squid in the deep scattering layer.

Acoustics and Hearing – The only sound recordings for the pygmy sperm whale are from a stranded individual that produced echolocation clicks ranging from 60 to 200 kHz, with a dominant frequency of 120 to 130 kHz. Recently, a dwarf sperm whale was recorded producing clicks at 13 to 33 kHz with durations of 0.3 to 0.5 sec. A study completed on a stranded pygmy sperm whale indicated a hearing range of 90 to 150 kHz. No information on sound production or hearing is available for the dwarf sperm whale.

Occurrence in NSWC PCD Study Area – As noted earlier, identification to species for this genus is difficult, particularly at sea. Based on the distribution of the available sighting records and the known preference of both *Kogia* sp. for deep waters, pygmy and dwarf sperm whales are expected to occur between the continental shelf break and the 3,000-m (9,843-ft) isobath. There

is a low or unknown occurrence of pygmy and dwarf sperm whales in the very deep waters seaward of the 3,000-m (9,843-ft) isobath.

There is no evidence that *Kogia* sp. regularly occur in continental shelf waters of the GOM. However, there are some sighting records for these species in waters over the continental shelf. Therefore, there is also a low or unknown occurrence of *Kogia* sp. between the 50-m (164-ft) isobath and the continental shelf break. Occurrence is assumed to be the same for all four seasons.

Beaked Whales (Various Species)

Description – Worldwide, there are 20 recognized beaked whale species in five genera (Mead, 2002). There are six species of beaked whales known to occur in the western North Atlantic Ocean: Cuvier's beaked whale (*Ziphius cavirostris*); four members of the genus *Mesoplodon*—Gervais' beaked whale (*M. europaeus*), Blainville's beaked whale (*M. densirostris*), True's (*M. mirus*), and Sowerby's beaked whale (*M. bidens*); and the northern bottlenose whale (*Hyperoodon ampullatus*). In the GOM, four have documented occurrence, including Cuvier's beaked whale and three members of the genus *Mesoplodon* (Gervais', Blainville's, and Sowerby's beaked whales).

Identification of *Mesoplodon* to species is very difficult, and in many cases, *Mesoplodon* and Cuvier's beaked whale (*Ziphius cavirostris*) cannot be distinguished; therefore, sightings of beaked whales (Family Ziphiidae) are identified as *Mesoplodon* sp., Cuvier's beaked whale, or unidentified Ziphiidae. Of the beaked whale species, the Cuvier's beaked whale is the easiest to identify. With the exception of the Cuvier's beaked whale, the aforementioned beaked whale species are nearly indistinguishable at sea. Little is known about the habitat preferences of beaked whales. All species of beaked whales probably feed at or close to the bottom in deep oceanic waters, taking whatever suitable prey they encounter or feeding on whatever species are locally abundant.

Mesoplodon species have maximum reported adult lengths of 6.2 m (20 ft); Blainville's beaked whales are documented to reach a maximum length of around 4.7 m (15 ft); Gervais' beaked whale males reach lengths of at least 4.5 m (15 ft), while females reach at least 5.2 m (17 ft); and Sowerby's beaked whale males and females attain lengths of at least 5.5 and 5.1 m (18 and 17 ft), respectively. Cuvier's beaked whales are relatively robust compared to other beaked whale species. Male and female Cuvier's beaked whales may reach 7.5 and 7.0 m (24.6 and 23.0 ft) in length, respectively. Northern bottlenose whales are 7 to 9 m (23.0 to 29.5 ft) in length and have rotund bodies, large bulbous heads, and small, well-defined beaks.

Status – The best abundance estimate for Cuvier's beaked whales in the northern GOM is 95 individuals, with a minimum population estimate for the northern GOM of 65 Cuvier's beaked whales. The total number of Cuvier's beaked whales off the eastern U.S. and Canadian Atlantic coast is unknown, but there have been several estimates of an undifferentiated grouping of beaked whales that includes both *Ziphius* and *Mesoplodon* species (see below). It is not possible to determine the minimum population estimate of only Cuvier's beaked whales. The western North Atlantic stock of both the Cuvier's beaked whale and *Mesoplodon* beaked whales, and all beaked whale stocks in the GOM, are strategic stocks because of uncertainty regarding

stock size and evidence of human-induced mortality and serious injury associated with acoustic activities. The best estimate of abundance for undifferentiated beaked whales (*Ziphius* and *Mesoplodon* species) in the Western North Atlantic is 3,513, with a minimum population estimate of 2,154. The best abundance estimate for *Mesoplodon* species in the northern GOM is 106 animals. The minimum population estimate for *Mesoplodon* species in the northern GOM is 76. The total number of northern bottlenose whales off the eastern U.S. coast is unknown.

Distribution – Little is known about beaked whale habitat preferences. World-wide, beaked whales normally inhabit continental slope and deep oceanic waters, normally inhabiting deep ocean waters (below 2,000 m [6,562 ft]) or continental slopes (200 to 2,000 m [656 to 6,562 ft]), and rarely straying over the continental shelf. Predictive modeling based on a habitat characterization study of beaked whales suggests similar distribution patterns for the western North Atlantic region. Distribution of *Mesoplodon* sp. in the North Atlantic may relate to water temperature; the Blainville's beaked whale and Gervais' beaked whale occur in warmer southern waters, in contrast to Sowerby's that are more northern. In the GOM, beaked whales are seen in waters with a bottom depth ranging from 420 to 3,487 m (1,378 to 11,440 ft). In many locales, occurrence patterns have been linked to physical features, in particular, the continental slope, canyons, escarpments, and oceanic islands.

Beaked whale abundance off the eastern United States may be highest in association with the Gulf Stream and the warm-core rings it develops. In summer, the continental shelf break off the northeastern U.S. is primary habitat. Waring et al., (2003) conducted a deepwater survey south of Georges Bank in 2002 and examined fine-scale habitat use by beaked whales. Beaked whales were located in waters characterized by a sea surface temperature of 20.7° to 24.9ºC (69.3 to 76.8ºF) and a bottom depth of 500 to 2,000 m (1,640 to 6,562 ft). Offshore waters beyond the continental slope are not often identified as beaked whale habitat; however, this may be due to a lack of survey effort rather than a reflection of the animals' true habitat. Beaked whale distribution in Northwest Providence Channel (within the Great Bahama Canyon) is stratified. Local scale distribution in the Bahamas might be limited to small areas of suitable habitat, particularly for foraging. In the northern Bahamas, Blainville's beaked whales spend the majority of their time along the canyon wall, where water depth is less than 800 m (2,625 ft), while the Cuvier's beaked whale occurs beyond the 1,000 m (3,281 ft) isobath.

Cuvier's beaked whales are the most widely distributed of the beaked whales and are present in most regions of all major oceans. This species occupies almost all temperate, subtropical, and tropical waters, as well as subpolar and even polar waters in some areas. Along the Atlantic U.S. coast, the Cuvier's beaked whale has been reported from Massachusetts and Rhode Island south to the Florida Keys, the West Indies, and the GOM. Cuvier's and Blainville's beaked whales are generally sighted in waters with a bottom depth greater than 200 m (656 ft) and are frequently recorded at bottom depths greater than 1,000 m (3,281 ft). At oceanic islands, Cuvier's beaked whales may be found in deeper waters than Blainville's beaked whales. Information on reproductive areas and seasons is not available for these species.

The ranges of most mesoplodonts are poorly known. The distribution of these species in the western North Atlantic and GOM are known almost entirely from strandings, and may relate to water temperature. Information on reproductive areas and seasons is not available for these species.

Sowerby's beaked whales and True's beaked whales are the most northerly species, occurring in northern, temperate waters of the North Atlantic; in the GOM it is currently considered extralimital. In the northern region, the Sowerby's beaked whale appears to occur primarily between Labrador and New England. The majority of records for True's beaked whale in the North Atlantic are from the east coast of North America, with most strandings occurring between New Jersey and Maryland. The Sowerby's beaked whale is endemic to the North Atlantic; this is considered to be more of a temperate species. Information on reproductive areas and seasons is not available for these species.

Blainville's and Gervais' beaked whales generally occur in warmer, southern waters. The Blainville's beaked whale is thought to have a continuous distribution throughout the tropical, subtropical, and warm-temperate waters of the world's oceans, occurring occasionally in cold temperate areas. There are occurrence records for the Blainville's beaked whale from Nova Scotia south to Florida, the Bahamas, and the GOM. In the western North Atlantic, this species apparently occurs south of North Carolina; the northernmost records may well be strays carried north by the waters of the Gulf Stream. The Gervais' beaked whale is restricted to warm-temperate and tropical Atlantic waters with records throughout the Caribbean Sea. The northernmost record for Gervais' beaked whale in the western North Atlantic Ocean is from New York State and the southernmost is Trinidad; the vast majority of strandings in the northwest Atlantic occur between North Carolina and Florida. The Gervais' beaked whale is the most frequently-stranded beaked whale in the GOM. Information on reproductive areas and seasons is not available for these species.

Diving Behavior – Dives range from those near the surface where the animals are still visible to long, deep dives. Tagged Cuvier's beaked whale dive durations as long as 87 min and dive depths of up to 1,990 m (6,529 ft) have been recorded. Dive durations for *Mesoplodon* sp. are typically over 20 min. Tagged Blainville's beaked whale dives have been recorded to 1,408 m (4,619 ft) and lasting as long as 54 min. Several aspects of diving have been identified between Cuvier's and Blainville's beaked whales: (1) both may dive for 48 to 68 minutes to depths greater than 800 m (2,625 ft), with one long dive occurring on average every two hours; (2) ascent rates for long/deep dives are substantially slower than descent rates, while during shorter dives there is no consistent differences; and (3) both may spend prolonged periods of time (66 to 155 min) in the upper 50 m (164 ft) of the water column. Both species make a series of shallow dives after a deep foraging dive to recover from oxygen debt; average surface intervals between foraging dives have been recorded as 63 min for Cuvier's beaked whales and 92 min for Blainville's beaked whales.

Acoustics and Hearing – Sounds recorded from beaked whales are divided into two categories: whistles and pulsed sounds (clicks); whistles likely serve a communicative function and pulsed sounds are important in foraging and/or navigation. Whistle frequencies are about 2 to 12 kHz, while pulsed sounds range in frequency from 300 Hz to 135 kHz; however, higher frequencies may not be recorded due to equipment limitations. Whistles recorded from free-ranging Cuvier's beaked whales off Greece ranged in frequency from 8 to 12 kHz, with an upsweep of about 1 sec, while pulsed sounds had a narrow peak frequency of 13 to 17 kHz, lasting 15 to 44 sec in duration. Short whistles and chirps from a stranded subadult Blainville's beaked whale ranged in frequency from slightly <1 to almost 6 kHz. Recent studies incorporating digital acoustic

recording tags (known commonly as DTAGs) attached to both Blainville's and Cuvier's beaked whales in the Ligurian Sea (arm of the Mediterranean Sea) recorded high-frequency echolocation clicks (duration: 175 μs for Blainville's and 200 to 250 μs for Cuvier's) with dominant frequency ranges from about 20 to over 40 kHz (limit of recording system was 48 kHz) and only at depths greater than 200 m. The source levels of the Blainville's beaked whales' clicks were estimated to range from 200 to 220 dB re 1 μPa-m, while they were 214 dB re 1 μPa-m for the Cuvier's beaked whale.

From anatomical examination of their ears, it is presumed that beaked whales are predominantly adapted to best hear ultrasonic frequencies. Beaked whales have well-developed semi-circular canals (typically for vestibular function but may function differently in beaked whales) compared to other cetacean species, and they may be more sensitive than other cetaceans to low frequency sounds. The only direct measure of beaked whale hearing is from using auditory evoked potential techniques on a stranded juvenile Gervais' beaked whale. The hearing range was 5 to 80 kHz, with greatest sensitivity at 40 and 80 kHz.

Occurrence in NSWC PCD Study Area – Based on the known preference of beaked whales for deep waters and the distribution of available sighting records for the GOM, beaked whales may be expected to occur throughout the GOM in waters off the continental shelf break in the eastern GOM. Occurrence is assumed to be the same year-round.

Rough-Toothed Dolphin (*Steno bredanensis*)

Description – The rough-toothed dolphin is a relatively robust dolphin that reaches 2.8 m (9.2 ft) in length. Cephalopods and fish, including large fish such as dorado, are prey.

Status – The best estimate of abundance for rough-toothed dolphins is 2,223 in the northern GOM. The minimum population estimate for the same area is 1,595 rough-toothed dolphins. There is no information on stock differentiation for the western North Atlantic stock of this species. There are no abundance estimates available for rough-toothed dolphins off the Atlantic coast of the U.S.

Distribution – Rough-toothed dolphins are found in tropical to warm-temperate waters globally, rarely ranging north of 40°N or south of 35°S. Rough-toothed dolphins occur in low densities throughout the ETP where surface water temperatures are generally above 25°C (77°F). This species is not a commonly-encountered species in the areas where it is known to occur. Not many records for this species exist from the western North Atlantic but they indicate that this species occurs from Virginia south to Florida, the GOM, the West Indies, and along the northeastern coast of South.

The rough-toothed dolphin is regarded as an offshore species that prefers deep waters; however, it can occur in waters with variable bottom depths. In the GOM, the rough-toothed dolphin occurs primarily in the deeper waters off the continental shelf. When stranded and rehabilitated individuals were released with tags off the Atlantic Coast of Florida in March 2005, they moved to waters as deep as 4,000 to 5,000 m (13,123 to 16,404 ft) in bottom depth. The rough-toothed dolphin may regularly frequent coastal waters and areas with shallow bottom depths. Sighting and tagging data indicate the use of continental shelf waters by this species in the northern GOM.

Additionally, there are reports of rough-toothed dolphins over the continental shelf in shallow waters around La Gomera, Canary Islands, Puerto Rico and the Virgin Islands, the Bahamas, and in coastal waters off Brazil, including even in a lagoon system. All records for this species for Puerto Rico and the Virgin Islands are in waters on the continental shelf. Rough-toothed dolphins have been sighted on the continental shelf in Ilha Grande Bay (southeastern coast of Brazil), but there has not been much sighting effort in deep waters. Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – Rough-toothed dolphins may stay submerged for up to 15 min and are known to dive as deep as 150 m (492 ft).

Acoustics and Hearing – The rough-toothed dolphin produces a variety of sounds, including broadband echolocation clicks and whistles. Echolocation clicks (duration <250 microseconds [µsec]) typically have a frequency range of 0.1 to 200 kHz, with a dominant frequency of 25 kHz. Whistles (duration <1 sec) have a wide frequency range of 0.3 to greater than 24 kHz but dominate in the 2 to 14 kHz range. There has been no data collected on rough-toothed dolphin hearing ability. However, odontocetes are generally adapted to hear high frequencies.

Occurrence in NSWC PCD Study Area – The rough-toothed dolphin is expected to occur seaward of the continental shelf break to the 3,000-m (9,843-ft) isobath based on the known preference of this species for deep waters and the distribution of available sighting records. There is a low or unknown occurrence of this species in waters with a bottom depth greater than 3,000 m (9,843 ft), based on a very small number of sightings in those waters. There is additionally an area of low or unknown occurrence between the 50-m (164-ft) isobath and the shelf break. Two separate mass strandings of rough-toothed dolphins occurred in the Florida Panhandle during December 1997 and 1998. Four of the stranded dolphins were rehabilitated and released, three with satellite-linked transmitters. Water depth at tracking locations of these individuals averaged 195 m (640 ft). Since the tagged individuals were observed again with wild rough-toothed dolphins off the Florida Panhandle, this suggests a previously undocumented regular occurrence of this species in the northeastern GOM and the possibility of encountering rough-toothed dolphins on the continental shelf.

Bottlenose Dolphin (*Tursiops truncatus*)

Description – Bottlenose dolphins (genus *Tursiops*) are large, relatively robust dolphins with striking regional variation in body size; adult body length ranges from 1.9 to 3.8 m (6.2 to 12.5 ft). *Tursiops* are opportunistic feeders, taking a wide variety of fish, cephalopods, and shrimp. *Tursiops* use a wide variety of feeding strategies, including feeding in association with shrimp trawls.

Scientists recognize a nearshore (coastal) and an offshore form of the bottlenose dolphin, which may be distinguished by external morphology, hematology, cranial morphology, diet, and parasite load. There is a clear distinction between the nearshore and offshore form of the bottlenose dolphin in the western North Atlantic, suggesting that the two forms may be eventually considered two different species.

Status – The stock structure of bottlenose dolphins off the U.S. Atlantic coast is complex. Based on current information, it is expected that multiple coastal stocks of bottlenose dolphins exist and include year-round residents, seasonal residents, and migratory groups. Seven management units for the coastal bottlenose dolphin along the U.S. Atlantic coast have been identified. The western North Atlantic coastal stock is considered depleted under the MMPA (based on estimates that this stock might have declined by over 50 percent as a result of the 1987 to 1988 die-off) and is therefore a strategic stock.

The best abundance estimate for the western North Atlantic coastal stock located within the South Carolina, Georgia, and Florida management units is 15,620, year-round. In summer, the best abundance estimate of dolphins within the northern migratory management unit is 17,466 animals, with a minimum population estimate of 14,621. In the summer for both the northern and southern NC management units, both estuarine and oceanic, the best abundance estimate is 10,865, with a minimum population estimate of 6,061. In the wintertime, much of these management units mix together. The best abundance estimate in the winter for this mixed management unit is 16,913, with a minimum population estimate of 13,558 dolphins. The combined abundance estimate for the western North Atlantic offshore stock is 81,588 dolphins, with a minimum population estimate of 70,775.

In the northern GOM, there are three coastal stocks; a continental shelf stock; an oceanic stock; and numerous bay, sound, and estuarine stocks. It is believed that many of these different stocks may overlap each other. The best estimate of abundance along the GOM continental shelf and slope is 25,320, with a minimum population estimate of 20,414 bottlenose dolphins.

Distribution – The overall range of the common bottlenose dolphin is worldwide in tropical and temperate waters. This species occurs in all three major oceans and many seas. Dolphins of the genus *Tursiops* generally do not range poleward of 45°, except around the United Kingdom and northern Europe. Climate changes can contribute to range extensions as witnessed in association with the 1982/83 El Niño event when the range of some bottlenose dolphins known to the San Diego, CA area was extended northward by 600 km (324 NM) to Monterey Bay.

In the western North Atlantic, bottlenose dolphins occur as far north as Nova Scotia but are most common in coastal waters from New England to Florida, the GOM, the Caribbean, and southward to Venezuela and Brazil. Bottlenose dolphins off the northeast United States are frequently found over the continental shelf, and especially along the shelf break. Bottlenose dolphins may also be found in very deep waters. The range of the offshore bottlenose dolphin stock may include waters beyond the continental slope, and offshore bottlenose dolphins may move between the Atlantic and the GOM.

North of Cape Hatteras, this species demonstrates a disjunctive distribution, with concentrations of animals nearshore (in embayment and within several kilometers of the shore) and offshore, near the continental shelf margin, from 60 to 200 km (32 to 108 NM) from the coast. There is a migratory component to the bottlenose dolphins occurring north of Cape Hatteras. Water temperature may directly or indirectly affect bottlenose dolphin movements. Water temperature may directly affect movements by acting as a thermal barrier to dolphin movement. Alternatively, water temperature may indirectly affect movements by directly affecting prey movements. The coastal bottlenose dolphin stock off the U.S. Atlantic coast shows a

temperature-limited distribution. Sightings of coastal bottlenose dolphins (contrasted with the offshore stock) during CETAP surveys occurred in significantly warmer waters, had a distinct northern boundary to their distribution, and were absent from the Study Area during the winter.

South of Cape Hatteras, the nearshore/offshore distribution pattern is less distinct and there appears to be latitudinal clusters of animal concentration rather than the longitudinally discrete concentration areas found north of Cape Hatteras. It should be noted that there has not been much survey effort south of this area. There is little genetic mixing among management units south of North Carolina, which is in contrast to north of Cape Hatteras. Photo-identification and tagging efforts support the genetic work. Based on photo-identification work, there appears to be generally less movement between areas south of Cape Hatteras along the U.S. Atlantic coast (Urian et al., 1999). At least some of the bottlenose dolphins in North Carolina are resident year-round; this is the northern limit of year-round residency documented for bottlenose dolphin in the western North Atlantic. The longest distance match to date south of Cape Hatteras, North Carolina, is between Jacksonville, FL, and Murrell's Inlet, SC (approximately 450 km [243 NM]). The coastal form, south of Cape Hatteras, North Carolina, is speculated to range from the coast to 27 km (15 NM) offshore.

The offshore stock is found in waters with a bottom depth greater than 25 m (82 ft) and occurs beyond the continental shelf into continental slope waters in lower densities; greater densities are found along the continental shelf break. Offshore bottlenose dolphins were generally distributed between the 200- and 2,000-m (656.2- and 6,562-ft) isobaths from Cape Hatteras to the eastern end of Georges Bank during CETAP surveys. The mean bottom depth for offshore sightings was 846 m (2,774 ft). Sightings of offshore bottlenose dolphins (contrasted with the nearshore stock) during CETAP surveys were more widely distributed relative to geography and temperature.

Nearshore and offshore bottlenose dolphins overlap spatially, and the nearshore stock appears less restricted in its offshore movements than originally suspected. The area of mixing for the offshore and coastal forms in this area is speculated to be 27 to 81 km (15 to 44 NM) offshore.

The bottlenose dolphin is by far the most widespread and common cetacean in coastal waters of the GOM. Bottlenose dolphins are frequently sighted near the Mississippi River Delta and have even been known to travel several kilometers up the Mississippi River. Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – Navy bottlenose dolphins have been trained to reach maximum diving depths of about 300 m (984 ft). The presence of deep-sea fish in the stomachs of some individual offshore bottlenose dolphins suggests that they dive to depths of more than 500 m (1,640 ft). A tagged individual near Bermuda had maximum recorded dives of 600 to 700 m (1,969 to 2,297 ft) and durations of 11 to 12 min. Dive durations up to 15 min have been recorded for trained individuals. Typical dives, however, are more shallow and of a much shorter duration. Data from a tagged individual off Bermuda indicated a possible diel dive cycle (i.e., a regular daily dive cycle) in search of mesopelagic (living at depths between 180 and 900 m (591 and 2,953 ft) prey in the deep scattering layer.

Acoustics and Hearing – Sounds emitted by bottlenose dolphins have been classified into two broad categories: pulsed sounds (including clicks and burst-pulses) and narrow-band continuous

sounds (whistles), which usually are frequency modulated. Clicks and whistles have a dominant frequency range of 110 to 130 kHz and a source level of 218 to 228 dB re 1 µPa-m and 3.4 to 14.5 kHz and 125 to 173 dB re 1 µPa-m, respectively. Whistles are primarily associated with communication and can serve to identify specific individuals (i.e., signature whistles). Up to 52 percent of whistles produced by bottlenose dolphin groups with mother-calf pairs can be classified as signature whistles. Sound production also is influenced by group type (single or multiple individuals), habitat, and behavior. Bray calls (low-frequency vocalizations; majority of energy below 4 kHz), for example, are used when capturing fish, specifically sea trout (*Salmo trutta*) and Atlantic salmon (*Salmo salar*), in some regions (i.e., Moray Firth, Scotland). Additionally, whistle production has been observed to increase while feeding. Furthermore, both whistles and clicks have been demonstrated to vary geographically in terms of overall vocal activity, group size, and specific context (e.g., feeding, milling, traveling, and socializing). For example, preliminary research indicates that characteristics of whistles from populations in the northern GOM significantly differ (i.e., in frequency and duration) from those in the western north Atlantic.

Bottlenose dolphins can typically hear within a broad frequency range of 0.04 to 160 kHz. Electrophysiological experiments suggest that the bottlenose dolphin brain has a dual analysis system: one specialized for ultrasonic clicks and another for lower-frequency sounds, such as whistles. Scientists have reported a range of highest sensitivity between 25 and 70 kHz, with peaks in sensitivity at 25 and 50 kHz. Recent research, on the same individuals, indicates that auditory thresholds obtained by electrophysiological methods correlate well with those obtained in behavior studies, except at the some lower (10 kHz) and higher (80 and 100 kHz) frequencies. Temporary threshold shifts (TTS) in hearing have been experimentally induced in captive bottlenose dolphins using a variety of noises (i.e., broad-band, pulses). For example, TTS has been induced with exposure to a 3 kHz, one-second pulse with sound exposure level (SEL) of 195 dB re 1 µPa2s, one-second pulses from 3 to 20 kHz at 192 to 201 dB re 1µPa-m, and octave band noise (4 to 11 kHz) for 50 minutes at 179 dB re 1 µPa-m. Preliminary research indicates that TTS and recovery after noise exposure are frequency dependent and that an inverse relationship exists between exposure time and sound pressure level associated with exposure. Observed changes in behavior were induced with an exposure to a 75 kHz one-second pulse at 178 dB re 1 µPa-m. TTS has been measured to be between 8 and 16 kHz (negligible or absent at higher frequencies) after 30 min of noise exposure (4 to 11 kHz) at 160 dB re 1 µPa-m (Nachtigall et al., 2004).

Occurrence in NSWC PCD Study Area – Based on the distribution of sighting records in the GOM, bottlenose dolphins are expected to occur from the shoreline to the 1,000-m (3,281-ft) isobath. There are concentrated occurrences of bottlenose dolphins from the shore to the 30-m (98-ft) isobath off west-central Florida and from the shore to just seaward of the continental shelf break from Cape San Blas, Florida to the western extent of the map area.

Additionally, bottlenose dolphin occurrence is concentrated in a swath encompassing the shelf break east of Cape San Blas, as well as the Florida Keys. There is a low or unknown occurrence of bottlenose dolphins in waters with a bottom depth greater than 1,000 m (3,281 ft), which takes into consideration that comparatively little survey effort has taken place in deeper waters and also that there is a small possibility of encountering this species in that area. Bottlenose dolphin occurrence in the NSWC PCD Study Area is assumed to be similar throughout the year.

In addition to these stocks, distinct populations of bottlenose dolphins reside in bays and estuaries of the GOM. A resident population exists in St. Andrew Bay, which lies within the NSWC PCD Study Area. The best abundance estimate in the bay is 124 individuals with a minimum population estimate of 79 dolphins (Waring et al., 2007). Additional stocks that occur adjacent to the NSWC PCD Study Area include populations of bottlenose dolphins in Mobile Bay/Bonsecour Bay, Perdido Bay, Pensacola Bay/East Bay, Choctawhatchee Bay, St. Andrew Bay, St. Joseph Bay, and St. Vincent Sound/Apalachicola Bay/St. Georges Sound.

Pantropical and Atlantic Spotted Dolphins (*Stenella attenuata* and *Stenella frontalis*)

Description – The pantropical spotted dolphin is a generally slender dolphin. Adults may reach up to 2.6 m (8.5 ft) in length. Pantropical spotted dolphins are born spotless and develop spots as they age although the degree of spotting varies geographically. Some populations may be virtually unspotted. Pantropical spotted dolphins prey on epipelagic fish, squid, and crustaceans, with some take of mesopelagic animals.

The Atlantic spotted dolphin tends to resemble the bottlenose dolphin more than it does the pantropical spotted dolphin. In body shape, it is somewhat intermediate between the two, with a moderately long but rather thick beak. Adults are up to 2.3 m (7.5 ft) long and 143 kg (315 lb) in weight. Atlantic spotted dolphins are born spotless and develop spots as they age. Some Atlantic spotted dolphin individuals become so heavily spotted that the dark cape and spinal blaze are difficult to see. There is marked regional variation in adult body size of the Atlantic spotted dolphin. There are two forms: a robust, heavily spotted form that inhabits the continental shelf, usually found within 250 to 350 km (135 to 189 NM) of the coast, and a smaller, less-spotted form that inhabits offshore waters. The largest body size is exhibited by the coastal form, which occurs in waters over the continental shelf of North America (U.S. East Coast, GOM, and Central America). The smallest Atlantic spotted dolphins are those around oceanic islands, such as the Azores, and on the high seas in the western North Atlantic. Atlantic spotted dolphins feed on small cephalopods, fish, and benthic invertebrates, and in the GOM have been seen feeding cooperatively and are known to feed in association with shrimp trawls.

Prior to 1998, sightings of the Atlantic spotted dolphin and the pantropical spotted dolphin in U.S. Atlantic waters were not always differentiated due to difficulty in distinguishing the two species at sea. The two species are still difficult to distinguish from one another in the field.

Status – The best estimate of abundance for Atlantic spotted dolphins in the northern GOM is 30,947, with a minimum population estimate of 24,752 dolphins. In the North Atlantic, the best abundance estimate is 50,978, with a minimum population estimate (based on the combined offshore and coastal abundance estimates) of 36,235. The northern GOM population was recently confirmed to be genetically differentiated from the western North Atlantic populations.

The pantropical spotted dolphin is the most abundant and commonly-seen cetacean in deep waters of the northern GOM. The best estimate of abundance for pantropical spotted dolphins in the northern GOM is 91,321, with a minimum population of 79,879 dolphins. In the western North Atlantic, the best estimate of abundance for pantropical spotted dolphins is 4,439 with a minimum population estimate of 3,010 (Waring et al., 2006).

Distribution – The pantropical spotted dolphin is distributed in tropical and subtropical waters worldwide, generally occurring in oceanic waters beyond the shelf break. *Stenellid* dolphins have been sighted within the Gulf Stream, which is consistent with the oceanic distribution of pantropical spotted dolphins and their preference for warm waters. Pantropical spotted dolphins in the GOM have been sighted in waters with bottom depths ranging from 435 to 2,121 m (1,427 to 6,959 ft). Pantropical spotted dolphins in the GOM do not appear to have a preference for any one specific habitat type (i.e., within the Loop Current, inside cold-core eddies, or along the continental slope).

The Atlantic spotted dolphin, as its name suggests, is endemic to the tropical and warm-temperate species. In the western North Atlantic, this translates to waters from northern New England to the GOM and the Caribbean, and southward to the coast of Venezuela. Known densities of Atlantic spotted dolphins are highest in the eastern GOM, east of Mobile Bay. The large, heavily spotted coastal form of the Atlantic spotted dolphin typically occurs over the continental shelf inside or near the 185-m (607-ft) isobath, usually at least 8 to 20 km (4 to 11 NM) offshore. Sightings of offshore spotted dolphins have been made along the north wall of the Gulf Stream and warm-core ring features. Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – Pantropical spotted dolphins dives during the day are generally shorter and shallower than dives at night; rates of descent and ascent are higher at night than during the day. Similar mean dive durations and depths have been obtained for tagged pantropical spotted dolphins in the Eastern Tropical Pacific (ETP) and off Hawaii. The only information on dive depth for Atlantic spotted dolphins is based on a satellite-tagged individual from the GOM. This individual made short, shallow dives (over 76 percent of the time to depths less than 10 m [33 ft]) over the continental shelf, although some dives were as deep as 40 to 60 m (131 to 197 ft).

Acoustics and Hearing – Pantropical spotted dolphin whistles have a frequency range of 3.1 to 21.4 kHz. Clicks typically have two frequency peaks (bimodal) at 40 to 60 kHz and 120 to 140 kHz with estimated source levels up to 220 dB re 1 µPa peak-to-peak. No direct measures of hearing ability are available for pantropical spotted dolphins, but ear anatomy has been studied and indicates that this species should be adapted to hear the lower range of ultrasonic frequencies (<100 kHz).

A variety of sounds including whistles, echolocation clicks, squawks, barks, growls, and chirps have been recorded for the Atlantic spotted dolphin. Whistles have dominant frequencies below 20 kHz (range: 7.1 to 14.5 kHz) but multiple harmonics extend above 100 kHz, while burst pulses consist of frequencies above 20 kHz (dominant frequency of approximately 40 kHz. Other sounds, such as squawks, barks, growls, and chirps, typically range in frequency from 0.1 to 8 kHz. Recently recorded echolocation clicks have two dominant frequency ranges at 40 to 50 kHz and 110 to 130 kHz, depending on source level (i.e., lower source levels typically correspond to lower frequencies and higher frequencies to higher source levels. Echolocation click source levels as high as 210 dB re 1 µPa-m peak-to-peak have been recorded. There are no empirical hearing data for Atlantic spotted dolphins.

Occurrence in NSWC PCD Study Area – The Atlantic spotted dolphin is expected to occur in waters over the continental shelf in the GOM from the 10-m (33-ft) isobath to the shelf break. The majority of the sightings support this determination. Taking into consideration sightings recorded seaward of the continental shelf break and over the continental slope near the Mississippi River Delta and in the southern GOM, there is a low or unknown occurrence of this species between the shelf break and the 2,000-m (6,562-ft) isobath. Occurrence is assumed to be similar during all seasons.

The pantropical spotted dolphin is an oceanic species and is the most common cetacean in the oceanic northern GOM and is found in the deeper waters off the continental shelf. The pantropical spotted dolphin is expected to occur from the continental shelf break to the 3,000-m (9,843-ft) isobath. There is a low or unknown occurrence of the pantropical spotted dolphin seaward of the 3,000-m (9,843-ft) isobath based on the little survey effort in waters this deep compared to the waters off the shelf break and over the continental slope. Occurrence is assumed to be similar throughout the year.

Spinner Dolphin (*Stenella longirostris*)

Description – This is a very slender dolphin that has a very long and slender beak and can reach lengths of 2.4 m (7.9 ft). This species has a three-part color pattern (dark gray cape, light gray sides, and white belly). There are four known subspecies of spinner dolphins and probably other undescribed ones. Spinner dolphins feed primarily on small mesopelagic fish, squid, and sergestid shrimp, diving to at least 200 to 300 m (656 to 984 ft). Many of these organisms become available to spinner dolphins when the deep-scattering layer moves toward the surface at night.

Status – The best estimate of abundance for spinner dolphins in the northern GOM is 11,971. The minimum population estimate for the northern GOM is 6,990 spinner dolphins. Population size in the western North Atlantic is unknown (Waring et al., 2006).

Distribution – The spinner dolphin is found in tropical and subtropical waters worldwide, occurring in both coastal and oceanic environments. Limits are near 40ºN and 40ºS. In the western North Atlantic, they are known from South Carolina to Florida, the Caribbean, the GOM, and the West Indies southward to Venezuela. Sightings of this species off the U.S. Atlantic coast and GOM have occurred primarily in deeper waters (bottom depth greater than 2,000 m [6,562 ft]). Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – Spinner dolphins feed primarily on small mesopelagic fish, squid, and sergestid shrimp, and they dive to at least 199 to 300 m (653 to 984 ft). Foraging takes place primarily at night when the mesopelagic prey migrates vertically towards the surface and also horizontally towards the shore. Spinner dolphins are well known for their propensity to leap high into the air and spin before landing in the water; the purpose of this behavior is unknown. Undoubtedly, spinner dolphins are one of the most aerially-active of all dolphin species.

Acoustics and Hearing – Pulses, whistles, and clicks have been recorded from this species. Pulses and whistles have dominant frequency ranges of 5 to 60 kHz and 8 to 12 kHz,

respectively. Spinner dolphins consistently produce whistles with frequencies as high as 16.9 to 17.9 kHz with a maximum frequency for the fundamental component at 24.9 kHz. Clicks have a dominant frequency of 60 kHz. The burst pulses are predominantly ultrasonic, often with little or no energy below 20 kHz. Source levels between 195 and 222 dB re 1 µPa-m have been recorded for spinner dolphin clicks. Other research indicates that this species produces whistles in the range of 1 to 22.5 kHz with the dominant frequency being 6.8 to 17.9 kHz, although their full range of hearing may extend down to 1 kHz or below as reported for other small odontocetes (Nedwell et al., 2004).

Occurrence in NSWC PCD Study Area – As a species with a preference for deep waters, the spinner dolphin is expected to occur from the continental shelf break to the 2,000-m (6,562-ft) isobath. There is a low or unknown occurrence of the spinner dolphin seaward of the 2,000-m (6,562-ft) isobath. Occurrence is assumed to be similar throughout the year.

Clymene Dolphin (*Stenella clymene*)

Description – The Clymene dolphin is easily confused with the spinner dolphin (and the short-beaked common dolphin) due to its similar appearance. The Clymene dolphin, however, is smaller and more robust, with a much shorter and stockier beak. The Clymene dolphin can reach at least 2 m (7 ft) in length and weights of at least 85 kg (187 lb). Available information on feeding habits is limited to the stomach contents of two individuals and one observation of free-ranging dolphins; Clymene dolphins feed on small fish and squid.

Status – For animals in the GOM, the best estimate of abundance for Clymene's dolphins is 17,355, with a minimum population estimate of 10,528 dolphins. Although it is not clear if the actual density is higher, there are more Clymene dolphin records from the GOM than from the rest of this species' range combined.

Distribution – The Clymene dolphin is known only from the tropical and subtropical Atlantic Ocean, primarily sighted in deep waters well beyond the edge of the continental shelf. Biogeographically, the Clymene dolphin is found in the warmer waters of the North Atlantic from the North Equatorial Current, the Gulf Stream, and the Canary Current. These records suggest that, in the mid-Atlantic off the U.S., the warm waters of the Gulf Stream influence Clymene dolphin distribution. In a study of habitat preferences in the GOM, Clymene dolphins were found more often on the lower slope and deep water areas in regions of cyclonic or confluence circulation. Clymene dolphins are found in deep waters with a mean bottom depth of 1,870 m (6,135 ft). Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – There is no diving information available for this species.

Acoustics and Hearing – The only data available for this species is a description of their whistles. Clymene dolphin whistle structure is similar to that of other stenellids, but it is generally higher in frequency (range of 6.3 to 19.2 kHz). There is no empirical data on the hearing ability of Clymene dolphins; however, the most sensitive hearing range for odontocetes generally includes high frequencies.

Occurrence in NSWC PCD Study Area – Based on the distribution of sighting records, the Clymene dolphin is expected to occur from the continental shelf break to the 3,000-m (9,843-ft) isobath. There has not been much survey effort in waters deeper than 3,000 m (9,843 ft), yet there are documented sightings seaward of the 3,000-m (9,843-ft) isobath. Therefore, there is a low or unknown occurrence of the Clymene dolphin seaward of the 3,000-m (9,843-ft) isobath. Occurrence is assumed to be the same during all seasons.

Striped Dolphin (*Stenella coeruleoalba*)

Description – The striped dolphin is a uniquely marked dolphin, which is relatively robust and reaches 2.6 m (8.5 ft) in length. Striped dolphins often feed in pelagic or benthopelagic zones along or seaward of the continental slope. Small, midwater fish (in particular, myctophids or lanternfish) and squid are the dominant prey.

Status – The best abundance estimate for striped dolphins in the northern GOM is 6,505, with a minimum population estimate of 4,599 striped dolphins (Waring et al., 2006).

Distribution – The striped dolphin has a worldwide distribution in cool-temperate to tropical waters. In the western North Atlantic, this species is known from Nova Scotia southward to the Caribbean, the GOM, and Brazil. Striped dolphins are usually found outside the continental shelf, typically over the continental slope out to oceanic waters, often associated with convergence zones and waters influenced by upwelling. This species appears to avoid waters with sea temperatures of less than 20°C (68°F). Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – Striped dolphins often feed in pelagic or benthopelagic zones along the continental slope or just beyond it in oceanic waters. A majority of their prey possesses luminescent organs, suggesting that striped dolphins may be feeding at great depths, possibly diving to 200 to 700 m (656 to 2,297 ft) to reach potential prey. Striped dolphins may feed at night in order to take advantage of the deep scattering layer's diurnal vertical movements.

Acoustics and Hearing – Striped dolphin whistles range from 6 to greater than 24 kHz, with dominant frequencies ranging from 8 to 12.5 kHz. A single striped dolphin's hearing range, determined by using standard psycho-acoustic techniques, was from 0.5 to 160 kHz with best sensitivity at 64 kHz.

Occurrence in NSWC PCD Study Area – The striped dolphin is expected to occur from the continental shelf break to the 2,000-m (6,562-ft) isobath. There are a few confirmed sightings of striped dolphins seaward of the 2,000-m (6,562-ft) isobath; therefore, there is a low or unknown occurrence of striped dolphins in waters with a bottom depth greater than 2,000 m (6,562 ft). Occurrence is assumed to be the same throughout the year.

Fraser's Dolphin (*Lagenodelphis hosei*)

Description – The Fraser's dolphin reaches a maximum length of 2.7 m (8.9 ft) and is generally more robust than other small delphinids. Fraser's dolphins feed on midwater fish, squid, and shrimp.

Status – The best estimate of abundance for Fraser's dolphins in the northern GOM is 726, with a minimum population estimate of 427 animals. The population size of Fraser's dolphins off the U.S. or Canadian Atlantic coast is unknown. Present data is not sufficient to calculate a minimum population estimate for this stock (Waring et al., 2006).

Distribution – Fraser's dolphin is found in tropical and subtropical waters around the world, typically between 30ºN and 30ºS. Strandings in temperate areas are considered extralimital and usually are associated with anomalously warm water temperatures. This is an oceanic species except in places where deep water approaches the coast. Few records exist of this species from the Atlantic Ocean. In the GOM, this species occurs mostly in very deep waters well beyond the continental shelf break. Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – There is no information available on depths to which Fraser's dolphins may dive, but they are thought to be capable of deep diving.

Acoustics and Hearing – Very little is known of the acoustic abilities of the Fraser's dolphin. Fraser's dolphin whistles have a frequency range of 7.6 to 13.4 kHz. There are no hearing data for this species.

Occurrence in NSWC PCD Study Area – Fraser's dolphin occurrence is assumed to be the same for all four seasons in the eastern GOM, and is expected to occur from the continental shelf break to the 3,000-m (9,843-ft) isobath. This determination was based on the distribution of sightings in the NSWC PCD Study Area and the known habitat preferences of this species. Fraser's dolphins have been sighted over the abyssal plain in the southern GOM. There is a low or unknown occurrence of the Fraser's dolphin seaward of the 3,000-m (9,843-ft) isobath.

Risso's Dolphin (*Grampus griseus*)

Description – The Risso's dolphin is a moderately large, robust animal reaching at least 3.8 m (12.5 ft) in length. Adults range from dark gray to nearly white and are heavily covered with white scratches and splotches. Cephalopods are the primary prey.

Status – The best abundance estimate for Risso's dolphins in the western North Atlantic is 20,479. The minimum population estimate is 12,920 animals (Waring et al., 2007). The best estimate of abundance for Risso's dolphins in the northern GOM is 2,169, with a minimum population estimate of 1,668 dolphins (Waring et al., 2006).

Distribution – The Risso's dolphin is distributed worldwide in tropical and warm-temperate waters, roughly between 60ºN and 60ºS, where surface water temperature is usually greater than 10 degrees Celsius (ºC) (50 degrees Fahrenheit [°F]). In the western North Atlantic, this species is found from Newfoundland southward to the GOM, throughout the Caribbean, and around the equator. A number of studies have noted that the Risso's dolphin is found along the continental slope. The strong correlation between the Risso's dolphin distribution and the steeper portions of the upper continental slope in the GOM is most likely the result of cephalopod distribution in the same area. Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – Individuals may remain submerged on dives for up to 30 min and dive as deep as 600 m.

Acoustics and Hearing – Risso's dolphin vocalizations include broadband clicks, barks, buzzes, grunts, chirps, whistles, and combined whistle and burst-pulse sounds that range in frequency from 0.4 to 22 kHz and in duration from less than a second to several seconds. The combined whistle and burst pulse sound (2 to 22 kHz, mean duration of 8 sec) appears to be unique to Risso's dolphin. Risso's dolphins also produce echolocation clicks (40 to 70 μs duration) with a dominant frequency range of 50 to 65 kHz and estimated source levels up to 222 dB re 1 μPa-m peak-to-peak.

Baseline research on the hearing ability of this species was conducted in a natural setting (included natural background noise) using behavioral methods on one older individual. This individual could hear frequencies ranging from 1.6 to 100 kHz and was most sensitive between 8 and 64 kHz. Hearing in a stranded infant has also been measured. This individual could hear frequencies ranging from 4 to 150 kHz, with best sensitivity at 90 kHz. This study demonstrated that this species can hear higher frequencies than previously reported.

Occurrence in NSWC PCD Study Area – The Risso's dolphin is most commonly found in areas with steep bottom topography. Based on this known habitat preference and the distribution of sighting records in the northern GOM, Risso's dolphins are expected to occur between the continental shelf break and the 2,000-m (6,562-ft) isobath throughout the year. There is a concentrated occurrence of the Risso's dolphin south of the Mississippi River Delta to approximately where the DeSoto Canyon begins, from the shelf break to the vicinity of the 1,000-m (3,281-ft) isobath. This is based on sighting concentrations, as well as the oceanography of the area being favorable to prey concentrations for this species. There is a low or unknown occurrence of this species in waters beyond the 2,000-m (6,562-ft) isobath.

Melon-Headed Whale (*Peponocephala electra*)

Description – Melon-headed whales at sea closely resemble pygmy killer whales. Melon-headed whales reach a maximum length of 2.75 m (9 ft). Melon-headed whales prey on squid, pelagic fish, and occasionally crustaceans. Most of the fish and squid families eaten by this species consist of mesopelagic species found in waters up to 1,500 m (4,921 ft) deep, suggesting that feeding takes place deep in the water column.

Status – The best estimate of abundance for melon-headed whales in the northern GOM is 3,451, with a minimum population estimate of 2,238 melon-headed whales (Waring et al., 2006).

Distribution – Melon-headed whales are found worldwide in deep tropical and subtropical waters. Maryland is thought to represent the extreme of the northern distribution for this species in the northwest Atlantic. There are very few records for melon-headed whales in the North Atlantic. Little information is available on habitat preferences for this species. Most melon-headed whale sightings in the GOM have been in deep waters, well beyond the edge of the continental shelf and waters out over the abyssal plain. A group of melon-headed whales and Fraser's dolphins was sighted in waters east of Cape Hatteras, North Carolina, with a bottom

depth of 3,000 m (9,843 ft). Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – There is no diving information available for this species. Melon-headed whales prey on squid, pelagic fish, and occasionally crustaceans. Most of the fish and squid families eaten by this species consist of mesopelagic species found in waters up to 1,500 m (4,921 ft) deep, suggesting that feeding takes place deep in the water column.

Acoustics and Hearing – The only published acoustic information for melon-headed whales is from the southeastern Caribbean. Sounds recorded included whistles and click sequences. Whistles had dominant frequencies around 8 to 12 kHz; higher-level whistles were estimated at no more than 155 dB re 1 µPa-m. Clicks had dominant frequencies of 20 to 40 kHz; higher-level click bursts were judged to be about 165 dB re 1 µPa-m. No data on hearing ability for this species are available.

Occurrence in NSWC PCD Study Area – Melon-headed whales and pygmy killer whales can be difficult to distinguish from one another, and on many occasions, only a determination of "pygmy killer whale/melon-headed whale" can be made. The occurrence of both species is considered similar and therefore appears combined. Based on known preferences of the melon-headed whale for deep waters and the confirmed sightings of this species in the GOM, melon-headed whales are expected to occur between the continental shelf break and the 3,000-m (9,843-ft) isobath. There is a low or unknown occurrence of melon-headed whales in waters with a bottom depth greater than 3,000 m (9,843 ft) based on the few available sighting records. Melon-headed whale occurrence patterns are expected to be the same year-round in the eastern GOM.

Pygmy Killer Whale (*Feresa attenuata*)

Description – Pygmy killer whales and melon-headed whales can be difficult to distinguish from one another, and on many occasions, only a determination of "pygmy killer whale/melon-headed whale" can be made. The rounded flipper shape is the best distinguishing characteristic of a pygmy killer whale. Pygmy killer whales reach lengths of up to 2.6 m (8.5 ft). Pygmy killer whales eat mostly fish and squid, and sometimes attack other dolphins.

Status – The best estimate of abundance for pygmy killer whales in the northern GOM is 408. The minimum population estimate for the northern GOM is 256 pygmy killer whales.

Distribution – This species has a worldwide distribution in deep tropical, subtropical, and warm temperate oceans. Pygmy killer whales generally do not range north of 40ºN or south of 35ºS. The sparse number of pygmy killer whale sightings might be due to its somewhat cryptic behavior. The pygmy killer whale is a deepwater species, with a possible occurrence most likely in waters outside the continental shelf break. This species does not appear to be common in the GOM. In the northern GOM, the pygmy killer whale is found primarily in deeper waters beyond the continental shelf extending out to waters over the abyssal plain.

Diving Behavior – There is no diving information available for this species.

Acoustics and Hearing – The pygmy killer whale emits short duration, broadband signals similar to a large number of other delphinid species. Clicks produced by pygmy killer whales have centroid frequencies between 70 and 85 kHz; there are bimodal peak frequencies between 45 and 117 kHz. The estimated source levels are between 197 and 223 dB re 1 μPa-m. These clicks possess characteristics of echolocation clicks. There are no hearing data available for this species.

Occurrence in NSWC PCD Study Area – As stated previously, pygmy killer whales and melon-headed whales can be difficult to distinguish from one another, and on many occasions, only a determination of "pygmy killer whale/melon-headed whale" can be made. The occurrence of both species is considered similar and therefore appears combined. Based on confirmed sightings of the pygmy killer whale in the GOM and this species' propensity for deeper water, pygmy killer whales are expected to occur between the continental shelf break and the 3,000-m (9,843-ft) isobath. There is a low or unknown occurrence of pygmy killer whales in waters with a bottom depth greater than 3,000 m (9,843 ft) based on the few available sighting records. Pygmy killer whales are thought to occur year-round in the GOM in small numbers and occurrence patterns are expected to be the same year-round. Additional information on reproductive areas and seasons is not available for this species.

False Killer Whale (*Pseudorca crassidens*)

Description – The false killer whale is a large, dark gray to black dolphin reaching lengths of 6.1 m (20.0 ft). The flippers have a characteristic hump on the leading edge—this is perhaps the best characteristic in distinguishing this species from the other "blackfish" (pygmy killer, melon-headed, and pilot whales).

Status – The best estimate of abundance for false killer whales in the northern GOM is 1,038. The minimum population estimate for the northern GOM is 606 false killer whales (Waring et al., 2006).

Distribution – False killer whales are found in tropical and temperate waters, generally between 50ºS and 50ºN with a few records north of 50ºN in the Pacific and the Atlantic. This species is found primarily in oceanic and offshore areas, though they do approach close to shore at oceanic islands. Inshore movements are occasionally associated with movements of prey and shoreward flooding of warm ocean currents. In the western North Atlantic, false killer whales have been reported off Maryland southward along the mainland coasts of North America, the GOM, and the southeastern Caribbean Sea. Although sample sizes are small, most false killer whale sightings in the GOM are east of the Mississippi River, and sightings of this species in the northern GOM occur in oceanic waters greater than 200 m (656 ft) deep. Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – There is no diving information available for this species. However, it is known that false killer whales primarily eat deep-sea cephalopods and fish, and have been known to attack other toothed whales, including sperm whales and baleen whales. False killer whales in many different regions are known to take tuna from long-lines worldwide.

Acoustics and Hearing – Dominant frequencies of false killer whale whistles are from 4 to 9.5 kHz, and those of their echolocation clicks are from either 20 to 60 kHz or 100 to 130 kHz depending on ambient noise and target distance. Click source levels typically range from 200 to 228 dB re 1 μPa-m. Recently, false killer whales recorded in the Indian Ocean produced echolocation clicks with dominant frequencies of about 40 kHz and estimated source levels of 201-225 dB re 1 μPa-m. False killer whales can hear frequencies ranging from approximately 2 to 115 kHz with best hearing sensitivity ranging from 16 to 64 kHz. Additional behavioral audiograms of false killer whales support a range of best hearing sensitivity between 16 and 24 kHz, with peak sensitivity at 20 kHz, peaking at 22.5 kHz.

Occurrence in NSWC PCD Study Area – Most sightings of false killer whales in the GOM have been made in oceanic waters with a bottom depth greater than 200 m (656 ft); there also have been sightings from over the continental shelf. False killer whales are expected to occur between the continental shelf break and the 2,000-m (6,562-ft) isobath throughout the GOM. There is a low or unknown occurrence of this species seaward of the 2,000-m (6,562-ft) isobath, which is based on the sighting records. There is also a low or unknown occurrence of false killer whales between the 50-m (164-ft) isobath and the shelf break in the NSWC PCD Study Area. This was based on the fact that false killer whales sometimes make their way into shallower waters, such as off Hong Kong and in the GOM, as well as many sightings reported by sport fishermen in the mid-1960s of "blackfish" (most likely false killer whales based on the descriptions) in waters offshore of Pensacola and Panama City, FL. There have been occasional reports of fish stealing by these animals (the false killer whale frequently has been implicated in such fishery interactions). False killer whale occurrence patterns in the eastern GOM are expected to be the same throughout the year.

Killer Whale (*Orcinus orca*)

Description – The killer whale is the largest member of the dolphin family; females may reach 7.7 m (25.3 ft) in length and males 9.0 m (29.5 ft). The black-and-white color pattern of this species is striking as is the tall, erect dorsal fin of the adult male (1.0 to 1.8 m in height [3.3 to 5.9 ft]). Killer whales feed on bony fish, elasmobranchs, cephalopods, seabirds, sea turtles, and other marine mammals.

Status – The best estimate of abundance for killer whales in the northern GOM is 133, with a minimum population estimate of 90 (Waring et al., 2006).

Distribution – This is a cosmopolitan species found throughout all oceans and contiguous seas, from equatorial regions to the polar pack ice zones. Although found in tropical waters and the open ocean, killer whales as a species are most numerous in coastal waters and at higher latitudes. Killer whales have the most ubiquitous distribution of any species of marine mammal, and they have been observed in virtually every marine habitat from the tropics to the poles and from shallow, inshore waters (and even rivers) to deep, oceanic regions. In coastal areas, killer whales often enter shallow bays, estuaries, and river mouths. Based on a review of historical sighting and whaling records, killer whales in the northwestern Atlantic are found most often along the shelf break and further offshore.

In the western North Atlantic, killer whales are known from the polar pack ice southward to Florida, the Lesser Antilles, and the GOM. Killer whales are sighted year-round in the northern GOM. It is not known whether killer whales in the GOM stay within the confines of the GOM or range more widely into the Caribbean and adjacent North Atlantic Ocean. Little is known of the movement patterns of killer whales in this region. Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – The maximum depth recorded for free-ranging killer whales diving off British Columbia is 264 m (866 ft). On average, however, for seven tagged individuals, less than 1 percent of all dives examined were to depths greater than 30 m (98 ft). A trained killer whale dove to a maximum of 260 m (853 ft). The longest duration of a recorded dive from a radio-tagged killer whale was 17 min.

Acoustics and Hearing – Killer whales produce a wide-variety of clicks and whistles, but most of this species' social sounds are pulsed, with frequencies ranging from 0.5 to 25 kHz (dominant frequency range: 1 to 6 kHz). Echolocation clicks recorded for this species indicate source levels ranging from 195 to 224 dB re 1 µPa-m peak-to-peak, dominant frequencies ranging from 20 to 60 kHz, and durations of 80 to 120 µs. Source levels associated with social sounds have been calculated to range from 131 to 168 dB re 1 µPa-m and have been demonstrated to vary with vocalization type (e.g., whistles: average source level of 140.2 dB re 1 µPa-m, variable calls: average source level of 146.6 dB re 1 µPa-m, and stereotyped calls: average source level 152.6 dB re 1 µPa-m). Additionally, killer whales modify their vocalizations depending on social context or ecological function (i.e., short-range vocalizations [<10 km, or 6.2 mile, range]) are typically associated with social and resting behaviors and long-range vocalizations [10 to 16 km, or 6.2 to 9.9 mile, range] associated with travel and foraging.

Acoustic studies of resident killer whales in British Columbia have found that they possess dialects, which are highly stereotyped, repetitive discrete calls that are group-specific and are shared by all group members. These dialects are likely used to maintain group identity and cohesion and may serve as indicators of relatedness that help in the avoidance of inbreeding between closely related whales. Dialects have been documented in northern Norway and southern Alaskan killer whales populations and likely occur in other regions as well. Both behavioral and ABR techniques indicate killer whales can hear a frequency range of 1 to 100 kHz and are most sensitive at 20 kHz, which is one the lowest maximum-sensitivity frequency known among toothed whales.

Occurrence in NSWC PCD Study Area – Killer whale sightings in the northern GOM are generally clumped in a broad region south of the Mississippi River Delta and in waters ranging in bottom depth from 256 to 2,652 m (840 to 8,701 ft). Based on this information, killer whales are expected to occur in an area south of the Mississippi River Delta from the shelf break into waters with an approximate bottom depth of 2,000 m (6,562 ft). Sightings have been made in waters over the continental shelf (including close to shore) as well as in waters past the 2,000-m (6,562-ft) isobath. There is a low or unknown possibility of encountering killer whales anywhere in the GOM (besides the before-mentioned area of expected occurrence) shoreward of the 10-m (33-ft) isobath. Occurrence patterns are assumed to be similar for all seasons.

Long-Finned and Short-Finned Pilot Whales (*Globicephala* sp.)

Description **–** Pilot whales are among the largest members of the dolphin family. The long-finned pilot whale (*Globicephala melas*) may reach 5.7 m (18.7 ft) (females) and 6.7 m (22 ft) (males) in length, whereas the short-finned pilot whale (*G. macrorhynchus*) may attain lengths of 5.5 m (18 ft) (females) and 6.1 m (20 ft) (males).

Distinguishing between the two species of pilot whales is difficult in the field. As the names imply, proportional flipper lengths in the two species generally differ. In long-finned pilot whales, the flippers are generally 20 percent of the total body length. In short-finned pilot whales, the flippers are typically about 17 percent of the total body length. Both pilot whale species feed primarily on squid but also take fish.

Status **–** For short-finned pilot whales in the GOM, the best estimate of abundance is 2,388, with a minimum population estimate of 1,628 animals (Waring et al., 2006). Long-finned pilot whales are considered extralimital in the GOM.

Distribution **–** Long-finned pilot whales occur in temperate and subpolar waters. The short-finned pilot whale is found worldwide in tropical and warm-temperate seas, generally in deep offshore areas. The short-finned pilot whale usually does not range north of 50ºN or south of 40ºS. The apparent ranges of the two pilot whale species overlap in shelf/shelf-edge and slope waters of the northeastern United States between 35ºN and 38º to 39ºN (or from New Jersey to Cape Hatteras, North Carolina).

Pilot whales are found in both nearshore and offshore environments. Pilot whales are found over the continental shelf break, in slope waters, and in areas of high topographic relief. Pilot whales are sometimes seen in waters over the continental shelf. A number of studies have found the distribution and movements of pilot whales to coincide closely with the abundance of squid. The occurrence of pilot whales in the Southern California Bight was found to be associated with high relief topography, which has been related to the squid-feeding habits of pilot whales. This is likely the case in other geographic locations. Only the short-finned pilot whale is known in the GOM. Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – Pilot whales are deep divers; foraging dives deeper than 600 m (1,969 ft) are recorded. Pilot whales are able to stay submerged for up to 40 min.

Acoustics and Hearing **–** Short-finned pilot whale whistles and clicks have a dominant frequency range of 2 to 14 kHz and 30 to 60 kHz, respectively, at an estimated source level of 180 dB re 1 µPa-m. There are no hearing data available for either pilot whale species.

Occurrence in NSWC PCD Study Area **–** The identifications of many pilot whale specimen records in the GOM, and most or all sightings, have not been unequivocally shown to be of the short-finned pilot whale. There are no confirmed records of long-finned pilot whales in the GOM. Based on known distribution and habitat preferences of pilot whales, it is assumed that all of the pilot whale records in the northern GOM are of the short-finned pilot whale.

Based on sightings and the apparent preference of pilot whales for steep bottom topography, this species is expected to occur from the continental shelf break to the 2,000-m (6,562-ft) isobath in the NSWC PCD Study Area. There is a low or unknown occurrence of pilot whales between the 10-m (33-ft) isobath and the shelf break, east of Cape San Blas, Florida, past the Florida Keys. There is a low or unknown occurrence of pilot whales between the 2,000 and 3,000-m (6,562- and 9,843-ft) isobath. Pilot whales do have an oceanic distribution, and the few shipboard surveys that have occurred past the 2,000-m (6,562-ft) isobath have occasionally recorded pilot whales.

There is a preponderance of pilot whale sightings in the historical records for the northern GOM. Pilot whales, however, are less often reported during recent surveys, such as GulfCet (DON, 2003). The reason for this apparent decline is not known, but it has been suggested that abundance or distribution patterns might have changed over the past few decades, perhaps due to changes in available prey species. Occurrence patterns are assumed to be the same throughout the year.

West Indian Manatee (*Trichechus manatus*)

Description – There are two geographically separated subspecies of West Indian manatee: the Florida manatee (*Trichechus manatus latirostris*) and the Antillean manatee (*Trichechus manatus manatus*). The manatee is a rotund, slow-moving animal, which reaches a maximum length of 3.9 m (13 ft). The manatee has a small head, a squarish snout with fleshy mobile lips, and two semicircular nostrils at the front. The tail is horizontal and rounded. The body is gray or gray-brown and covered with fine hairs that are sparsely distributed. The back is often covered with distinctive scars from boat propeller cuts. Manatees are predominantly herbivores that feed opportunistically on a wide variety of submerged, floating, and emergent vegetation, but they also preferentially ingest invertebrates.

Status – The Florida Fish and Wildlife Conservation Commission (FWC) coordinates a series of aerial surveys and ground counts one to three times each winter in Florida to determine the number of manatees statewide (USFWS, 2007). The best, current, minimum population estimate of the statewide manatee population is approximately 3,300 animals based on a single statewide count at warm-water refuges and adjacent areas in January 2001 (USFWS, 2007). In the most recent revision of the manatee recovery plan, it was concluded that based on data on manatee movement patterns, Florida manatees should be divided into four relatively discrete management units or subpopulations, each representing a significant portion of the species' range.

West Indian manatees are currently classified as endangered under the ESA, and are therefore considered depleted under the MMPA. The U.S. Fish and Wildlife Service (USFWS) recently concluded the overall population of the Florida Manatee has increased and the Antillean manatee levels are stable, and neither subspecies is currently in danger of becoming extinct within all or a significant portion of their range. As, such, the USFWS has recently recommended that this species be reclassified from endangered to threatened (USFWS, 2007).

Several different mathematical models have been created in an attempt to model the dynamics of Florida manatee populations (Runge et al. 2007). One model, the manatee core biological model, was developed to forecast population dynamics and describe the life history of the

Florida manatee in four separate regions of Florida (Atlantic, Southwest, Upper St. Johns and Northwest) (Runge et al. 2007). This model found that under current levels of threats, including the anticipated loss of warm-water, the statewide manatee population has a low probability of extinction and a substantial shift in the regional distribution of manatees within the state is likely (Runge et al. 2007).

In 1976, critical habitat was designated for the manatee in Florida. The designated area included all of the manatee's known range at that time (including waterways throughout about one-third to one-half of Florida). This critical habitat designation has been infrequently used or referenced since it is broad in description, treats all waterways the same, and does not highlight any particular areas. There are two types of manatee protection areas in the state of Florida: manatee sanctuaries and manatee refuges. Manatee sanctuaries are areas where all waterborne activities are prohibited while manatee refuges are areas where activities are permitted but certain waterborne activities may be regulated.

Distribution – West Indian manatees occur in warm, subtropical and tropical waters of the western North Atlantic from the southeastern United States to Central and northern South America, the Caribbean, and the West Indies, primarily in freshwater systems, estuaries, and shallow, nearshore, coastal waters. Manatees occur along both the Atlantic and Gulf coasts of Florida. Manatees are sometimes reported in the Florida Keys; these sightings are typically in the upper Florida Keys, with some reports as far south as Key West. Manatees along the Atlantic coast exhibit several different patterns of seasonal movement, ranging from year-round residents to long-distance migrants. Manatees have been found to be highly consistent in their seasonal movement patterns over time and showed strong fidelity to warm season and winter ranges both within and across years. Historically, manatees were probably restricted to southernmost Florida during the winter, expanding their distribution northward in the summer. Industrial development has created warm-water refuges (e.g., power plant effluent plumes) for the manatee, even in winter, while the introduction of several exotic aquatic plant species expanded the available food supply; both factors enabled the manatee population to expand its winter range. The Wakulla River is the northern limit of the manatee's typical warm-season range on the Gulf Coast.

Sightings of manatees are usually restricted to warm freshwater, estuarine, and extremely nearshore coastal waters. Shallow grass beds with ready access to deep channels are preferred feeding areas in coastal and riverine habitats. Manatees often use secluded canals, creeks, embayments, and lagoons, particularly near the mouths of coastal rivers and sloughs, for feeding, resting, mating, and calving. Estuarine and brackish waters and natural and artificial freshwater sources are sought by manatees. A biological status review of the Florida manatee was completed in April 2006. In this report, the extent of occurrence of this species included all areas within large bays, estuaries, and rivers plus remaining areas lying between the shoreline and the 3.7-m (12-ft) depth contour for the entire State of Florida (Haubold et al., 2006). The report indicated the Florida manatee can occur in waters deeper than 3.7 m (12 ft), but survey data suggests the majority of this species occurs in relatively shallow waters (Haubold et al., 2006). However, although manatees are expected to inhabit nearshore areas, some have been sighted offshore as well, indicating that some individuals are capable of wide-ranging movements.

Florida manatees are generally restricted to peninsular Florida due to their inability to thermoregulate and their need for warm water to survive the winter (USFWS, 2007). Specifically, during the months of December through February, manatees seek shelter from the cold at a limited number of warm-water sites or areas in the southern two-thirds of Florida (USFWS, 2007). These aggregation sites include eight principal power plant thermal outfalls (five on the Atlantic coast, three on the Gulf coast) and four major artesian springs (Blue Spring, Crystal River, Homosassa Springs, and Warm Mineral Springs) that are frequented by a large proportion of the manatees counted during synoptic surveys (USFWS, 2007). Some winter aggregations can number in the hundreds. Other industrial outfalls, smaller springs, and passive thermal basins that retain heat longer than ambient waters provide additional secondary warm-water habitat for manatees (USFWS, 2007). From March through November, manatees disperse throughout the coastal waters, estuaries, and major rivers of Florida. Some migrate to neighboring states, particularly southeastern Georgia and there are reports of some individuals traveling as far north as Massachusetts and west to Texas (USFWS, 2007). Additional information on reproductive areas and seasons is not available for this species.

Diving Behavior – Manatees are shallow divers. The distribution of preferred seagrasses is mostly limited to high-light areas; therefore, manatees are fairly restricted to shallower near-shore waters (Wells et al., 1999). It is unlikely that manatees descend much deeper than 20 m (66 ft), and don't usually remain submerged for longer than 2 to 3 minutes. However, when bottom resting, manatees have been known to stay submerged for up to 24 minutes (Wells et al., 1999).

Acoustics and Hearing – West Indian manatees produce a variety of squeak-like sounds that have a typical frequency range of 0.6 to 12 kHz (dominant frequency range from 2 to 5 kHz), and last 0.18 to 0.9 sec. Recently, vocalizations below 0.1 kHz have also been recorded. Overall, manatee vocalizations are considered relatively stereotypic, with little variation between isolated populations examined. However, vocalizations have been newly shown to possess nonlinear dynamic characteristics (e.g., subharmonics or abrupt, unpredictable transitions between frequencies) aid in individual recognition and mother-calf communication. Average source levels for vocalizations have been calculated to range from 90 to 138 dB re 1 μPa (average: 100 to 112 dB re 1 μPa).

Audiogram work suggests that manatees may hear better than originally suggested. Manatees have high-frequency sensitivity, narrow critical bands, and pulsed broadband calls. Behavioral data on two animals indicate an underwater hearing range of approximately 0.4 to 46 kHz, with best sensitivity between 16 and 18 kHz (50 dB re 1 μPa-m), while earlier electrophysiological studies indicated best sensitivity from 1 to 1.5 kHz.

Occurrence in NSWC PCD Study Area – During warmer months, manatees are common along the Gulf Coast of Florida from the Everglades National Park northward to the Suwannee River in northwestern Florida, and are less common farther westward. In winter, the GOM subpopulations move southward to warmer waters. The winter range is restricted to waters at the southern tip of Florida and to waters near localized warm-water sources, such as power plant outfalls and natural springs in west-central Florida. Crystal River in Citrus County is typically the northern limit of the manatee's winter range on the Gulf Coast. Manatees are uncommon west of the Suwannee River in Florida and are infrequently found as far west as Texas. The

Florida Gulf Coast population of manatees is estimated to be approximately 1,520 individuals (USFWS, 2001b). This species occurs in nearshore waters to the east of the NSWC PCD Study Area, and the probability of encountering manatees in the NSWC PCD Study Area is highly unlikely.

F.6 SEA TURTLES

Green Sea Turtle (*Chelonia mydas*)

The green turtle is the largest hard-shelled sea turtle; adults commonly reach 100 cm (39.4 in) in carapace (shell) length and 180 kg (397 lbs) in weight. Green turtles are classified as threatened under the ESA, with the Florida and Mexican Pacific coast nesting populations listed as endangered. Green turtles found in the southeastern Atlantic Coast OPAREAs are likely a mix of offspring from both threatened and endangered nesting populations in the western North Atlantic Ocean and GOM. Due to the inability to distinguish between these populations away from the nesting beach, green turtles are considered endangered wherever they occur in U.S. waters. There are no current estimates of abundance for green turtle populations in the western North Atlantic Ocean.

Green turtles are distributed worldwide in tropical and subtropical waters. In U.S. Atlantic and GOM waters, greens are found around the U.S. Virgin Islands, Puerto Rico, and along the continental United States from Texas to Massachusetts. Adults are predominantly tropical and are only occasionally found north of southern Florida. Most sightings are of juveniles and occur north of Florida between late spring and early fall. Small numbers of juveniles regularly occur as far north as Long Island Sound, New York. Green turtle nesting in North America occurs in southern Florida and Mexico, with scattered records in the Florida Panhandle, Alabama, Georgia, and the Carolinas.

Post-hatchling green turtles are believed to reside in oceanic waters for a period of three to seven years. Once green turtles reach a carapace length of 20 to 25 cm (7.9 to 9.8 in), they migrate to shallow nearshore areas (less than 50 m [164 ft] in depth) where they spend the majority of their lives as late juveniles and adults. The optimal habitats for benthic-stage juveniles and adults are warm waters that (1) are quiet and shallow, (2) possess an abundance of submerged vegetation (seagrass and/or algae), and (3) are located in close proximity to nearshore reefs or rocky areas that are used for resting. The optimal feeding habitats for green turtles in the continental United States include waters in Florida (such as the Indian River Lagoon, Florida Keys, Florida Bay, Homosassa Springs, Crystal River, and Cedar Keys) and southern Texas (such as the Laguna Madre Complex). The inshore waters of North Carolina are also an important feeding habitat for juveniles of this species.

Green turtles typically make dives shallower than 30 m (98 ft); however, a maximum dive depth of 110 m (361 ft) has been recorded in the Pacific Ocean). The maximum dive time recorded for a subadult green turtle is 66 minutes (min), with routine dives ranging from 9 to 23 min.

Occurrence in NSWC PCD Study Area – East of the mouth of the Mississippi River, green sea turtles are expected to occur throughout the year in waters that are less than 50 m (164 ft) deep. The vast majority of winter and spring sightings off the southern coast of Alabama and the

summer and fall sightings off the southwestern coast of Florida occur shoreward of the 50-m (164-ft) isobath. Due to the green sea turtle's high preference for shallow water habitats along the southwestern coast of Florida, its year-round occurrence is concentrated in waters less than 50 m (164 ft) deep around the southeastern tip of Florida, the Florida Keys, and the Dry Tortugas. The area of concentrated occurrence also includes waters less than 10 m (32.8 ft) deep off western Florida as far north as Cedar Keys.

The occurrence of green sea turtle is low/unknown during all seasons in waters of the NSWC PCD Study Area deeper than 50 m (164 ft) and west of the mouth of the Mississippi River. This low/unknown occurrence is mainly a result of low survey effort in these areas. In addition, repeated surveys of deeper waters off Naples, Florida produced no green sea turtle sightings in waters beyond the 50-m (164-ft) isobath. Green Sea turtles found in deeper waters are likely post-hatchlings that are entrained in the Gulf Stream or older individuals migrating between foraging and nesting grounds. Green sea turtles have been seen in the open ocean more than 1,600 km (863.4 NM) from land and can likely traverse an entire ocean basin during their life cycle. However, since the primary food source of these animals is often restricted to shallow water habitats, most individuals use nearshore, rather than offshore, migration routes on their way to the primary foraging grounds.

Hawksbill Sea Turtles (*Eretmochelys imbricata*)

The hawksbill turtle is a small- to medium-sized sea turtle. Adults range between 65 and 90 cm (26 and 35 in) in carapace length and typically weigh around 80 kg (176 lbs). Hawksbill turtles are listed as endangered under the ESA and are second only to Kemp's ridley turtles in terms of endangerment. Hawksbill populations in the western North Atlantic Ocean are considered greatly depleted. In U.S. waters, hawksbill populations are noted as neither declining nor showing indications of recovery. Little is known about the abundance of this species along the U.S. Atlantic coast.

Hawksbill turtles are distributed worldwide and appear to be the most confined of all the sea turtles to tropical waters. In the western North Atlantic Ocean, hawksbills are found in the GOM, the Caribbean Sea, and along the southern coast of Florida. Although encounters north of southern Florida are rare, accidental occurrences have been documented as far north as New England. Hawksbill nesting within the continental United States is restricted to beaches in southern Florida and the Florida Keys, although even there, it is extremely rare. However, hawksbill nesting in these areas may be underestimated due to the masking effects of thousands of loggerheads that nest along the same stretches of beach.

Hawksbill turtles inhabit oceanic waters as post-hatchlings and small juveniles, where they are sometimes associated with floating patches of *Sargassum*. Hawksbills recruit to benthic foraging grounds when they are 20 to 25 cm (8 to 10 in) in length. The primary feeding habitats of benthic-stage juveniles and adults are tropical, nearshore waters that are associated with coral reefs or mangroves. Sponges, the preferred prey of hawksbills, are very abundant in these areas. Hawksbills are seldom found in waters deeper than 20 m (66 ft), unless they are in transit between foraging and nesting grounds. Major foraging populations in U.S. waters occur in the vicinity of the coral reefs surrounding Mona Island, Puerto Rico, and Buck Island (St. Croix,

U.S. Virgin Islands). Smaller populations of hawksbills reside in the hard-bottom habitats that surround the Florida Keys and other small islands in Puerto Rico and the U.S. Virgin Islands.

Hawksbills may have one of the longest routine dive times of all the sea turtles. Internesting females at Buck Island averaged 56.1-min dives, with a maximum dive time of 73.5 min. The mean surface time was about 2 min. Average dives during the day ranged from 34 to 65 min, while those at night were between 42 and 74 min. Data from time-depth recorders have indicated that foraging dives of immature hawksbills in Puerto Rico range from 8.6 to 14 min in duration and have a mean depth of 4.7 m (15.4 ft). These individuals were found to be most active during the day and mostly inactive at night.

Occurrence in NSWC PCD Study Area – As indicated by the available sighting data and the scientific literature on habitat preferences, the hawksbill, like the green sea turtle, inhabits the shallow nearshore waters off of southern Florida year-round. Hawksbill occurrence in the NSWC PCD Study Area and vicinity is expected during all seasons in waters less than 50 m (164 ft) in depth from the Florida Keys to waters just northwest of Tampa Bay. The area of expected occurrence tapers off to the coastline in the area where the northernmost stranding records occur. The existence of coral reef and hard-bottom habitats in the waters off southern Florida should incite populations of juvenile and adult hawksbills to feed there. Waters to the north and west are designated as areas of low/unknown occurrence.

Although hawksbills are common inhabitants of the coastal waters off southern Florida and Texas, they are rarely observed as far north as the waters off the Florida Panhandle, Alabama, Mississippi, and Louisiana (Rester and Condrey, 1996). The sightings of hawksbill sea turtles in the GOM are almost always of post-hatchlings or juveniles that have originated from nesting beaches in Mexico. Scientists know relatively little about the oceanic distribution of this species in the western Atlantic Ocean aside from records of hatchlings associated with *Sargassum* mats and long-distance tag returns from migrating females.

Loggerhead Sea Turtles (*Caretta caretta*)

The loggerhead turtle is a large, hard-shelled sea turtle. The mean straight carapace length of adult loggerheads is approximately 92 cm (36 in); the average weight is 115 kg (254 lbs). This species is listed as threatened under the ESA. There is no available estimate of the size of the loggerhead population in the western North Atlantic Ocean. The loggerhead is the most abundant sea turtle occurring in U.S. waters, numbering in the thousands throughout inner continental shelf waters of the Atlantic coast from Cape Cod to southern Florida and the Gulf coast from southern Florida to southern Texas.

In the continental United States, there are three demographically independent loggerhead nesting groups or subpopulations: (1) Northern: North Carolina, South Carolina, Georgia, and northeast Florida (approximately 7,500 nests in 1998); (2) South Florida: occurring from 29°N on the east coast to Sarasota on the west coast (approximately 83,400 nests in 1998); and (3) Florida Panhandle: Eglin Air Force Base (AFB) and the beaches near Panama City, Florida (approximately 1,200 nests in 1998). A small but significant nesting aggregation is also known from the Dry Tortugas off the Florida Keys. The south Florida nesting subpopulation is the largest loggerhead rookery in the Atlantic Ocean (approximately 83,400 nests in 1998) and is the

second largest in the world. Nesting trends indicate that the number of nesting females associated with the south Florida subpopulation is increasing. However, environmental groups have recently petitioned for both the Northern and Florida Panhandle nesting subpopulations to be uplisted to endangered due to continually decreasing numbers of nesting females over the past decade.

The loggerhead turtle occurs worldwide in habitats ranging from coastal estuaries to waters far beyond the continental shelf. Loggerheads are primarily oceanic as post-hatchlings and early juveniles, often occurring in *Sargassum* drift lines where they are transported throughout the ocean by dominant currents. In the North Atlantic Ocean, it is hypothesized that early juvenile loggerheads inhabit the pelagic zone of the North Atlantic Gyre system. As the pelagic zone immatures, loggerheads apparently then shift to a different midwater feeding habitat; in the eastern North Atlantic Ocean, it is believed to be the waters surrounding the Azores and Madeira (islands off the southwest coast of Europe and the northwest coast of Africa). Genetic evidence has shown that pelagic-feeding loggerheads found off the Azores are often derived from the southeast U.S. nesting population. After reaching a certain size, early juvenile loggerheads will then make a transoceanic crossing back towards the western Atlantic Ocean. As later juveniles and adults, loggerheads most often occur on the continental shelf and shelf edge of the U.S. Atlantic and Gulf coasts; they are also known to inhabit coastal estuaries and bays along both coasts.

Immature benthic-feeding loggerheads are the predominant age class found along the Atlantic and Gulf coasts of the U. S. Based on the sighting records, the entire continental shelf south of southern New England should be considered a loggerhead turtle feeding habitat. Later developmental habitat for loggerheads includes lagoons, estuaries, bays, river mouths, and coastal waters typically less than 100 m (328 ft) deep. Based on growth models, immature loggerheads may occupy coastal feeding grounds for 20 years before their first reproductive migration.

On average, loggerhead turtles spend over 90 percent of their time underwater. Routine dive depths of 9 to 22 m (29.5 to 72 ft) have been recorded, and dives of up to 233 m (764 ft) have been recorded for a post-nesting female loggerhead. Routine dives typically last from 4 to 172 min.

Occurrence in NSWC PCD Study Area – Throughout the year, loggerheads are the most often sighted and stranded species of sea turtle in the NSWC PCD Study Area and vicinity. The combination of sighting data and information on habitat preferences helps to demonstrate that loggerhead sea turtle occurrence is concentrated during all seasons in waters with a bottom depth of 50 m (164 ft) or less east of the mouth of the Mississippi River. The abundance of loggerheads in nearshore waters west of the Mississippi River is likely lower for two reasons. First, adult loggerheads seldom use the beaches of eastern Texas and western Louisiana as nesting habitats. Second, juveniles do not use the northwestern GOM as extensively as they use the northeastern GOM for development habitat. However, loggerhead sea turtles may be associated with the many offshore oil platforms west of the NSWC PCD Study Area, although they are more often documented in association with artificial reef structures off of Florida.

Over the past decade, scientists have studied both the movements and nesting activity of adult female loggerheads in the GOM region. Satellite tagging data from post-nesting loggerheads show that adult females exhibit both short- and long-range movements within the GOM. In Florida's west-central counties, nesting is minimal if not nonexistent, due to the prevalence of salt marsh habitats along that part of Florida's coastline. The vast majority of loggerhead nests in the GOM region are laid in Florida's southwestern counties, with Sarasota and Charlotte counties boasting nest densities of 57.8 and 36.4 nests/km, respectively; this is more than double that of any other county in western Florida.

Loggerhead sea turtles are not as dependent upon nearshore waters as the greens and hawksbills; thus, the expected distribution of loggerheads extends from the shoreline past the continental shelf break into waters of the continental slope as deep as 2,000 m (6,562 ft). Beyond this depth, loggerhead occurrence is low/unknown due to potential associations of hatchlings with *Sargassum* and the possibility that adults are occupying mid-ocean habitats as they travel to and from nesting beaches and foraging grounds in the Atlantic Ocean and Caribbean Sea.

Kemp's Ridley Sea Turtles (*Lepidochelys kempi*)

The Kemp's ridley seas turtle is the smallest living sea turtle. The straight carapace length is approximately 65 cm (26 in); adult Kemp's ridley shells are almost as wide as they are long. Kemp's ridley turtles are listed as endangered under the ESA and are considered the most imperiled of the world's sea turtles. The worldwide population of Kemp's ridley sea turtle declined in numbers from tens of thousands of nesting females in the late 1940s to approximately 300 nesting females in 1985. From 1985 to 1999, the number of nests at Rancho Nuevo, Tamaulipas, on the eastern coast of Mexico (the primary and most important Kemp's ridley nesting beach) and nearby beaches has increased at a mean rate of 11.3 percent per year. Current totals at these beaches exceed 3,000 nests per year. No population estimates exist for Kemp's ridleys in the western North Atlantic Ocean.

The Kemp's ridley turtle is unique among sea turtles in that it is restricted to the North Atlantic Ocean as post-hatchlings and small juveniles, but as large juveniles and adults, it moves to benthic nearshore feeding grounds along the U.S. Atlantic and Gulf coasts. Adults occur primarily in the GOM, while moderate numbers of juveniles occur along the Atlantic coast of North America as far north as Nova Scotia, Canada. Kemp's ridleys are likely only found along the mid-Atlantic coast of the U. S. from spring to fall, but they may be found along the south Atlantic and Gulf coasts year-round. Kemp's ridley nests primarily on a single beach at Rancho Nuevo, Tamaulipas, Mexico, although additional nesting activity has been documented in Texas, Florida, South Carolina, and North Carolina. It is likely that several of the Kemp's ridleys that currently nest in the continental United States are individuals hatched during the experimental imprinting and head-start project conducted by NMFS at South Padre Island, Texas (Bowen et al., 1994).

Kemp's ridley turtles occur in open-ocean and *Sargassum* habitats of the North Atlantic Ocean as post-hatchlings and small juveniles. Once they reach a size of approximately 20 to 30 cm (8 to 12 in), they migrate to shallow, nearshore (bottom depth less than 50 m [164 ft]) feeding grounds along the U.S. Atlantic and Gulf coasts, where they spend the majority of their lives as large juveniles and adults. The nearshore habitats in the continental United States that are frequently

used by Kemp's ridleys include warm-temperate to subtropical sounds, bays, estuaries, tidal passes, shipping channels, and beachfront waters where their preferred food, the blue crab (*Callinectes sapidus*), is known to exist. The highly suitable habitats identified for the Kemp's ridley turtle in the GOM include the western coast of Florida (particularly the Cedar Keys area), the eastern coast of Alabama (including Mobile Bay), the mouth of the Mississippi River, and the coastal waters off western Louisiana and eastern Texas. The movements of juveniles have been documented within and among preferred habitats along both the Atlantic and Gulf coasts.

Few data are available on the maximum dive duration. Satellite-tagged juvenile Kemp's ridley turtles show different mean surface intervals and dive depths depending on whether they are located in shallow coastal areas (short surface intervals) or in deeper, offshore areas (longer surface intervals). Dive times range from a few seconds to a maximum of 167 min; routine dives last between 16.7 and 33.7 min. Kemp's ridleys will spend between 89 and 96 percent of that time submerged.

Occurrence in NSWC PCD Study Area – Based upon the above information, as well as the available survey and satellite tagging data, Kemp's ridley sea turtles are expected to occur year-round in all waters of the NSWC PCD Study Area and in the vicinity of waters less than 50 m (164 ft) deep. Unlike the green sea turtle, the area of expected occurrence for this species also encompasses nearshore waters west of the mouth of the Mississippi River, due to the fact that the coastal waters off western Louisiana and eastern Texas are known benthic-feeding habitats. Also, nearly all Kemp's ridleys occurring in the GOM originate from nesting beaches along the western GOM.

Throughout much of the year, the shallow nearshore waters of the northern GOM are habitats of medium suitability, or higher, for this species. However, beyond the 50-m (164-ft) isobath the habitat suitability of waters in the GOM declines dramatically, with waters becoming unsuitable a slight distance seaward of the continental shelf break. There is a low/unknown occurrence of this species in NSWC PCD Study Area waters beyond the 50-m (164-ft) isobath.

Leatherback Sea Turtles (*Dermochelys coriacea*)

The leatherback turtle is the largest living sea turtle. Adult carapace lengths range from 130 to 180 cm (4 to 6 ft), with a maximum of 256.5 cm (8.4 ft). Adult leatherbacks weigh between 200 and 700 kg (441 and 1,543 lbs). Leatherback turtles are listed as endangered under the ESA. There are an estimated 20,000 to 30,000 leatherbacks in the North Atlantic Ocean. Nesting populations in the United States are believed to be increasing due to heightened protection and monitoring of the nesting habitat over the past 20 years.

The leatherback turtle is distributed worldwide in tropical and warm-temperate waters throughout the year and into cooler temperate waters during warmer months. Leatherbacks in the western North Atlantic Ocean are broadly distributed from the Caribbean region to as far north as Nova Scotia, Newfoundland, Labrador, Iceland, the British Isles, and Norway. This species migrates further and moves into cold waters more than any other sea turtle species. It is also the most oceanic and wide-ranging of sea turtles, undertaking extensive migrations along depth contours for hundreds, even thousands, of kilometers. Along the U.S. Atlantic and Gulf coasts, leatherback nesting occurs on the beaches of Florida and Georgia. Once the nesting season is

over, leatherbacks leave the waters adjacent to their nesting grounds for feeding grounds further north.

There is limited information about the entirely oceanic distribution of post-hatchling and early juvenile leatherbacks. What is known is that these life stages are restricted to waters with temperatures greater than 26°C (79°F), and they are likely not associated with *Sargassum* in contrast to the other four sea turtle species found in U.S. waters. Late juvenile and adult leatherback turtles are known to range from mid-ocean to the continental shelf and nearshore waters. Juvenile and adult foraging habitats include both coastal feeding areas in temperate waters and offshore feeding areas in tropical waters. The distribution and movement of adult leatherbacks appear to be linked to the seasonal availability of their prey and the requirements of their reproductive cycle.

The leatherback is the deepest diving sea turtle. The average dive depths from tagging studies off the continental shelf of St. Croix are 35 to 122 m (115 to 400 ft), with estimated maximum depths of over 1,000 m (3,281 ft). Typical dive durations average 6.9 to 14.5 min per dive, with a maximum of 42 min. Routine dive lengths for leatherbacks around St. Croix can range from 4 to 14.5 min. The maximum known dive length is 7.7 min for a subadult leatherback.

Occurrence in NSWC PCD Study Area – The leatherback is the most oceanic of all sea turtle species occurring in the NSWC PCD Study Area and vicinity, occurring most commonly in waters beyond the 50-m (164-ft) isobath. Leatherbacks use the offshore waters of the NSWC PCD Study Area (especially waters in the vicinity of DeSoto and Mississippi Canyons) for feeding and resting as well as for migratory corridors. However, off southwestern Florida, the leatherback is also expected to occur in shallower waters, as evidenced by aerial surveys off Naples, Florida, in which eight of nine leatherbacks sightings occurred in waters less than 50 m (164 ft) deep. Although these sightings occurred during the latter part of the year (June, August, October, and December), it is possible that the summer sightings were of nesting females.

In the northern GOM, leatherbacks are rare inhabitants of shallow-water environments. Several leatherbacks, however, have been spotted in the nearshore waters off Pensacola, Florida, feeding on dense aggregations of jellyfish. Several leatherbacks have also been sighted in the shallow waters off the Mississippi River Delta over the course of three seasons; the presence of these individuals was also likely associated with an abundance of jellyfish in the area. Leatherbacks may enter the shallow waters of the northern GOM on rare occasions to nest. Low levels of annual leatherback nesting have been documented on the beaches of Bay, Franklin, and Gulf counties in the Florida Panhandle. Therefore, the occurrence of leatherbacks in waters less than 50 m (164 ft) deep, and north of Charlotte Harbor, is low or unknown, rather than not expected. The distribution of sighting records in the NSWC PCD Study Area and vicinity depicts a pattern of leatherback occurrence in the GOM that is the same year-round, as there are similar numbers of records for winter, summer, and fall (the three seasons with the most survey effort).

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APPENDIX G

MARINE MAMMAL STRANDING REPORT

MARINE MAMMAL STRANDING REPORT

G.1 WHAT IS A STRANDED MARINE MAMMAL?

When a live or dead marine mammal swims or floats onto shore and becomes "beached" or incapable of returning to sea, the event is termed a "stranding" (Geraci et al., 1999; Perrin and Geraci, 2002; Geraci and Lounsbury, 2005; National Marine Fisheries Service [NMFS], 2007). The legal definition for a stranding within the United States is that "(A) a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water, is in need of apparent medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance." (16 United States Code [U.S.C.] 1421h).

The majority of animals that strand are dead or moribund (NMFS, 2007). For those that are alive, human intervention through medical aid and/or guidance seaward may be required for the animal to return to the sea. If unable to return to sea, rehabilitation at an appropriate facility may be determined as the best opportunity for animal survival.

Three general categories can be used to describe strandings: single, mass, and unusual mortality events. The most frequent type of stranding is a single stranding, which involves only one animal (or a mother/calf pair) (NMFS, 2007).

Mass stranding involves two or more marine mammals of the same species other than a mother/calf pair (Wilkinson, 1991), and may span one or more days and range over several miles (Simmonds and Lopez-Jurado, 1991; Frantzis, 1998; Walsh et al., 2001; Freitas, 2004). In North America, only a few species typically strand in large groups of 15 or more and include sperm whales, pilot whales, false killer whales, Atlantic white-sided dolphins, white-beaked dolphins, and rough-toothed dolphins (Odell, 1987; Walsh et al., 2001). Some species, such as pilot whales, false killer whales, and melon-headed whales occasionally strand in groups of 50 to 150 or more (Geraci et al., 1999). All of these normally pelagic off-shore species are highly sociable and usually infrequently encountered in coastal waters. Species that commonly strand in smaller numbers (e.g., one to several individuals) include pygmy killer whales, common dolphins, bottlenose dolphins, Pacific white-sided dolphins, Frasier's dolphins, gray whales and humpback whales (West Coast only), harbor porpoises, Cuvier's beaked whales, California sea lions, and harbor seals (Mazzuca et al., 1999; Norman et al., 2004; Geraci and Lounsbury, 2005).

Unusual mortality events (UMEs) can be a series of single strandings or mass strandings, or unexpected mortalities (i.e., die-offs) that occur under unusual circumstances (Dierauf and Gulland, 2001; Harwood, 2002; Gulland, 2006; NMFS, 2007). These events may be interrelated: for instance, at-sea die-offs lead to increased stranding frequency over a short period of time,

generally within one to two months. As published by the NMFS, revised criteria for defining a UME include (Hohn et al., 2006):

(1) A marked increase in the magnitude or a marked change in the nature of morbidity, mortality, or strandings when compared with prior records.

(2) A temporal change in morbidity, mortality, or strandings is occurring.

(3) A spatial change in morbidity, mortality, or strandings is occurring.

(4) The species, age, or sex composition of the affected animals is different than that of animals that are normally affected.

(5) Affected animals exhibit similar or unusual pathologic findings, behavior patterns, clinical signs, or general physical condition (e.g., blubber thickness).

(6) Potentially significant morbidity, mortality, or stranding is observed in species, stocks or populations that are particularly vulnerable (e.g., listed as depleted, threatened or endangered or declining). For example, stranding of three or four right whales may be cause for great concern whereas stranding of a similar number of fin whales may not.

(7) Morbidity is observed concurrent with or as part of an unexplained continual decline of a marine mammal population, stock, or species.

Unusual environmental conditions are probably responsible for most UMEs and marine mammal die-offs (Vidal and Gallo-Reynoso, 1996; Geraci et al., 1999; Walsh et al., 2001; Gulland and Hall, 2005).

Table G-1 provides an overview of documented UMEs attributable to natural causes over the past four decades worldwide

Table G-1. Marine Mammal Unusual Mortality Events Attributed to or Suspected from Natural Causes 1978-2005

Year	Species and number	Location	Cause
1978	Hawaiian monk seals (50)	NW Hawaiian Islands	Ciguatoxin and maitotoxin
1979-80	Harbor seals (400)	Massachusetts	Influenza A
1982	Harbor seals	Massachusetts	Influenza A
1983	Multiple pinniped species	West coast of U.S., Galapagos	El Nino
1984	California sea lions (226)	California	Leptospirosis
1987	Sea otters (34)	Alaska	Saxitoxin
1987	Humpback whales (14)	Massachusetts	Saxitoxin
1987-88	Bottlenose dolphins (645)	Eastern seaboard (New Jersey to Florida)	Morbillivirus; Brevetoxin
1987-88	Baikal seals (80-100,000)	Lake Baikal, Russia	Canine distemper virus
1988	Harbor seals (approx 18,000)	Northern Europe	Phocine distemper virus
1990	Striped dolphins (550)	Mediterranean Sea	Dolphin morbillivirus
1990	Bottlenose dolphins (146)	Gulf Coast, U.S.	Unknown; unusual skin lesions observed
1994	Bottlenose dolphins (72)	Texas	Morbillivirus
1995	California sea lions (222)	California	Leptospirosis
1996	Florida manatees (149)	West Coast Florida	Brevetoxin
1996	Bottlenose dolphins (30)	Mississippi	Unknown; Coincident with algal bloom
1997	Mediterranean monk seals (150)	Western Sahara, Africa	Harmful algal bloom; Morbillivirus
1997-98	California sea lions (100s)	California	El Nino
1998	California sea lions (70)	California	Domoic acid
1998	Hooker's sea lions (60% of pups)	New Zealand	Unknown, bacteria likely
1999	Harbor porpoises	Maine to North Carolina	Oceanographic factors suggested
2000	Caspian seals (10,000)	Caspian Sea	Canine distemper virus
1999-2000	Bottlenose dolphins (115)	Panhandle of Florida	Brevetoxin
1999-2001	Gray whales (651)	Canada, U.S. West Coast, Mexico	Unknown; starvation involved
2000	California sea lions (178)	California	Leptospirosis
2000	California sea lions (184)	California	Domoic acid
2000	Harbor seals (26)	California	Unknown; Viral pneumonia suspected
2001	Bottlenose dolphins (35)	Florida	Unknown
2001	Harp seals (453)	Maine to Massachusetts	Unknown
2001	Hawaiian monk seals (11)	NW Hawaiian Islands	Malnutrition
2002	Harbor seals (approx. 25,000)	Northern Europe	Phocine distemper virus
2002	Multispecies (common dolphins, California sea lions, sea otters) (approx. 500)	California	Domoic acid
2002	Hooker's sea lions	New Zealand	Pneumonia
2002	Florida manatee	West Coast of Florida	Brevetoxin
2003	Multispecies (common dolphins, California sea lions, sea otters) (approx. 500)	California	Domoic acid

Year	Species and number	Location	Cause
2003	Beluga whales (20)	Alaska	Ecological factors
2003	Sea otters	California	Ecological factors
2003	Large whales (16 humpback, 1 fin, 1 minke, 1 pilot, 2 unknown)	Maine	Unknown; Saxitoxin and domoic acid detected in 2 of 3 humpbacks
2003-2004	Harbor seals, minke whales	Gulf of Maine	Unknown
2003	Florida manatees (96)	West Coast of Florida	Brevetoxin
2004	Bottlenose dolphins (107)	Florida Panhandle	Brevetoxin
2004	Small cetaceans (67)	Virginia	Unknown
2004	Small cetaceans	North Carolina	Unknown
2004	California sea lions (405)	Canada, U.S. West Coast	Leptospirosis
2005	Florida manatees, bottlenose dolphins (ongoing Dec 2005)	West Coast of Florida	Brevetoxin
2005	Harbor porpoises	North Carolina	Unknown
2005	California sea lions; Northern fur seals	California	Domoic acid
2005	Large whales	Eastern North Atlantic	Domoic acid suspected
2005-2006	Bottlenose dolphins	Florida	Brevetoxin suspected

Note: Data from Gulland and Hall (2007); citations for each event contained in Gulland and Hall (2007)

G.2 UNITED STATES STRANDING RESPONSE ORGANIZATION

Stranding events provide scientists and resource managers information not available from limited at-sea surveys, and may be the only way to learn key biological information about certain species such as distribution, seasonal occurrence, and health (Rankin, 1953; Moore et al., 2004; Geraci and Lounsbury, 2005). Necropsies are useful in attempting to determine a reason for the stranding, and are performed on stranded animals when the situation and resources allow.

In 1992, Congress passed the Marine Mammal Health and Stranding Response Act (MMHSRA) which authorized the Marine Mammal Health and Stranding Response Program (MMHSRP) under authority of the Department of Commerce, NMFS. The MMHSRP was created because of public concern over marine mammal mortalities. Its objectives are twofold: to formalize the response process and to focus efforts being initiated by numerous local stranding organizations.

Major elements of the MMHSRP include (NMFS, 2007):

- National Marine Mammal Stranding Network
- Marine Mammal UME Program
- National Marine Mammal Tissue Bank (NMMTB) and Quality Assurance Program
- Marine Mammal Health Biomonitoring, Research, and Development
- Marine Mammal Disentanglement Network
- John H. Prescott Marine Mammal Rescue Assistance Grant Program (a.k.a. the Prescott Grant Program)
- Information Management and Dissemination.

The United States has a well-organized network in the coastal states to respond to marine mammal strandings. Overseen by the NMFS, the National Marine Mammal Stranding Network is comprised of smaller organizations manned by professionals and volunteers from nonprofit organizations, aquaria, universities, and state and local governments trained in stranding response. Currently, more than 400 organizations are authorized by NMFS to respond to marine mammal strandings (NMFS, 2007).

NMFS Regions and Associated States and Territories

- NMFS Northeast Region- ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, VA
- NMFS Southeast Region- NC, SC, GA, FL, AL, MS, LA, TX, PR, VI
- NMFS Southwest Region- CA
- NMFS Northwest Region- OR, WA
- NMFS Alaska Region- AK
- NMFS Pacific Islands Region- HI, Guam, American Samoa, Commonwealth of the Northern Mariana Islands (CNMI)

Stranding reporting and response efforts over time have been inconsistent, although effort and data quality within the U.S. have been improving within the last 20 years (NMFS, 2007). Given the historical inconsistency in response and reporting, however, interpretation of long-term trends in marine mammal stranding is difficult (NMFS, 2007). During the past decade (1995 – 2004), approximately 40,000 stranded marine mammals (about 12,400 were cetaceans) have been reported by the regional stranding networks, averaging 3,600 reported strandings per year (Figure G-1; NMFS, 2007). The highest number of strandings was reported between the years 1998 and 2003. Detailed regional stranding information including most commonly stranded species can be found in Zimmerman (1991), Geraci and Lounsbury (2005), and NMFS (2007).

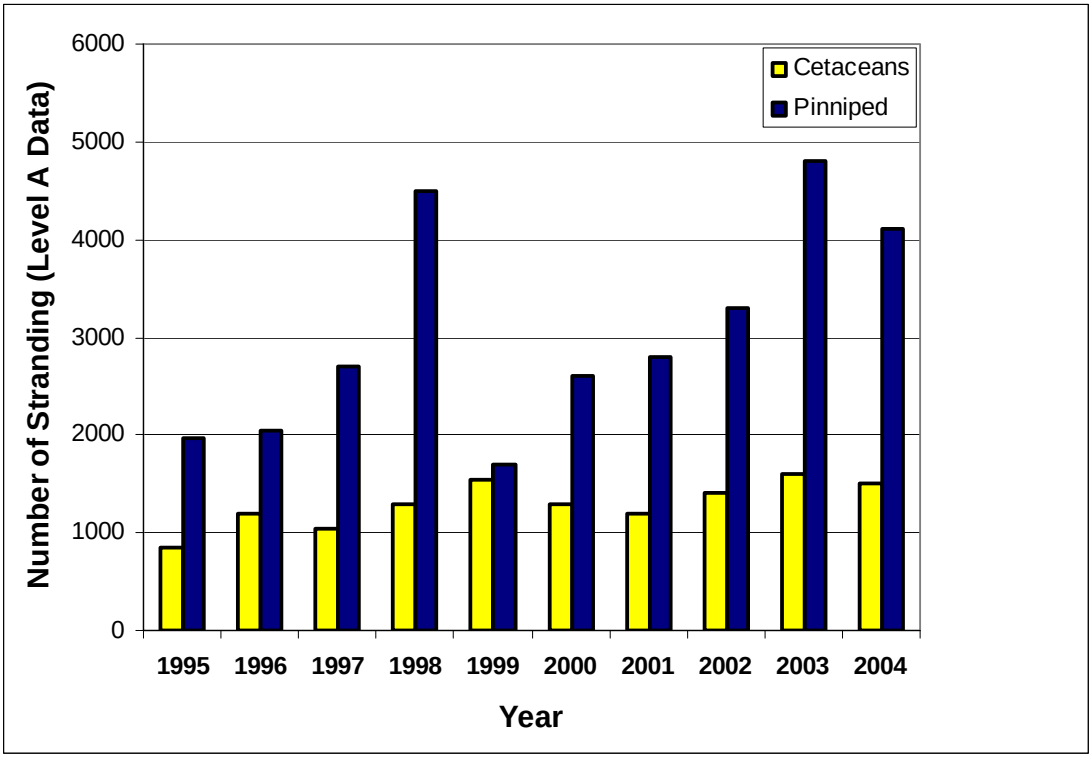


Figure G-1. United States Annual Cetacean and Pinniped Stranding Events from 1995-2004
(Source: NMFS 2007)

G.3 THREATS TO MARINE MAMMALS AND POTENTIAL CAUSES FOR STRANDING

Like any wildlife population, there are normal background mortality rates that influence marine mammal population dynamics, including starvation, predation, aging, reproductive success, and disease (Geraci et al., 1999; Carretta et al., 2007). Strandings may be reflective of this natural cycle or, more recently, may be the result of anthropogenic sources (i.e., human impacts). Current science suggests that multiple factors, both natural and man-made, may be acting alone or in combination to cause a marine mammal to strand (Geraci et al., 1999; Culik, 2002; Perrin and Geraci, 2002; Hoelzel, 2003; Geraci and Lounsbury, 2005; NRC, 2006). While post-stranding data collection and necropsies of dead animals are attempted in an effort to find a possible cause for the stranding, it is often difficult to pinpoint exactly one factor that is responsible for any given stranding. An animal suffering from one ailment becomes susceptible to various other influences because of its weakened condition, making it difficult to determine a primary cause. In many stranding cases, scientists never learn the exact reason for the stranding. Specific threats and potential stranding causes may include:

Natural Causes

- Disease
- Natural toxins
- Weather and climatic influences

- Navigation errors
- Social cohesion
- Predation

Anthropogenic (Human Influenced) Causes

- Fisheries interaction
- Vessel strike
- Pollution and ingestion
- Noise

G.4 NATURAL THREATS/STRANDING CAUSES

Overview

Significant natural causes of mortality, die-offs, and stranding discussed below include disease and parasitism; marine neurotoxins from algae; navigation errors that lead to inadvertent stranding; and climatic influences that impact the distribution and abundance of potential food resources (i.e., starvation). Other natural mortality not discussed in detail includes predation by other species such as sharks (Cockcroft et al., 1989; Heithaus, 2001), killer whales (Constantine et al., 1998; Guinet et al., 2000; Pitman et al., 2001), and some species of pinniped (Hiruki et al., 1999; Robinson et al., 1999).

Disease

Like other mammals, marine mammals frequently suffer from a variety of diseases of viral, bacterial, and fungal origin (Visser et al., 1991; Dunn et al., 2001; Harwood, 2002). Gulland and Hall (2005) provide a more detailed summary of individual and population effects of marine mammal diseases.

Microparasites such as bacteria, viruses, and other microorganisms are commonly found in marine mammal habitats and usually pose little threat to a healthy animal (Geraci et al., 1999). For example, long-finned pilot whales that inhabit the waters off of the northeastern coast of the U.S. are carriers of the morbillivirus, yet have grown resistant to its usually lethal effects (Geraci et al., 1999). Since the 1980s, however, viral infections have been strongly associated with marine mammal die-offs (Domingo et al., 1992; Geraci and Lounsbury, 2005). Morbillivirus is the most significant identified marine mammal virus and suppresses a host's immune system and increases the risk of secondary infection (Harwood, 2002). The largest bottlenose dolphin die-off associated with morbillivirus occurred in 1987, when hundreds of coastal dolphins succumbed to the virus (Lipscomb et al., 1994). A bottlenose dolphin UME in 1993 and 1994 was caused by morbillivirus. Die-offs ranged from northwestern Florida to Texas, with an increased number of deaths as it spread (NMFS, 2007). A 2004 UME in Florida was also associated with dolphin morbillivirus (NMFS, 2004). Influenza A was responsible for the first reported mass mortality in the U.S., occurring along the coast of New England in 1979-1980 (Geraci et al., 1999; Harwood, 2002). Canine distemper virus has been responsible for large scale pinniped mortalities and die-

offs (Grachev et al., 1989; Kennedy et al., 2000; Gulland and Hall, 2005), while a bacteria, *Leptospira pomona*, is responsible for periodic die-offs in California sea lions about every four years (Gulland et al., 1996; Gulland and Hall, 2005). It is difficult to determine whether microparasites commonly act as a primary pathogen, or whether they show up as a secondary infection in an already weakened animal (Geraci et al., 1999). Most marine mammal die-offs from infectious disease in the last 25 years, however, have had viruses associated with them (Simmonds and Mayer, 1997; Geraci et al., 1999; Harwood, 2002).

Macroparasites are usually large parasitic organisms and include lungworms, trematodes (parasitic flatworms), and protozoans (Geraci and St.Aubin, 1987; Geraci et al., 1999). Marine mammals can carry many different types, and have shown a robust tolerance for sizeable infestation unless compromised by illness, injury, or starvation (Morimitsu et al., 1987; Dailey et al., 1991; Geraci et al., 1999). *Nasitrema*, a usually benign trematode found in the head sinuses of cetaceans (Geraci et al., 1999), can cause brain damage if it migrates (Ridgway and Dailey, 1972). As a result, this worm is one of the few directly linked to stranding in the cetaceans (Dailey and Walker, 1978; Geraci et al., 1999).

Non-infectious disease, such as congenital bone pathology of the vertebral column (osteomyelitis, spondylosis deformans, and ankylosing spondylitis [AS]), has been described in several species of cetacean (Paterson, 1984; Alexander et al., 1989; Kompanje, 1995; Sweeny et al., 2005). In humans, bone pathology such as AS, can impair mobility and increase vulnerability to further spinal trauma (Resnick and Niwayama, 2002). Bone pathology has been found in cases of single strandings (Paterson, 1984; Kompanje, 1995), and also in cetaceans prone to mass stranding (Sweeny et al., 2005), possibly acting as a contributing or causal influence in both types of events.

Naturally Occurring Marine Neurotoxins

Some single cell marine algae common in coastal waters, such as dinoflagellates and diatoms, produce toxic compounds that can accumulate (termed bioaccumulation) in the flesh and organs of fish and invertebrates (Geraci et al., 1999; Harwood, 2002). Marine mammals become exposed to these compounds when they eat prey contaminated by these naturally produced toxins (Van Dolah, 2005). Figure G-2 shows U.S. animal mortalities from 1997-2006 resulting from toxins produced during harmful algal blooms.

In the Gulf of Mexico and mid- to southern Atlantic states, "red tides," a form of harmful algal bloom, are created by a dinoflagellate (*Karenia brevis*). *K. brevis* is found throughout the Gulf of Mexico and sometimes along the Atlantic coast (Van Dolah, 2005; NMFS, 2007). It produces a neurotoxin known as brevetoxin. Brevetoxin has been associated with several marine mammal UMEs within this area (Geraci, 1989; Van Dolah et al., 2003; NMFS, 2004; Flewelling et al., 2005; Van Dolah, 2005; NMFS, 2007). On the U.S. west coast and in the northeast Atlantic, several species of diatoms produce a toxin called domoic acid which has also been linked to marine mammal strandings (Geraci et al., 1999; Van Dolah et al., 2003; Greig et al., 2005; Van Dolah, 2005; Brodie et al., 2006; NMFS, 2007). Other algal toxins associated with marine mammal strandings include saxitoxins and ciguatoxins and are summarized by Van Dolah (2005).



Figure G-2. Animal Mortalities from Harmful Algal Blooms within the U.S. from 1997-2006
Source: Woods Hole Oceanographic Institute (WHO) http://www.whoi.edu/redtide/HABdistribution/HABmap.html

Weather Events and Climate Influences

Severe storms, hurricanes, typhoons, and prolonged temperature extremes may lead to localized marine mammal strandings (Geraci et al., 1999; Walsh et al., 2001). Hurricanes may have been responsible for mass strandings of pygmy killer whales in the British Virgin Islands and Gervais' beaked whales in North Carolina (Mignucci-Giannoni et al., 2000; Norman and Mead, 2001). Storms in 1982-1983 along the California coast led to deaths of 2,000 northern elephant seal pups (Le Boeuf and Reiter, 1991). Ice movement along southern Newfoundland has forced groups of blue whales and white-beaked dolphins ashore (Sergeant, 1982). Seasonal oceanographic conditions in terms of weather, frontal systems, and local currents may also play a role in stranding (Walker et al., 2005).

The effect of large scale climatic changes to the world's oceans and how these changes impact marine mammals and influence strandings is difficult to quantify given the broad spatial and

temporal scales involved, and the cryptic movement patterns of marine mammals (Moore, 2005; Learmonth et al., 2006). The most immediate, although indirect, effect is decreased prey availability during unusual conditions. This, in turn, results in increased search effort required by marine mammals (Crocker et al., 2006) and potential starvation if foraging is not successful. Stranding may follow either as a direct result of starvation or as an indirect result of a weakened and stressed state (e.g., succumbing to disease) (Selzer and Payne, 1988; Geraci et al., 1999; Moore, 2005; Learmonth et al., 2006; Weise et al., 2006).

Two recent papers examined potential influences of climate fluctuation on stranding events in southern Australia, including Tasmania, an area with a history of more than 20 mass stranding since the 1920s (Evans et al., 2005; Bradshaw et al., 2006). These authors note that patterns in animal migration, survival, fecundity, population size, and strandings will revolve around the availability and distribution of food resources. In southern Australia, movement of nutrient-rich waters pushed closer to shore by periodic meridional winds (occurring about every 12 to 14 years) may be responsible for bringing marine mammals closer to land, thus increasing the probability of stranding (Bradshaw et al., 2006). The papers conclude, however, that while an overarching model can be helpful for providing insight into the prediction of strandings, the particular reasons for each one are likely to be quite varied.

Navigational Error

Geomagnetism- It has been hypothesized that, like some land animals, marine mammals may be able to orient to the Earth's magnetic field as a navigational cue, and that areas of local magnetic anomalies may influence strandings (Bauer et al., 1985; Klinowska, 1985; Kirschvink et al., 1986; Klinowska, 1986; Walker et al., 1992; Wartzok and Ketten, 1999). In a plot of live stranding positions in Great Britain with magnetic field maps, Klinowska (1985, 1986) observed an association between live stranding positions and magnetic field levels. In all cases, live strandings occurred at locations where magnetic minima, or lows in the magnetic fields, intersect the coastline. Kirschvink et al. (1986) plotted stranding locations on a map of magnetic data for the east coast of the United States, and were able to develop associations between stranding sites and locations where magnetic minima intersected the coast. The authors concluded that there were highly significant tendencies for cetaceans to beach themselves near these magnetic minima and coastal intersections. The results supported the hypothesis that cetaceans may have a magnetic sensory system similar to other migratory animals, and that marine magnetic topography and patterns may influence long-distance movements (Kirschvink et al., 1986). Walker et al. (1992) examined fin whale swim patterns off the northeastern U.S. continental shelf, and reported that migrating animals aligned with lows in the gradient of magnetic intensity. While a similar pattern between magnetic features and marine mammal strandings at New Zealand stranding sites was not seen (Brabyn and Frew, 1994), mass strandings in Hawaii typically were found to occur within a narrow range of magnetic anomalies (Mazzuca et al., 1999).

Echolocation Disruption in Shallow Water- Some researchers believe stranding may result from reductions in the effectiveness of echolocation within shallow water, especially with the pelagic species of odontocetes who may be less familiar with the coastline (Dudok van Heel, 1966;

Chambers and James, 2005). For an odontocete, echoes from echolocation signals contain important information on the location and identity of underwater objects and the shoreline. The authors postulate that the gradual slope of a beach may present difficulties to the navigational systems of some cetaceans, since it is common for live strandings to occur along beaches with shallow, sandy gradients (Brabyn and McLean, 1992; Mazzuca et al., 1999; Maldini et al., 2005; Walker et al., 2005). A contributing factor to echolocation interference in turbulent, shallow water is the presence of microbubbles from the interaction of wind, breaking waves, and currents. Additionally, ocean water near the shoreline can have an increased turbidity (e.g., floating sand or silt, particulate plant matter, etc.) due to the run-off of fresh water into the ocean, either from rainfall or from freshwater outflows (e.g., rivers and creeks). Collectively, these factors can reduce and scatter the sound energy within echolocation signals and reduce the perceptibility of returning echoes of interest.

Social Cohesion

Many pelagic species such as sperm whale, pilot whales, melon-head whales, and false killer whales, and some dolphins occur in large groups with strong social bonds between individuals. When one or more animals strand due to any number of causative events, then the entire pod may follow suit out of social cohesion (Geraci et al., 1999; Conner, 2000; Perrin and Geraci, 2002; NMFS, 2007).

G.5 ANTHROPOGENIC THREATS/STRANDING CAUSES

With the exception of historic whaling in the 19th and early part of the 20th century, during the past few decades there has been an increase in marine mammal mortalities associated with a variety of human activities (Geraci et al., 1999; NMFS, 2007). These include fisheries interactions (bycatch and directed catch), pollution (marine debris, toxic compounds), habitat modification (degradation, prey reduction), vessel strikes (Laist et al., 2001), and gunshots. Figure G-3 shows potential worldwide risk to small-toothed cetaceans by source.

Fisheries Interaction: By-catch and Entanglement

The incidental catch of marine mammals in commercial fisheries is a significant threat to the survival and recovery of many populations of marine mammals (Geraci et al., 1999; Baird, 2002; Culik, 2002; Carretta et al., 2004; Geraci and Lounsbury, 2005; NMFS, 2007). Interactions with fisheries and entanglement in discarded or lost gear continue to be a major factor in their deaths worldwide (Geraci et al., 1999; Nieri et al., 1999; Geraci and Lounsbury, 2005; Read et al., 2006; Zeeber et al., 2006).

Bycatch- Bycatch is the catching of non-target species within a given fishing operation and can include non-commercially used invertebrates, fish, sea turtles, birds, and marine mammals (NRC, 2006). Read et al. (2006) estimated the magnitude of marine mammal by-catch in U.S. and global fisheries. Data for the United States was obtained from fisheries observer programs, reports of entangled stranded animals, and fishery logbooks. In U.S. fisheries, the mean annual bycatch of marine mammals between 1990 and 1999 was 6,215 animals, (Standard Error [S.E.] =

±448). Eighty-four percent of cetacean bycatch occurred in gill-net fisheries, with dolphins and porpoises constituting the majority of these. The authors noted a 40 percent decline in marine mammal by-catch in the years 1995-1999 as compared to 1990 through 1994, and suggested that effective conservation measures implemented during the later time period played a significant role (Read et al., 2006).

To estimate global by-catch, Read et al. (2006) used U.S. vessel by-catch data from 1990-1994 and extrapolated to the world's vessels for the same time period. They calculated an estimate of 653,365 marine mammals caught annually around the world, again with most occurring in gill-net fisheries. The authors concluded that with global marine mammal by-catch likely to be in the hundreds of thousands every year, by-catch in fisheries will be the single greatest threat to many marine mammal populations around the world (Read et al., 2006).

Entanglement- Active and discarded fishing gear pose a major threat to marine mammals. Entanglement can lead to drowning and/or impairment in activities such as diving, swimming, feeding, and breeding. Stranded marine mammals frequently exhibit signs of previous fishery interaction, such as scarring or gear still attached to their bodies, and the cause of death for many stranded marine mammals is often attributed to such interactions (Baird and Gorgone, 2005; Geraci et al., 1999; Campagna et al., 2007). Because marine mammals that die or are injured in fisheries may not wash ashore, and not all animals that do wash ashore exhibit clear signs of interactions, stranding data probably underestimate fishery-related mortality and serious injury (NMFS, 2005a).

Various accounts of fishery-related stranding deaths have been reported over the last several decades along the U.S. coast. From 1993 through 2003, 1,105 harbor porpoises were reported stranded from Maine to North Carolina, many of which had cuts and body damage suggestive of net entanglement (NMFS, 2005c). In 1999, it was possible to determine that the cause of death for 38 of the stranded porpoises was from fishery interactions (NMFS, 2005d). An estimated 78 baleen whales were killed annually in the offshore southern California/Oregon drift gillnet fishery during the 1980s (Heyning and Lewis 1990). From 1998-2005, based on observer records, five fin whales (California/Oregon/Washington stock), 12 humpback whales (Eastern North Pacific [ENP] stock), and six sperm whales (California/Oregon/Washington stock) were either seriously injured or killed in fisheries off the mainland U.S. west coast (California Marine Mammal Stranding Network Database 2006).

Ship Strike

Marine mammals sometimes come into physical contact with oceangoing vessels, which can lead to injury or death and cause subsequent stranding (Laist et al. 2001; Geraci and Lounsbury, 2005; de Stephanis and Urquiola, 2006). These events, termed 'ship strikes,' occur when an animal at the surface is struck directly by a vessel, when a surfacing animal hits the bottom of a vessel, or when an animal just below the surface is cut by a vessel's propeller. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus, 2001; Laist et al., 2001; Vanderlaan and Taggart, 2007).

The growth in civilian commercial ports has been accompanied by a large increase in commercial vessel traffic. This trend has, in turn, expanded the threat of ship strikes to marine mammals in recent decades. The Final Report of the NOAA International Symposium on "Shipping Noise and Marine Mammals: A Forum for Science, Management, and Technology" stated that the worldwide commercial fleet has grown from approximately 30,000 vessels in 1950 to over 85,000 vessels in 1998 (NRC, 2003; Southall, 2005). From 1985 to 1999, world seaborne trade doubled to 5 billion tons and currently includes 90 percent of the total world trade, with container shipping movements representing the largest volume of seaborne trade. Current statistics support the prediction that the international shipping fleet will continue to grow at current or greater rates. Vessel densities along existing coastal routes are expected to increase both domestically and internationally. New routes are expected to develop as new ports are opened and existing ports are expanded. Vessel propulsion systems are also advancing toward faster ships operating in higher sea states for lower operating costs; and container ships are expected to become larger along certain routes (Southall, 2005). Given the expected increase in vessel density and operational capability, a parallel increase in marine mammal ship strikes can be expected.

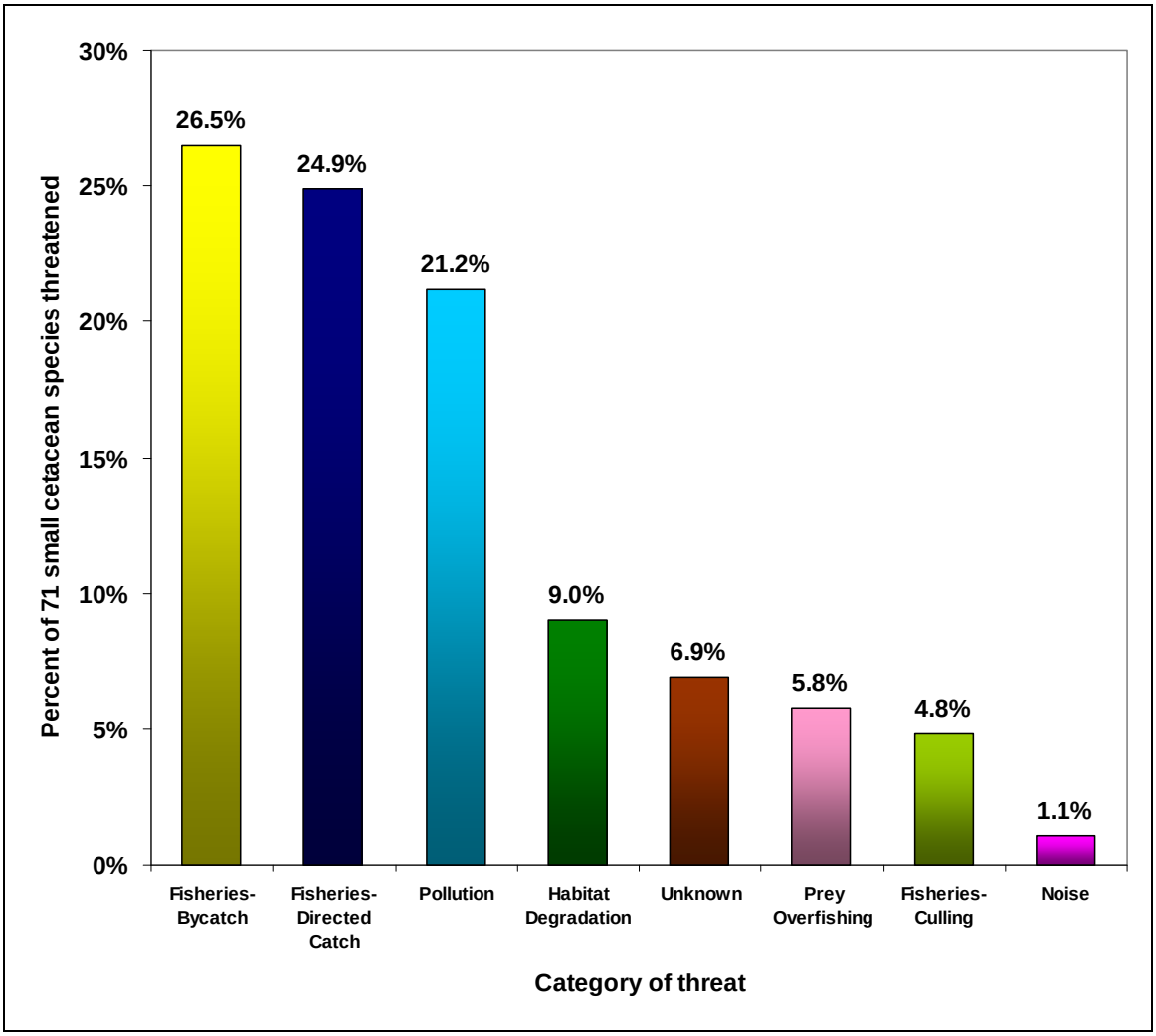


Figure G-3. Human Threats to Worldwide Small Cetacean Populations*
(Source: Culik 2002)

*The Navy realizes that the total percentages add up to 100.2 percent;
However, this figure is referenced directly from the aforementioned report.

Ingestion of Marine Debris and Exposure to Toxins

Debris in the marine environment poses a health hazard for marine mammals. Not only can they become entangled, but animals may ingest plastics and other debris that are indigestible, and which can contribute to illness or death through irritation or blockage of the stomach and intestines (Tarpley and Marwitz, 1993; Whitaker et al., 1994; Gorzelany, 1998; Secchi and Zarzur, 1999; Baird and Hooker, 2000). There are certain species of cetaceans (e.g. sperm whales) that are more likely to eat trash, especially plastics (Geraci et al., 1999; Evans et al. 2003; Whitehead 2003).

For example, between 1990 and October 1998, 215 pygmy sperm whales stranded along the U.S. Atlantic coast from New York through the Florida Keys (NMFS, 2005a). Remains of plastic bags and other debris were found in the stomachs of 13 of these animals. In 1987, a pair of latex examination gloves was retrieved from the stomach of a stranded dwarf sperm whale (NMFS, 2005c). In one pygmy sperm whale found stranded in 2002, red plastic debris was found in the stomach along with squid beaks (NMFS, 2005a). Oliveira de Meirelles and Barros (2007) documented mortality to a rough-toothed dolphin in Brazil from plastic debris ingestion.

Chemical contaminants like organochlorines (PCBs, DDT) and heavy metals may pose potential health risks to marine mammals (Das et al., 2003; De Guise et al., 2003). Despite having been banned for decades, levels of organochlorines are still high in marine mammal tissue samples taken along US coasts (Hickie et al. 2007; Krahn et al. 2007; NMFS, 2007a). These compounds are long-lasting, reside in marine mammal adipose tissues (especially in the blubber), and can be toxic. Contaminant levels in odontocetes (piscivorous animals) have been reported to be one to two orders of magnitude higher compared to mysticetes (planktivorous animals) (Borell, 1993; O'Shea and Brownell, 1994; O'Hara and Rice, 1996; O'Hara et al., 1999).

Chronic exposure to PCBs and/or DDT is immunosuppressive, as has been seen in bottlenose dolphins (Lahvis et al., 1995) and seals (*p. vitulina*) (Ross et al., 1996). Chronic exposure has been linked to infectious disease mortality in harbor porpoises stranded in the UK (Jepson et al., 1999; Jepson et al., 2005), carcinoma in California in sea lions (Ylitalo et al., 2005), and population reductions of Baltic seals (Bergman et al., 2001). High levels of PCBs in immature, pelagic dolphins has been observed (Struntz et al., 2004), raising concern about contaminant loads further offshore. Moderate levels of PCBs and chlorinated pesticides (such as DDT, DDE, and dieldrin) have been found in pilot whale blubber with bioaccumulation levels more similar in whales from the same stranding event than from animals of the same age or sex (NMFS, 2005b). Accumulation of heavy metals has also been documented in many cetaceans (Frodello and Marchand, 2001; Das et al., 2003; Wittnich et al., 2004), sometimes exceeding levels known to cause neurologic and immune system impairment in other mammals (Nielsen et al., 2000; Das et al., 2003; De Guise et al., 2003).

Other forms of habitat contamination and degradation may also play a role in marine mammal mortality and strandings. Some events caused by humans have direct and obvious effects on marine mammals, such as oil spills (Geraci et al., 1999). Oil spills can cause both short- and long-term medical problems for many marine mammal species through ingestion of tainted prey, coating of skin/fur, and adherence to oral and nasal cavities (Moeller, 2003). In most cases, the

effects of contamination are likely to be indirect in nature; e.g. effects on prey species availability or an increase in disease susceptibility (Geraci et al., 1999).

Anthropogenic Sound

There is evidence that underwater man-made sounds, such as explosions, drilling, construction, and certain types of sonar (Southall et al., 2006), may be a contributing factor in some stranding events. Marine mammals may respond both behaviorally and physiologically to anthropogenic sound exposure, (e.g., Richardson et al., 1995; Finneran et al., 2000; Finneran et al., 2003; Finneran et al., 2005); however, the range and magnitude of the behavioral response of marine mammals to various sound sources is highly variable (Richardson et al., 1995) and appears to depend on the species involved, the experience of the animal with the sound source, the motivation of the animal (e.g., feeding, mating), and the context of the exposure.

Exposure to sonar signals has been postulated as being a specific cause of several stranding events. Given that it is likely that the frequency of certain sonar systems is within the range of hearing of many marine mammals, the consideration of sonar as a causative mechanism of stranding is warranted. In the following sections, specific stranding events that have been putatively linked to sonar operations are discussed.

G.6 STRANDING EVENT CASE STUDIES

Beaked Whale Strandings

Over the past two decades, several mass stranding events involving beaked whales have been documented. A review of historical data (mostly anecdotal) maintained by the Marine Mammal Program in the National Museum of Natural History, Smithsonian Institution reports 49 beaked whale mass stranding events between 1838 and 1999. The largest beaked whale mass stranding occurred in the 1870s in New Zealand when 28 Gray's beaked whales (*Mesoplodon grayi*) stranded. Blainsville's beaked whale (*Mesoplodon densirostris*) strandings are rare, and records show that they were involved in one mass stranding in 1989 in the Canary Islands. Cuvier's beaked whales (*Ziphius cavirostris*) are the most frequently reported beaked whale to strand, with at least 19 stranding events from 1804 through 2000 (DoC and DoN, 2001; Smithsonian Institution, 2000). While beaked whale strandings have occurred since the 1800s (Geraci and Lounsbury, 1993; Cox et al., 2006; Podesta et al., 2006), several mass strandings have been temporally and spatially associated with naval operations utilizing mid-frequency active (MFA) sonar (Simmonds and Lopez-Jurado, 1991; Frantzis, 1998; Jepson et al., 2003; Cox et al., 2006).

In the following sections, specific stranding events that have been putatively linked to potential sonar operations are discussed. These events represent a small overall number of animals over an 11-year period (40 animals) and not all worldwide beaked whale strandings can be linked to naval activity (ICES, 2005a; 2005b; Podesta et al., 2006). Four of the five events occurred during NATO exercises or events where U.S. Navy presence was limited (Greece, Portugal, and Spain). One of the five events involved only U.S. Navy ships (Bahamas). These events are given specific consideration in the case studies that follow.

Beaked whale stranding events associated with potential naval operations:

1996	May	Greece (NATO/US)
2000	March	Bahamas (US)
2000	May	Portugal, Madeira Islands (NATO/US)
2002	September	Spain, Canary Islands (NATO/US)
2006	January	Spain, Mediterranean Sea coast (NATO/US)

Beaked Whale Case Studies

1996 Greece Beaked Whale Mass Stranding (May 12 – 13)

Description: Twelve Cuvier's beaked whales (*Ziphius cavirostris*) stranded along a 38.2 kilometer (km) (20.6 nautical mile [NM]]) stretch of the coast of the Kyparissiakos Gulf on May 12 and 13, 1996 (Frantzis, 1998). From May 11 through May 15, the NATO research vessel *Alliance* was conducting sonar tests with signals of 600 Hz and 3 kHz and root mean squared (rms) sound pressure levels (SPL) of 228 and 226 dB re 1μPa, respectively (D'Amico and Verboom, 1998; D'Spain et al., 2006). The timing and the location of the testing encompassed the time and location of the whale strandings (Frantzis, 1998).

Findings: Partial necropsies of eight of the animals were performed, including external assessments and the sampling of stomach contents. No abnormalities attributable to acoustic exposure were observed, but the stomach contents indicated that the whales were feeding on cephalods soon before the stranding event. No unusual environmental events before or during the stranding event could be identified (Frantzis, 1998).

Conclusions: The timing and spatial characteristics of this stranding event were atypical of stranding in Cuvier's beaked whale, particularly in this region of the world. No natural phenomenon that might contribute to the stranding event coincided in time with the mass stranding. Because of the rarity of mass strandings in the Greek Ionian Sea, the probability that the sonar tests and stranding coincided in time and location, while being independent of each other, was estimated as being extremely low (Frantzis, 1998). However, because information for the necropsies was incomplete and inconclusive, the cause of the stranding cannot be precisely determined.

2000 Bahamas Marine Mammal Mass Stranding (March 15-16)

Description: Seventeen marine mammals comprised of nine Cuvier's beaked whales, three Blainville's beaked whales (*Mesoplodon densirostris*), two unidentified beaked whales, two minke whales (*Balaenoptera acutorostrata*), and one spotted dolphin (*Stenella frontalis*), stranded along the Northeast and Northwest Providence Channels of the Bahamas Islands on March 15-16, 2000 (Evans and England, 2001). The strandings occurred over a 36-hour period and coincided with DoN use of MFA sonar within the channel. Navy ships were involved in tactical sonar exercises for approximately 16 hours on March 15. The ships, which operated the AN/SQS-53C and AN/SQS-56, moved through the channel while emitting sonar pings approximately every 24 seconds. The timing of pings was staggered between ships and average source levels of pings varied from a nominal 235 dB SPL (AN/SQS-53C) to 223 dB SPL (AN/SQS-56). The center frequency of pings was 3.3 kHz and 6.8 to 8.2 kHz, respectively.

Seven of the animals that stranded died, while ten animals were returned to the water alive. The animals known to have died included five Cuvier's beaked whales, one Blainville's beaked whale, and the single spotted dolphin. Six necropsies were performed and three of the six necropsied marine mammals (one Cuvier's beaked whale, one Blainville's beaked whale, and the spotted dolphin) were fresh enough to permit identification of pathologies by computerized tomography (CT). Tissues from the remaining three animals were in a state of advanced decomposition at the time of inspection.

Findings: All five necropsied beaked whales were in good body condition and did not show any signs of external trauma or disease. In the two best preserved whale specimens, hemorrhage was associated with the brain and hearing structures. Specifically, subarachnoid hemorrhage within the temporal region of the brain and intracochlear hemorrhages were noted. Similar findings of bloody effusions around the ears of two other moderately decomposed whales were consistent with the same observations in the freshest animals. In addition, three of the whales had small hemorrhages in their acoustic fats, which are fat bodies used in sound production and reception (i.e., fats of the lower jaw and the melon). The best-preserved whale demonstrated acute hemorrhage within the kidney, inflammation of the lung and lymph nodes, and congestion and mild hemorrhage in multiple other organs.

Other findings were consistent with stresses and injuries associated with the stranding process. These consisted of external scrapes, pulmonary edema and congestion. The spotted dolphin demonstrated poor body condition and evidence of a systemic debilitating disease. In addition, since the dolphin stranding site was isolated from the acoustic activities of Navy ships, it was determined that the dolphin stranding was unrelated to the presence of Navy active sonar.

Conclusions: The post-mortem analyses of stranded beaked whales led to the conclusion that the immediate cause of death resulted from overheating, cardiovascular collapse and stresses associated with being stranded on land. However, the presence of subarachnoid and intracochlear hemorrhages were believed to have occurred prior to stranding and were hypothesized as being related to an acoustic event. Passive acoustic monitoring records demonstrated that no large scale acoustic activity besides the Navy sonar exercise occurred in the times surrounding the stranding event. The mechanism by which sonar could have caused the observed traumas or caused the animals to strand was undetermined. The spotted dolphin was in overall poor condition for examination, but showed indications of long-term disease. No analysis of baleen whales (minke whale) was conducted.

2000 Madeira Island, Portugal Beaked Whale Strandings (May 10 – 14)

Description: Three Cuvier's beaked whales stranded on two islands in the Madeira Archipelago, Portugal, from May 10 – 14, 2000 (Cox et al., 2006). A joint NATO amphibious training exercise, named "Linked Seas 2000," which involved participants from 17 countries, took place in Portugal during May 2 – 15, 2000. The timing and location of the exercises overlapped with that of the stranding incident.

Findings: Two of the three whales were necropsied. Two heads were taken to be examined. One head was intact and examined grossly and by CT; the other was only grossly examined because it was partially flensed and had been seared from an attempt to dispose of the whale by fire

(Ketten, 2005). No blunt trauma was observed in any of the whales. Consistent with prior CT scans of beaked whales stranded in the Bahamas 2000 incident, one whale demonstrated subarachnoid and peribullar hemorrhage and blood within one of the brain ventricles. Post-cranially, the freshest whale demonstrated renal congestion and hemorrhage, which was also consistent with findings in the freshest specimens in the Bahamas incident.

Conclusions: The pattern of injury to the brain and auditory system were similar to those observed in the Bahamas strandings, as were the kidney lesions and hemorrhage and congestion in the lungs (Ketten, 2005). The similarities in pathology and stranding patterns between these two events suggested a similar causative mechanism. Although the details about whether or how sonar was used during "Linked Seas 2000" is unknown, the presence of naval activity within the region at the time of the strandings suggested a possible relationship to Navy activity.

2002 Canary Islands Beaked Whale Mass Stranding (September 24)

Description: On September 24, 2002, 14 beaked whales stranded on Fuerteventura and Lanzaote Islands in the Canary Islands (Jepson et al., 2003). Seven of the 14 whales died on the beach and the other 7 live stranded whales were returned to the ocean. In addition to these initial strandings, four beaked whales were found stranded dead over the next three days either on the coast or floating offshore (Fernández et al., 2005). At the time of the strandings, an international naval exercise called "Neo-Tapon" that involved numerous surface warships and several submarines was being conducted off the coast of the Canary Islands. Tactical MFA sonar was utilized during the exercises, and strandings began within hours of the onset of the use of MFA sonar (Fernández et al., 2005).

Findings: Eight Cuvier's beaked whales, one Blainville's beaked whale, and one Gervais' beaked whale were necropsied, six of them within 12 hours of stranding (Fernández et al., 2005). The stomachs of the whales contained fresh and undigested prey contents. No pathogenic bacteria were isolated from the whales, although parasites were found in the kidneys of all of the animals. The head and neck lymph nodes were congested and hemorrhages were noted in multiple tissues and organs, including the kidney, brain, ears, and jaws. Widespread fat emboli were found throughout the carcasses, but no evidence of blunt trauma was observed in the whales. In addition, the parenchyma of several organs contained macroscopic intravascular bubbles and lesions, putatively associated with nitrogen off-gassing.

Conclusions: The association of NATO MFA sonar use close in space and time to the beaked whale strandings, and the similarity between this stranding event and previous beaked whale mass strandings coincident with sonar use, suggests that a similar scenario and causative mechanism of stranding may be shared between the events. Beaked whales stranded in this event demonstrated brain and auditory system injuries, hemorrhages, and congestion in multiple organs, similar to the pathological findings of the Bahamas and Madeira stranding events. In addition, the necropsy results of the Canary Islands stranding event led to the hypothesis that the presence of disseminated and widespread gas bubbles and fat emboli were indicative of nitrogen bubble formation, similar to what might be expected in decompression sickness (Jepson et al., 2003; Fernández et al., 2005). Whereas gas emboli would develop from the nitrogen gas, fat emboli would enter the blood stream from ruptured fat cells (presumably where nitrogen bubble formation occurs) or through the coalescence of lipid bodies within the blood stream.

The possibility that the gas and fat emboli found by Fernández et al. (2005) was due to nitrogen bubble formation has been hypothesized to be related to either direct activation of the bubble by sonar signals or to a behavioral response in which the beaked whales flee to the surface following sonar exposure. The first hypothesis is related to rectified diffusion (Crum and Mao, 1996), the process of increasing the size of a bubble by exposing it to a sound field. This process is facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard, 1979). Deeper and longer dives of some marine mammals, such as those conducted by beaked whales, are theoretically predicted to induce greater levels of supersaturation (Houser et al., 2001). If rectified diffusion were possible in marine mammals exposed to high-level sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth. Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness.

It is unlikely that the short duration of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis has also been suggested: stable bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario, the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size. The second hypothesis speculates that rapid ascent to the surface following exposure to a startling sound might produce tissue gas saturation sufficient for the evolution of nitrogen bubbles (Jepson et al., 2003; Fernández et al., 2005). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation.

Although theoretical predictions suggest the possibility for acoustically mediated bubble growth, there is considerable disagreement among scientists as to its likelihood (Piantadosi and Thalmann, 2004). Sound exposure levels predicted to cause *in vivo* bubble formation within diving cetaceans have not been evaluated and are suspected as needing to be very high (Evans, 2002; Crum et al., 2005). Further, although it has been argued that traumas from recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson et al., 2003), there is no conclusive evidence supporting this hypothesis and there is concern that at least some of the pathological findings (e.g., bubble emboli) are artifacts of the necropsy. Currently, stranding networks in the United States have created a set of necropsy guidelines to determine, in part, the possibility and frequency with which bubble emboli can be introduced into marine mammals during necropsy procedures (Arruda et al., 2007).

2006 Spain, Gulf of Vera Beaked Whale Mass Stranding (January 26-27)

Description: The Spanish Cetacean Society reported an atypical mass stranding of four beaked whales that occurred January 26, 2006, on the southeast coast of Spain near Mojacar (Gulf of Vera) in the Western Mediterranean Sea. According to the report, two of the whales were discovered the evening of January 26 and were found to be alive still. Two other whales were discovered during the day on January 27, but had already died. A following report stated that the first three animals were located near the town of Mojacar and were examined by a team from the

University of Las Palmas de Gran Canarias, with the help of the stranding network of Ecologistas en Acción Almería-PROMAR and others from the Spanish Cetacean Society. The fourth animal was found dead on the afternoon of May 27, a few kilometers north of the first three animals.

From January 25-26, 2006, a NATO surface ship group (seven ships including one U.S. ship under NATO operational command) conducted active sonar training against a Spanish submarine within 93 km (50 NM) of the stranding site.

Findings: Veterinary pathologists necropsied the two male and two female beaked whales (*Z. cavirostris*).

Conclusions: According to the pathologists, a likely cause of this type of beaked whale mass stranding event may have been anthropogenic acoustic activities. However, no detailed pathological results confirming this supposition have been published to date, and no positive acoustic link was established as a direct cause of the stranding.

Even though no causal link can be made between the stranding event and naval exercises, certain conditions may have existed in the exercise area that, in their aggregate, may have contributed to the marine mammal strandings (Freitas, 2004):

- Operations were conducted in areas of at least 1,000 m (3,281 ft) in depth near a shoreline where there is a rapid change in bathymetry on the order of 1,000 to 6,000 m (3,281 to 19,685 ft) occurring across a relatively short horizontal distance (Freitas, 2004).
- Multiple ships, in this instance, five MFA sonar equipped vessels, were operating in the same area over extended periods of time (20 hours) in close proximity.
- Exercises took place in an area surrounded by landmasses, or in an embayment. Operations involving multiple ships employing MFA sonar near land may produce sound directed towards a channel or embayment that may cut off the lines of egress for marine mammals (Freitas, 2004).

G.7 OTHER GLOBAL STRANDING DISCUSSIONS

In the following sections, stranding events that have been putatively linked to U.S. Navy activity in popular press are presented. As detailed in the individual case study conclusions, the DoN believes that there is enough evidence available to refute allegations of impacts from MFA sonar.

2003 Washington State Harbor Porpoise Strandings (May 2 – June 2)

Description: At 10:40 a.m. on May 5, 2003, the USS Shoup began the use of mid-frequency tactical active sonar as part of a naval exercise. At 2:20 p.m., the USS Shoup entered the Haro Strait and terminated active sonar use at 2:38 p.m., thus limiting active sonar use within the strait to less than 20 minutes. Between May 2 and June 2, 2003, approximately 16 strandings involving 15 harbor porpoises (*Phocoena phocoena*) and one Dall's porpoise (*Phocoenoides dalli*) were reported to the Northwest Marine Mammal Stranding Network. A comprehensive review of all strandings and the events involving the USS Shoup on May 5, 2003 were presented in U.S. Department of Navy (DON, 2003*). Given that the USS Shoup was known to have operated sonar in the strait on May 5, and that supposed behavioral reactions of killer whales

(*Orcinus orca*) had been putatively linked to these sonar operations (NMFS Office of Protected Resources, 2005), NMFS undertook an analysis of whether sonar caused the strandings of the harbor porpoises.

Ten whole carcasses of harbor porpoises and the head of an additional porpoise were collected for analysis. Necropsies were performed on ten of the harbor porpoises and six whole carcasses and two heads were selected for CT imaging. Gross examination, histopathology, age determination, blubber analysis, and various other analyses were conducted on each of the carcasses (Norman et al., 2004).

Findings: Post-mortem findings and analysis details are found in Norman et al. (2004). All of the carcasses suffered from some degree of freeze-thaw artifact that hampered gross and histological evaluations. At the time of necropsy, three of the porpoises were moderately fresh, whereas the remainder of the carcasses was considered to have moderate to advanced decomposition. None of the 11 harbor porpoises demonstrated signs of acoustic trauma. In contrast, a putative cause of death was determined for five of the porpoises; two animals had blunt trauma injuries and three animals had indication of disease processes (fibrous peritonitis, salmonellosis, and necrotizing pneumonia). A cause of death could not be determined in the remaining animals, which is consistent with expected percentage of marine mammal necropsies conducted within the northwest region.

Conclusions: The NMFS concluded from a retrospective analysis of stranding events that the number of harbor porpoise stranding events in the approximate month surrounding the USS Shoup use of sonar was higher than expected based on annual strandings of harbor porpoises (Norman et al., 2004). It is important to note that the number of strandings in the May – June timeframe in 2003 was also higher for the outer coast, indicating a much wider phenomena than use of sonar by the USS Shoup in Puget Sound for one day in May. The conclusion by NMFS that the number of strandings in 2003 was higher is also different from that of The Whale Museum, which has documented and responded to harbor porpoise strandings since 1980 (Osborne, 2003). According to The Whale Museum, the number of strandings as of May 15, 2003, was consistent with what was expected based on historical stranding records and was less than that occurring in certain years. For example, since 1992 the San Juan Stranding Network has documented an average of 5.8 porpoise strandings per year. In 1997, there were 12 strandings in the San Juan Islands with more than 30 strandings throughout the general Puget Sound area. Disregarding the discrepancy in the historical rate of porpoise strandings and its relation to the USS Shoup, NMFS acknowledged that the intense level of media attention focused on the strandings likely resulted in an increased reporting effort by the public over that which is normally observed (Norman et al., 2004). NMFS also noted in its report that the "sample size is too small and biased to infer a specific relationship with respect to sonar usage and subsequent strandings."

Seven of the porpoises collected and analyzed died prior to the USS Shoup departing to sea on May 5, 2003. Of these seven, one, discovered on May 5, 2003, was in a state of moderate decomposition, indicating it died before May 5; the cause of death was determined to be due, most likely, to salmonella septicemia. Another porpoise, discovered at Port Angeles on May 6, 2003, was in a state of moderate decomposition, indicating that this porpoise also died prior to May 5. One stranded harbor porpoise discovered fresh on May 6 is the only animal that could

potentially be linked in time to the USS Shoup's May 5 MFA sonar use. Necropsy results for this porpoise found no evidence of acoustic trauma. The remaining eight strandings were discovered one to three weeks after the USS Shoup's May 5 transit of the Haro Strait, making it difficult to causally link the sonar activities of the USS Shoup to the timing of the strandings. Two of the eight porpoises died from blunt trauma injury and a third suffered from parasitic infestation, which possibly contributed to its death (Norman et al., 2004). For the remaining five porpoises, NMFS was unable to identify the causes of death.

The speculative association of the harbor porpoise strandings to the use of sonar by the USS Shoup is inconsistent with prior stranding events linked to the use of MFA sonar. Specifically, in prior events, the stranding of whales occurred over a short period of time (less than 36 hours), stranded individuals were spatially co-located, traumas in stranded animals were consistent between events, and active sonar was known or suspected to be in use. Although MFA sonar was used by the USS Shoup, the distribution of harbor porpoise strandings by location and with respect to time surrounding the event do not support the suggestion that MFA sonar was a cause of harbor porpoise strandings. Rather, a complete lack of evidence of any acoustic trauma within the harbor porpoises, and the identification of probable causes of stranding or death in several animals, further supports the conclusion that harbor porpoise strandings were unrelated to the sonar activities of the USS Shoup (DON, 2003*).

2004 Hawai'i Melon-Headed Whale Mass Stranding (July 3-4)

Description: The majority of the following information is taken from the NMFS report on the stranding event (Southall et al., 2006). On the morning of July 3, 2004, 150 to 200 melon-headed whales (*Peponocephala electra*) entered Hanalei Bay, Kauai. Individuals attending a canoe blessing ceremony observed the animals entering the bay at approximately 7:00 a.m. The whales were reported entering the bay in a "wave as if they were chasing fish" (Braun, 2005). At 6:45 a.m. on July 3, 2004, approximately 46.3 km (25 NM) north of Hanalei Bay, active sonar was tested briefly prior to the start of an anti-submarine warfare (ASW) exercise.

The whales stopped in the southwest portion of the bay, grouping tightly, and displayed spy-hopping and tail-slapping behavior. As people went into the water among the whales, the pod separated into as many as four groups, with individual animals moving among the clusters. This continued through most of the day, with the animals slowly moving south and then southeast within the bay. By about 3 p.m., police arrived and kept people from interacting with the animals. At 4:45 p.m. on July 3, 2004, the RIMPAC Battle Watch Captain received a call from a NMFS representative in Honolulu, Hawaii, reporting the sighting of as many as 200 melon-headed whales in Hanalei Bay. At 4:47 p.m., the Battle Watch Captain directed all ships in the area to cease active sonar transmissions.

At 7:20 p.m. on July 3, 2004, the whales were observed in a tight single pod 68.6 m (75 yards) from the southeast side of the bay. The pod was circling in a group and displayed frequent tail slapping and whistle vocalizations and some spy hopping. No predators were observed in the bay and no animals were reported as having fresh injuries. The pod stayed in the bay through the night of July 3, 2004.

On the morning of July 4, 2004, the whales were observed to still be in the bay and collected in a tight group. A decision was made at that time to attempt to herd the animals out of the bay. A 213 to 244-m (700-to-800-ft) rope was constructed by weaving together beach morning glory vines. This vine rope was tied between two canoes and with the assistance of 30 to 40 kayaks, was used to herd the animals out of the bay. By approximately 11:30 a.m. on July 4, 2004, the pod was coaxed out of the bay.

A single neonate melon-headed whale was observed in the bay on the afternoon of July 4, after the whale pod had left the bay. The following morning on July 5, 2004, the neonate was found stranded on Lumahai Beach. It was pushed back into the water but was found stranded dead between 9 and 10 a.m. near the Hanalei pier. NMFS collected the carcass and had it shipped to California for necropsy, tissue collection, and diagnostic imaging.

Following the stranding event, NMFS undertook an investigation of possible causative factors of the stranding. This analysis included available information on environmental factors, biological factors, and an analysis of the potential for sonar involvement. The latter analysis included vessels that utilized MFA sonar on the afternoon and evening of July 2. These vessels were to the southeast of Kauai, on the opposite side of the island from Hanalei Bay.

Findings: NMFS concluded from the acoustic analysis that the melon-headed whales would have had to have been on the southeast side of Kauai on July 2 to have been exposed to sonar from naval vessels on that day (Southall et al., 2006). There was no indication whether the animals were in that region or whether they were elsewhere on July 2. NMFS concluded that the animals would have had to swim from 1.4 to 4.0 meters per second (m/sec) (3 to 9 miles per hour [mi/hr]) for 6.5 to 17.5 hours after sonar transmissions ceased to reach Hanalei Bay by 7:00 a.m. on July 3. Sound transmissions by ships to the north of Hanalei Bay on July 3 were produced as part of exercises between 6:45 a.m. and 4:47 p.m. Propagation analysis conducted by the 3rd Fleet estimated that the level of sound from these transmissions at the mouth of Hanalei Bay could have ranged from 138 to 149 dB re 1 μPa.

NMFS was unable to determine any environmental factors (e.g., harmful algal blooms, weather conditions) that may have contributed to the stranding. However, additional analysis by Navy investigators found that a full moon occurred the evening before the stranding and was coupled with a squid run (Mobely et al., 2007). In addition, a group of 500 to 700 melon-headed whales were observed to come close to shore and interact with humans in Sasanhaya Bay, Rota, on the same morning as the whales entered Hanalei Bay (Jefferson et al., 2006). Previous records further indicated that, though the entrance of melon-headed whales into the shallows is rare, it is not unprecedented. A pod of melon-headed whales entered Hilo Bay in the 1870s in a manner similar to that which occurred at Hanalei Bay in 2004.

The necropsy of the melon-headed whale calf suggested that the animal died from a lack of nutrition, likely following separation from its mother. The calf was estimated to be approximately one week old. Although the calf appeared not to have eaten for some time, it was not possible to determine whether the calf had ever nursed after it was born. The calf showed no signs of blunt trauma or viral disease and had no indications of acoustic injury.

Conclusions: Although it is not impossible, it is unlikely that the sound level from the sonar caused the melon-headed whales to enter Hanalei Bay. This conclusion is based on a number of factors:

1. The speculation that the whales may have been exposed to sonar the day before and then fled to Hanalei Bay is not supported by reasonable expectation of animal behavior and swim speeds. The flight response of the animals would have had to persist for many hours following the cessation of sonar transmissions. Such responses have not been observed in marine mammals and no documentation of such persistent flight response after the cessation of a frightening stimulus has been observed in other mammals. The swim speeds, though feasible for the species, are highly unlikely to be maintained for the durations proposed, particularly since the pod was a mixed group containing both adults and neonates. Whereas Southall et al. (2006) suggest that the animals would have had to swim from 1.4 to 4.0 m/s (3 to 9 mi/hr) for 6.5 to 17.5 hours, it is improbable that a neonate could achieve the same for a period of many hours.

2. The area between the islands of Oahu and Kauai and the Pacific Missile Range Facility (PMRF) training range have been used in Rim of the Pacific (RIMPAC) exercises for more than 20 years, and are used year-round for ASW training using MFA sonar. Melon-headed whales inhabiting the waters around Kauai are likely not naive to the sound of sonar and there has never been another stranding event associated in time with ASW training at Kauai or in the Hawaiian Islands. Similarly, the waters surrounding Hawaii contain an abundance of marine mammals, many of which would have been exposed to the same sonar operations that were speculated to have affected the melon-headed whales. No other strandings were reported coincident with the RIMPAC exercises. This leaves it uncertain as to why melon-headed whales, and no other species of marine mammal, would respond to the sonar exposure by stranding.

3. At the nominal swim speed for melon-headed whales, the whales had to be within 2.8 and 3.7 km (1.5 to 2.0 NM) of Hanalei Bay before sonar was activated on July 3. The whales were not in their open ocean habitat but had to be close to shore at 6:45 A.M. when the sonar was activated to have been observed inside Hanalei Bay from the beach by 7:00 A.M (Hanalei Bay is a very large area). This observation suggests that other potential factors could be causative of the stranding event (see below).

4. The simultaneous movement of 500 to 700 melon-headed whales and Risso's dolphins into Sasanhaya Bay, Rota, in the Northern Marianas Islands on the same morning as the 2004 Hanalei stranding (Jefferson et al., 2006) suggests that there may be a common factor that prompted the melon-headed whales to approach the shoreline. A full moon occurred the evening before the stranding and a run of squid was reported concomitant with the lunar activity (Mobley *et al.*, 2007). Thus, it is possible that the melon-headed whales were capitalizing on a lunar event that provided an opportunity for relatively easy prey capture. A report of a pod entering Hilo Bay in the 1870s indicates that on at least one other occasion, melon-headed whales entered a bay in a manner similar to the occurrence at Hanalei Bay in July 2004. Thus, although melon-headed whales entering shallow embayments may be an infrequent event, and every such event might be considered anomalous, there is precedent for the occurrence.

5. The received noise sound levels at the bay were estimated to range from roughly 95 to 149 dB re 1 μPa. Received levels as a function of time of day have not been reported, so it is not possible to determine when the presumed highest levels would have occurred and for how long. However, received levels in the upper range would have been audible by human participants in the bay. The statement by one interviewee that he heard "pings" that lasted an hour and that they were loud enough to hurt his ears is unreliable. Received levels necessary to cause pain over the duration stated would have been observed by most individuals in the water with the animals. No other such reports were obtained from people interacting with the animals in the water.

Although NMFS concluded that sonar use was a "plausible, if not likely, contributing factor in what may have been a confluence of events (Southall et al., 2006)," this conclusion was based primarily on the basis that there was an absence of any other compelling explanation. The authors of the NMFS report on the incident were unaware, at the time of publication, of the simultaneous event in Rota. In light of the simultaneous Rota event, the Hanalei stranding does not appear as anomalous as initially presented and the speculation that sonar was a causative factor is weakened. The Hanalei Bay incident does not share the characteristics observed with other mass strandings of whales coincident with sonar activity (e.g., specific traumas, species composition, etc.). In addition, the inability to conclusively link or exclude the impact of other environmental factors makes a causal link between sonar and the melon-headed whale strandings highly speculative at best.

1980- 2004 Beaked Whale Strandings in Japan (Brownell et al. 2004)

Description: Brownell et al. (2004) compared the historical occurrence of beaked whale strandings in Japan (where there are U.S. Naval bases), with strandings in New Zealand (which lacks a U.S. Naval base) and concluded the higher number of strandings in Japan may be related to the presence of U.S. Navy vessels using MFA sonar. While the dates for the strandings were well documented, the authors of the study did not attempt to correlate the dates of any Navy activities or exercises with the dates of the strandings.

To fully investigate the allegation made by Brownell et al. (2004), the Center for Naval Analysis (CNA) looked at the past U.S. Naval exercise schedules from 1980 to 2004 for the water around Japan in comparison to the dates for the strandings provided by Brownell et al. (2004). None of the strandings occurred during or within weeks after any DoN exercises. While the CNA analysis began by investigating the probabilistic nature of any co-occurrences, the results were a 100 percent probability that the strandings and sonar use were not correlated by time. Given there was no instance of co-occurrence in over 20 years of stranding data, it can be reasonably postulated that sonar use in Japan waters by DON vessels did not lead to any of the strandings documented by Brownell et al. (2004).

2004 Alaska Beaked Whale Strandings (June 7-16)

Description: In the timeframe between June 17 and July 19, 2004, five beaked whales were discovered at various locations along 2,575 km (1,389.4 NM) of the Alaskan coastline and one was found floating (dead) at sea. Because the Navy exercise Alaska Shield/Northern Edge 2004

occurred within the approximate timeframe of these strandings, it has been alleged that sonar may have been the probable cause of these strandings. The Alaska Shield/Northern Edge 2004 exercise consisted of a vessel tracking event followed by a vessel-boarding search-and-seizure event. There was no ASW component to the exercise, no use of MFA sonar, and no use of explosives in the water. There were no events in the Alaska Shield/Northern Edge exercise that could have caused any of the strandings over this 33 day period

2005 North Carolina Marine Mammal Mass Stranding Event (January 15-16, 2005)

Description: On January 15 and 16, 2005, 36 marine mammals consisting of 33 short-finned pilot whales, one minke whale, and two dwarf sperm whales stranded alive on the beaches of North Carolina (Hohn et al., 2006). The animals were scattered across a 111 km (59.9 NM) area from Cape Hatteras northward. Because of the live stranding of multiple species, the event was classified as a UME. It is the only stranding on record for the region in which multiple offshore species were observed to strand within a two- to three-day period.

The DoN indicated that from January 12 to 14 some unit level training with MFA sonar was conducted by vessels that were 93 to 185 km (50.2 to 99.8 NM) from Oregon Inlet. An expeditionary strike group was also conducting exercises to the southeast, but the closest point of active sonar transmission to the inlet was 650 km (350.7 NM) away. The unit level operations were not unusual for the area or time of year and the vessels were not involved in ASW exercises. Marine mammal observers on board the vessels did not detect any marine mammals during the period of unit level training. No sonar transmissions were made on January 15-16.

The National Weather Service reported that a severe weather event moved through North Carolina on January 13 and 14 (Figure G-4). The event was caused by an intense cold front that moved into an unusually warm and moist air mass that had been persisting across the eastern United States for about a week. The weather caused flooding in the western part of the state, considerable wind damage in central regions of the state, and at least three tornadoes that were reported in the north central part of the state. Severe, sustained (one to four days) winter storms are common for this region.

Over a two-day period (January 16-17), two dwarf sperm whales, 27 pilot whales, and one minke whale were necropsied and tissue samples collected. Twenty-five of the stranded cetacean heads were examined; two pilot whale heads and the heads of the dwarf sperm whales were analyzed by CT.

Findings: The pilot whales and dwarf sperm whale were not emaciated, but the minke whale, which was believed to be a dependent calf, was emaciated. Many of the animals were on the beach for an extended period of time prior to necropsy and sampling, and many of the biochemical abnormalities noted in the animals were suspected of being related to the stranding and prolonged time on land. Lesions were observed in all of the organs, but there was no consistency across species. Musculoskeletal disease was observed in two pilot whales and cardiovascular disease was observed in one dwarf sperm whale and one pilot whale. Parasites were a common finding in the pilot whales and dwarf sperm whales, but were considered consistent with the expected parasite load for wild odontocetes. None of the animals exhibited traumas similar to those observed in prior stranding events associated with MFA sonar activity.

Specifically, there was an absence of auditory system trauma and no evidence of distributed and widespread bubble lesions or fat emboli, as was previously observed (Fernández et al., 2005).

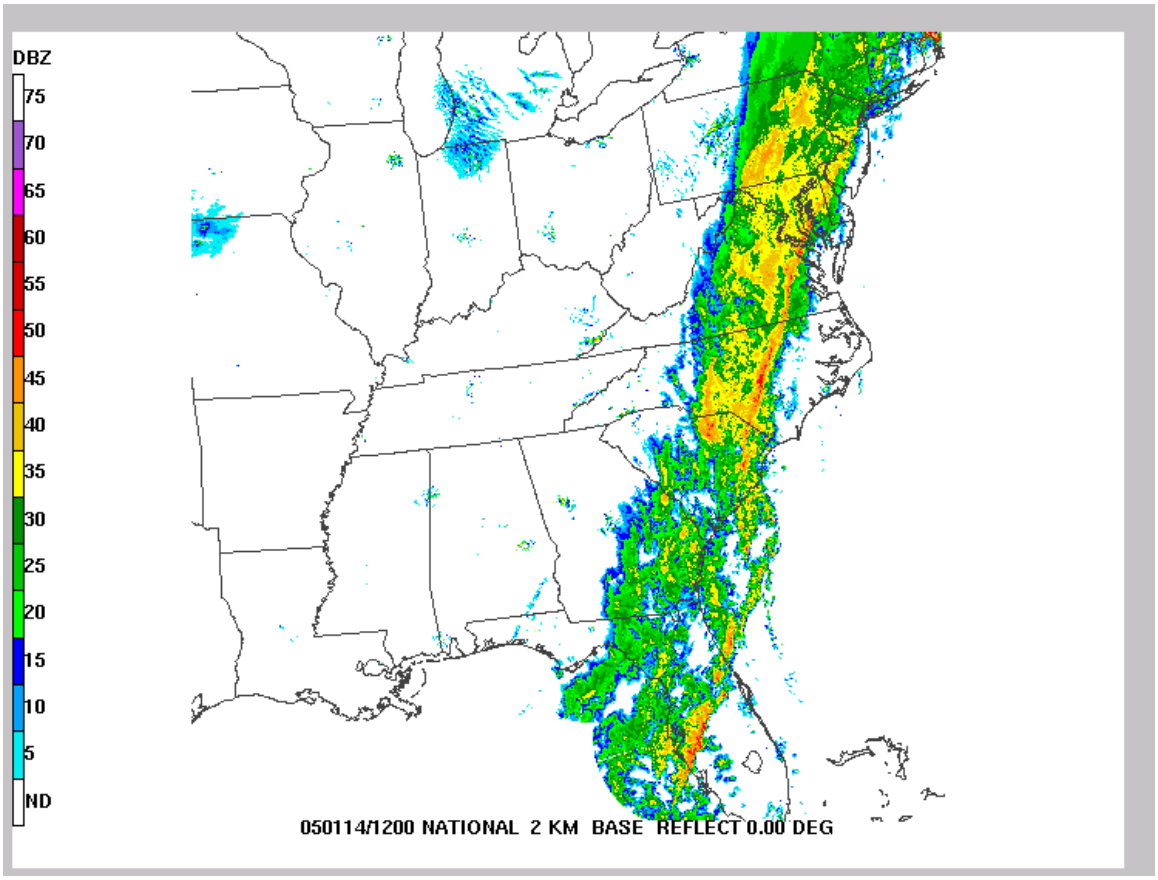


Figure G-4. Regional Radar Imagery for the East Coast (including North Carolina) on January 14, 2005
(The time of the image is approximately 7:00 a.m.**)**

Sonar transmissions prior to the strandings were limited in nature and did not share the concentration identified in previous events associated with MFA sonar use (Evans and England, 2001). The operational/environmental conditions were also dissimilar (e.g., no constrictive channel and a limited number of ships and sonar transmissions). NMFS noted that environmental conditions were favorable for a shift from up-welling to down-welling conditions, which could have contributed to the event. However, other severe storm conditions existed in the days surrounding the strandings and the impact of these weather conditions on at-sea conditions is unknown. No harmful algal blooms were noted along the coastline.

Conclusions: All of the species involved in this stranding event are known to occasionally strand in this region. Although the cause of the stranding could not be determined, several whales had preexisting conditions that could have contributed to the stranding. Cause of death for many of the whales was likely due to the physiological stresses associated with being stranded. A consistent suite of injuries across species, which was consistent with prior strandings where sonar exposure is expected to be a causative mechanism, was not observed.

NMFS was unable to determine any causative role that sonar may have played in the stranding event. The acoustic modeling performed, as in the Hanalei Bay incident, was hampered by uncertainty regarding the location of the animals at the time of sonar transmissions. However, as in the Hanalei Bay incident, the response of the animals following the cessation of transmissions would imply a flight response that persisted for many hours after the sound source was no longer operational. In contrast, the presence of a severe weather event passing through North Carolina during January 13 and 14 is a possible contributing factor to the North Carolina UME of January 15.

G.8 STRANDING SECTION CONCLUSIONS

Marine mammal strandings have been a historic and ongoing occurrence attributed to a variety of causes. Over the last fifty years, increased awareness and reporting has led to more information about the species affected and has raised concerns about anthropogenic sources of stranding. While there have been some marine mammal mortalities potentially associated with MFA sonar effects to a small number of species (primarily limited numbers of certain species of beaked whales), the significance and actual causative reason for any impacts is still subject to continued investigation. ICES (2005a) noted that, taken in context of marine mammal populations in general, sonar is neither a major threat nor a significant contributor to the overall ocean noise budget. However, continued research based on sound scientific principles is needed in order to avoid speculation as to stranding causes and to further our understanding of the potential effects or lack of effects resulting from military MFA sonar (Bradshaw et al., 2006; ICES 2005b; Barlow and Gisiner, 2006; Cox et al. 2006).

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APPENDIX H

SUPPORTING INFORMATION ON SOCIOECONOMICS

SUPPORTING INFORMATION ON SOCIOECONOMICS

H.1 COMMERCIAL SHIPPING

Port Panama City USA was established in 1967 and is comprised of a deepwater and a barge terminal in St. Andrews Bay and the Gulf Intracoastal Waterway. The deepwater terminal contains six deepwater berths with 988 meters (m) (3,241 feet [ft]) of deepwater berthing and intermodal transportation facilities. The barge terminal has 183 m (600 ft) of shallow draft and bulk transfer capability. There are 32,515 square meter (m^2) (350,000 square feet [ft^2]) of warehouse space at the port and an 11-m (36-ft) deep channel. Foreign-Trade Zone (FTZ) 65 is located at the port, and with over 2.0 square kilometers (km^2) (500 acres) designated FTZ status, provides financial advantages to importers and exporters in the international market. Port Panama City provides modern seaport facilities for a variety of break-bulk and bulk cargoes including forest products, steel, non-ferrous metals, bagged products, aggregates, and molasses. Port Panama City handled almost 816,300 metric tons (900,000 short tons) of cargo in FY02/03, an increase of 38 percent over the previous fiscal year (Florida Ports Council, 2003). The value of commodities handled at the port exceeded $420 million in FY02/03, an increase of almost 75 percent over the previous fiscal year (Table 3-31).

The Port of Pensacola is a deep-water port and offers stevedoring and marine terminal services for a wide array of bulk, break-bulk and unitized freight. Bagged agricultural products, forest products, asphalt, sulfur, lime, steel products, frozen and refrigerated foods, and project cargos are the major commodities handled through the port. FTZ 249 and Enterprise Zone (EZ) 1702 are located at the port. Port of Pensacola handled just over 508,020 metric tons (560,000 short tons) of cargo in FY02/03, a decrease of 10 percent over the previous fiscal year (Florida Ports Council, 2003). The value of commodities handled at the port exceeded $115 million in FY02/03, a decrease of 37 percent over the previous fiscal year (Table 3-31).

The Port of Tampa is Florida's largest seaport; about half of the state's port cargo is handled through this facility. In operation since the 1880s, the port has a main shipping channel 13 m (43 ft) deep and is the closest sea trade facility to the Panama Canal. Tampa has a full-service port, which includes capabilities for shipbuilding and repair. The facility supports the transfer of such products as steel, petroleum, vehicles, limestone, citrus concentrate, fertilizer, containerized cargo, scrap metal, and poultry. The port handles an average of 50 million short tons (45 million metric tons) of cargo per year.

The Port of St. Petersburg primarily accommodates cruise ships. The facility includes a 465 m^2 (5,000 ft^2) renovated cruise ship terminal. In addition to this service, the port has 1,254 m^2 (13,500 ft^2) of commercial and retail space for a variety of businesses as well as a 3,010 m^2 (32,400 ft^2) area for marine research, education, and exhibits called Port Discovery. The U.S Coast Guard, the FDEP, and the University of South Florida have branches at the Port of St. Petersburg.

Port Manatee is the fifth largest seaport of Florida's 14 facilities. The port opened in 1970 and today serves as the second largest U.S. port facility for Fresh Del Monte Produce and leads the southeast in forestry product imports. Port Manatee has nearly 2,134 m (7,000 ft) of dock space

with 2.0 undeveloped km^2 (500 undeveloped acres). It has 79,990 m^2 (861,000 ft^2) for warehouse space and a 12-m (40-ft) deep channel. According to a recent economic impact analysis of the port, 22,484 jobs are supported by the facility with revenue of approximately $2.3 billion.

Port of Key West provides facilities for cruise lines and the U.S. Navy. In 2003, almost 1.1 million people took cruises on ships that entered this port. This number increased by about 3.6 percent compared with 2002 data (Key West Chamber of Commerce, 2004). An economic and environmental impact analysis is currently being conducted to determine the impact of increasing the number of cruise ships with access to the Port of Key West.

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APPENDIX I

SUPPORTING INFORMATION ON CULTURAL RESOURCES

SUPPORTING INFORMATION ON CULTURAL RESOURCES

I.1 HISTORICAL SETTING

The Florida peninsula was first populated around 13,000 years ago. As the climate warmed, the sea level rose, reaching its modern level about 5,000 years ago. The archaeological remains of the first inhabitants who lived along the coast are now submerged by the sea and in springs and rivers. These early residents ate fish, shellfish, and crustaceans found along the coast and in the bays and rivers (DHR, 2004a). They relied on dugout canoes for water transportation. Important coastal archaeological sites such as from the Fort Walton Period (AD 1000-1500) served as political and ceremonial centers (DHR, 2004a). Cultural remains found at Santa Rosa Island prehistoric sites include lithic and ceramic artifacts and shell middens. Artifacts indicate that human activity was associated with the Weeden Island culture and the Fort Walton/Pensacola culture (U.S. Air Force, 1997). The diet of these people included estuarine fish, turtles, and shellfish (U.S. Air Force, 1997).

With the arrival of the first Europeans in the sixteenth century, aboriginal political and cultural organizations became fragmented, and by the mid-1600s tribal confederations such as the Apalachee, Calusa, Timucua, and Yamasee inhabited Florida (NCSS, 2003). Mound building stopped and social stratification was reduced, probably due to warfare, relocation of native populations, and epidemic diseases introduced by the Spanish, and later the English, likely responsible for major depopulation across the southeast (NCSS, 2003).

Spanish exploration and the subsequent colonization began in 1508 and lasted for approximately two centuries, including the establishment of a settlement and fort in Pensacola. The Spanish dominated maritime activities in the region with galleons, frigates, and various other light and heavy sailing craft. For more than two centuries after their first contacts, the sole means of communication and transportation between Florida and the outside world was the sailing ship. By 1600, Florida's coasts were well known and charted, and accurate sailing instructions were widely available. In the sixteenth century, several thousand people lost their lives on the coast of Florida as the result of shipwrecks (DHR, 2004a). Florida's earliest shipwreck site, in Pensacola Bay, is a colonial Spanish ship thought to have been part of the expedition of Tristán de Luna who led the first attempt by Europeans to colonize Florida in 1559. A month after his fleet arrived in Pensacola, a hurricane destroyed most of the ships at anchor in the bay (DHR, 2004e).

Spanish settlers had little interest in commercial exploitation of marine resources, and during the British occupation in the late eighteenth century, there was no development of the fishing industry (DHR, 2004a). During the second half of the First Spanish Period (1565 to 1763), Pensacola developed as a coastal colonial outpost protected by a fort overlooking its sheltered harbor, although the coast between Apalachicola and Pensacola was not well explored (DHR, 2004a).

The British acquisition of Florida in 1763 led to an exhaustive survey that included the first accurate record of St. Andrews Bay. Free land grants to pensioned soldiers led to the establishment of Wells, the first settlement in the St. Andrews/Panama City area (DHR, 2004a). The brief British period of occupation (1763 to 1784) was marked by a new settlement strategy

based on commercial plantations. The West Florida colonies were incorporated into the British mercantile shipping network, exporting hides, indigo, sugar, timber, citrus, rice, and naval stores to other British colonies. Slaves were imported to provide labor for the plantations. The coast and the interior were mapped in detail as settlement grants surrounded Pensacola (DHR, 2004a). Sites on Santa Rosa Island include the probable location of an eighteenth century British occupation of Fort Pickens (The History Net, 2007). By 1783, Britain lost control of the Florida territory and ceded the land back to Spain.

During the Second Spanish Period (1784 to 1821), West Florida became prominent as vast quantities of timber and turpentine were exported to Europe (DHR, 2004a). The numbers of French in the area increased until 1793, but English and Spanish colonists displaced the French during the end of the eighteenth century (CEI, 1977).

The American period began with the reacquisition of Florida from Spain in 1821. American commerce grew between 1830 and 1845, increasing ship traffic for the transport of cotton, lumber, and grain. Timber and oysters attracted exporters in the mid-nineteenth century. The Cape San Blas Lighthouse and Keeper's Station was established in 1848 and used through the first quarter of the twentieth century. The first lighthouse lasted from 1847 to 1851. The next collapsed in 1859, the year it was built. A third lighthouse constructed the same year was built about one quarter mile off the Cape. This light was damaged during the Civil War and then was in use again from 1865 until its collapse in 1882. The base of this lighthouse still stands intact in 6.1 m (20 ft) of water. The remains of the two earlier lighthouses are also nearby under water and is listed in the National Park Service's inventory of historic light stations (DHR, 1994; NPS, 2002).

The first Navy presence in the Pensacola area began in 1826 with the construction of the Pensacola Navy Yard, which became one of the nation's best equipped naval stations (NCSS, 2003). The Navy Yard survived the Civil War and a hurricane and tidal wave in 1906, but was decommissioned in 1911 following a yellow fever epidemic. The Naval Air Station (NAS), known as the "Cradle of Naval Aviation," , which was established in 1911-1912 as the NAS we know today, is now the Navy's primary installation for aviation training (NCSS, 2003).

During the Civil War, successful blockade running out of the bay and the numerous salt works attracted a Union bombardment in 1863 that destroyed most of the salt works, the city of St. Andrew, and its docks (DHR 2004a). After the Civil War, the increase in seaborne trade along the northern Gulf Coast, especially with Cuba and Latin America, resulted in St. Andrew being renamed Panama City to celebrate its ties to that country. Fishing and timber remained economic staples of the port and Florida's first paper mill opened in Panama City in 1931.

Well-known shipwrecks in the NSWC PCD Study Area from the late nineteenth and early twentieth century include the *USS Massachusetts* and the *SS Tarpon*. The National Register-listed *USS Massachusetts*, one of three Indiana class battleships authorized in 1890 for the new Steel Navy, was commissioned in 1896. The *Massachusetts*' first battle was during the Spanish-American War as part of the blockade of Cuban ports. The ship was decommissioned in 1906, but in 1910 was refitted with modern hardware, including one of the first shipboard wireless telegraphs, and served as a practice ship. In 1919, the *Massachusetts* returned to Philadelphia, was decommissioned for the final time, and towed to Pensacola in 1921 to be used

as a target for experimental artillery. The remains of the *USS Massachusetts* are 2.4 kilometers (km) (1.5 miles [mi]) south of Pensacola Pass in the Fort Pickens State Aquatic Preserve, administered by the Florida Department of Natural Resources (DHR, 2004d).

The National Register-listed *SS Tarpon*, now a Florida Underwater Archaeological Preserve, was a passenger and cargo ship that sank in 1937 about 13 km (8 mi) offshore of St. Andrews Bay. The ship was well preserved until 1994 when Hurricane Opal scattered debris from the ship after the sides split. The *SS Tarpon* was constructed in 1887 at Wilmington, Delaware, by the renowned shipbuilders Pusey and Jones (DHR, 2004c). It was christened *Naugatuck* and delivered to the Naugatuck Valley Steamboat Company of Derby, Connecticut. Competition with local railroads resulted in hard times for the steamship company, and within two years the ship was offered for sale. The steamer was put into service in the Tampa area. In 1891 the ship was sent back to the builders, who lengthened the hull by 9.1 m (30 ft) and added several staterooms. Renamed *Tarpon*, the ship returned to Florida and may have been one of the dozens of vessels used to transport troops and supplies to and from Cuba during the Spanish-American War. In 1902, the *Tarpon* was purchased by the Pensacola, St. Andrew & Gulf Steamship Company. Beginning in 1903, *Tarpon* made weekly runs between Mobile, Pensacola, St. Andrews Bay (Panama City), Apalachicola, and Carrabelle. *Tarpon* continued the weekly schedule until 1937, when the heavily loaded ship was lost in a gale (DHR, 2004c).

World War II helped to rejuvenate the shipbuilding industry in the Panama City area (DHR, 2004a). Santa Rosa Island was the location of World War II testing of the JB-2 missile, an American version of the V-1 flying bomb that Germany used during World War II (U.S. Air Force, 1997). The Naval Coastal Systems Station (i.e., Naval Surface Warfare Center Panama City Division [NSWC PCD]) was created as a Naval Section Base in 1942. It became the U.S. Naval Amphibious Training Base, St. Andrews Bay, by mid-1944 and was deactivated in June 1945 (DHR, 2004b). In July 1945, the U.S. Navy Mine Countermeasures Station was established there.

Within the present project area, World War II ship remains include the *Empire Mica,* a British oil tanker built in 1941 by Furness S.B. Company of Haverton Hill on Tees. The *Mica* was en route from Houston to England for the Anglo-American Oil Company Limited when two torpedoes from the *U-67* ignited the 12,000 short tons (10,886 metric tons) of oil onboard. The ship burned for a day as it drifted in the Gulf of Mexico (GOM), finally sinking in 32 meters of (105 feet) of water south of Cape San Blas, Florida (AUE, 2004).

Also during World War II, the U.S. Maritime Commission had a shipyard built for the construction of Liberty ships in Panama City (DHR, 2004b). In the Wainwright Yard, more than 100 ships were built from 1943 to the end of the war. The yard employed as many as 15,000 employees at a time, and provided housing, stores, and restaurant and laundry facilities (DHR, 2004b). The Panama City population increased from 20,000 in 1940 to a peak of 60,000 residents during the World War II era (DHR, 2004b). Men began arriving for gunnery training at what is now Tyndall Air Force Base in 1941. Eventually the base included more than 113.3 km^2 (28,000 acres) along the GOM. Classes began in early 1942 with 8,000 graduates during its first year of operation (DHR, 2004b).

In 1955, the U.S. Navy Mine Countermeasures Station was renamed the U.S. Navy Mine Defense Laboratory with a mission that included torpedo countermeasures, mine hunting, and mine watching. In 1968, the laboratory was renamed the Naval Ship Research and Development Laboratory, Panama City. This later became the Naval Coast Systems Laboratory in 1972 and the Naval Coastal Systems Center (NCSC) in 1978. NCSC was later redesignated the NSWC PCD.

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APPENDIX J

FEDERAL AGENCY COASTAL ZONE MANAGEMENT ACT (CZMA) CONSISTENCY DETERMINATION FOR FLORIDA

FEDERAL AGENCY COASTAL ZONE MANAGEMENT ACT (CZMA) CONSISTENCY DETERMINATION FOR FLORIDA

J.1 INTRODUCTION

This document provides the state of Florida with the Department of the Navy's (DON) Consistency Determination under CZMA Section 307 and 15 C.F.R. Part 930 subpart C. The information in this Consistency Determination is provided pursuant to 15 C.F.R. Section 930.39.

Pursuant to Section 307 of the Coastal Zone Management Act, 16 USC § 1456, as amended, its implementing regulations at 15 C.F.R. Part 930, this is a Federal Consistency Determination for activities described within the Naval Surface Warfare Center (NSWC) Panama City Division (PCD), Florida, Environmental Impact Statement (EIS), Chapter 2 of the EIS.

J.1.1 Proposed Federal Agency Action

The Proposed Action is to improve NSWC PCD's capabilities to conduct new and increased mission operations for DoD and other users within the three military Operating Areas (W-155 (includes Pensacola Operating Area), W-151 (includes Panama City Operating Area), and W-470) in the northern Gulf of Mexico (GOM), and in the St. Andrews Bay (SAB) area (Figure 1-1 of the EIS).

The test operation occurring in these areas includes: air operations, surface operations, subsurface operations, sonar operations, electromagnetic operations, laser operations, ordnance operations, and projectile firing. Specific operational capabilities are further discussed in Chapter 2 of the EIS.

J.1.2 Federal Consistency Review

Statutes addressed as part of the Florida Coastal Zone Management Program consistency review and considered in the analysis of the Proposed Action are discussed in Table J-1.

Pursuant to 15 C.F.R. § 930.41, the Florida State Clearinghouse has 60 days from receipt of this document in which to concur with or object to this Consistency Determination, or to request an extension, in writing, under 15 C.F.R. § 930.41(b). The Navy received a letter in May 2008 which provided concurrence with this Consistency Determination. A copy of the letter is included at the end of this appendix.

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Table J-1. Florida Coastal Management Program Consistency Review

Statute	Consistency	Scope
Chapter 161 *Beach and Shore Preservation*	The proposed project would not adversely affect beach and shore management, specifically as it pertains to: -The Coastal Construction Permit Program. -The Coastal Construction Control Line (CCCL) Permit Program. -The Coastal Zone Protection Program. Line charge testing activities will only occur in the water; thus no land activities will occur.	Authorizes the Bureau of Beaches and Coastal Systems within Department of Environmental Protection (DEP) to regulate construction on or seaward of the state's beaches.
Chapter 163, Part II *Growth Policy; County and Municipal Planning; Land Development Regulation*	The Proposed Action would not affect local government comprehensive plans.	Requires local governments to prepare, adopt, and implement comprehensive plans that encourage the most appropriate use of land and natural resources in a manner consistent with the public interest.
Chapter 186 *State and Regional Planning*	The Proposed Action would not affect state-level planning requirements.	Details state-level planning requirements. Requires the development of special statewide plans governing water use, land development, and transportation.
Chapter 252 *Emergency Management*	The Proposed Action would not have an impact on the ability of the state to respond to or recover from natural or man-made disasters.	Provides for planning and implementation of the state's response to, efforts to recover from, and the mitigation of natural and man-made disasters.
Chapter 253 *State Lands*	The Department of the Navy (DON) has a Categorical Exclusion available for the deployment of test minefields (i.e., inert mine-like objects) and do not require permits. Line charge detonations will be separated in both time and location, which will disperse effects and allow sufficient time for sediments to settle between events. Therefore, there will be no impact to state lands.	Addresses the state's administration of public lands and property of this state and provides direction regarding the acquisition, disposal, and management of all state lands.
Chapter 258 *State Parks and Preserves*	The Proposed Action would not impact the administration or management of state parks and preserves.	Addresses administration and management of state parks and preserves (Chapter 258).
Chapter 259 *Land Acquisition for Conservation or Recreation*	The Proposed Action would not have an effect on the acquisition of environmentally endangered and outdoor recreation lands.	Authorizes acquisition of environmentally endangered lands and outdoor recreation lands (Chapter 259).
Chapter 260 *Recreational Trails System*	The Proposed Action would not have an impact on the acquisition of land to create a recreational trails system.	Authorizes acquisition of land to create a recreational trails system and to facilitate management of the system (Chapter 260).

Table J-1. Florida Coastal Management Program Consistency Review Cont'd

Statute	Consistency	Scope
Chapter 267 *Historical Resources*	Air Operations, subsurface, and ordnance operations may have the potential to impact historical resources of the state. Standard management practices would include compliance with Section 106 of the National Historic Preservation Act (NHPA), including State Historic Preservation Officer (SHPO), prior to the implementation of actions with the potential to affect historic properties. Impacts to historical resources as a result of the Proposed Action are discussed in further detail in Chapter 4 of the Environmental Impact Statement (EIS).	Addresses management and preservation of the state's archaeological and historical resources.
Chapter 288 *Commercial Development and Capital Improvements*	The Proposed Action would not have an effect on commercial development or capital improvements.	Provides the framework for promoting and developing the general business, trade, and tourism components of the state economy.
Chapter 334 *Transportation Administration*	The Proposed Action would not have an impact on the state's policy concerning transportation administration.	Addresses the state's policy concerning transportation administration (Chapter 334).
Chapter 339 *Transportation Finance and Planning*	The Proposed Action would not have an impact on the finance and planning needs of the state's transportation system.	Addresses the finance and planning needs of the state's transportation system (Chapter 339).
Chapter 370 *Saltwater Fisheries*	The Proposed Action may impact federally-listed species. A formal Section 7 consultation under the Endangered Species Act with the National Marine Fisheries Service as well as a Letter of Authorization under the Marine Mammal Protection Act will be completed before initiation of the Proposed Action.	Addresses management and protection of the state's saltwater fisheries.
Chapter 372 *Wildlife*	Impacts to wildlife resources will be addressed through a federal consultation process with the National Marine Fisheries Service. No impacts to any terrestrial species will occur as a result of the Proposed Action.	Addresses the management of the wildlife resources of the state.
Chapter 373 *Water Resources*	The Proposed Action will have a minimal impact on water quality and would not add appreciably to existing water quality impacts from other activities. Additionally, the following best management practices will be implemented during the Proposed Action: • Depleted uranium rounds will not be used.	Addresses the state's policy concerning water resources.

Table J-1. Florida Coastal Management Program Consistency Review Cont'd

Statute	Consistency	Scope
	• Collection of ammunition casings and restricting them from entering the water • Minimizing the number of bottom mine detonations. • Using the smallest amount of explosive material possible that will still achieve test objectives. Impacts to water resources as a result of the Proposed Action are further discussed in Chapter 4 of the EIS.	
Chapter 375 *Multipurpose Outdoor Recreation; Land Acquisition, Management, and Conservation*	Impacts to multipurpose outdoor recreation are not significant.	Develops comprehensive multipurpose outdoor recreation plan to document recreational supply and demand, describe current recreational opportunities, estimate need for additional recreational opportunities, and propose means to meet the identified needs (Chapter 375).
Chapter 376 *Pollutant Discharge Prevention and Removal*	Impacts from munitions release are discussed under Chapter 373 of this table, Water Resources, and are further addressed in Chapter 4 of the EIS. Pollutant discharges as a result of the Proposed Action are anticipated to be minimal.	Regulates transfer, storage, and transportation of pollutants, and cleanup of pollutant discharges.
Chapter 377 *Energy Resources*	The Proposed Action would not have an impact on oil and gas exploration in the GOM.	Addresses regulation, planning, and development of energy resources of the state.
Chapter 380 *Land and Water Management*	Under the Proposed Action, development of state lands with regional (i.e., more than one county) impacts would not occur. Areas of Critical State Concern or areas with approved state resource management plans, such as the Northwest Florida Coast, would not be affected. Changes to coastal infrastructure such as bridge construction, capacity increases of existing coastal infrastructure, or use of state funds for infrastructure planning, designing, or construction would not occur.	Establishes land and water management policies to guide and coordinate local decisions relating to growth and development.
Chapter 381 *Public Health, General Provisions*	The Proposed Action does not involve the construction of an on-site sewage treatment and disposal system.	Establishes public policy concerning the state's public health system.
Chapter 388 *Mosquito Control*	The Proposed Action would not affect mosquito control efforts.	Addresses mosquito control efforts in the state.
Chapter 403 *Environmental Control*	The Proposed Action would not affect the quality of public water supply, nor does it entail discharging of industrial wastes into	Establishes public policy concerning environmental control in the state.

Table J-1. Florida Coastal Management Program Consistency Review Cont'd

Statute	Consistency	Scope
	state waters. Refer to Chapter 373 for the state's policy for water resources. Furthermore, NSWC PCD RDT&E activities will have no bearing on the drinking water supply or standards set forth in Part VI, and will not involve any agricultural activities or the use of agricultural water management systems. NSWC PCD RDT&E activities do not involve the construction of power plants or routing for transmission lines, nor involve any aspect of solid waste management. Finally, the proposed action will not involve the construction or maintenance of natural gas transmission pipelines. The Proposed Action will have a minimal impact on air quality. There would be impacts to air quality from the use of live ordnance detonations, weapons usage, surface and air operations associated with the Naval Surface Warfare Center Panama City Division (NSWC PCD) programmatic efforts; however, these impacts would be temporary and localized. Based on evaluation using various references including AP-42 values as well as the U.S. Air Force Inventory Guidance for Mobile Sources at Air Force Installations (AFIERA), the increase in emissions would not exceed the established 10% criterion for the total NSWC PCD Study Area counties emissions on an individual pollutant basis. It should be noted that air quality issues associated with the programmatic activities are a result of mobile and area sources. Air Quality analysis is discussed in further detail in Chapter 4 of the EIS.	
Chapter 582 *Soil and Water Conservation*	The Proposed Action would not require any preventative measures against soil erosion, as no land activities would occur.	Provides for the control and prevention of soil erosion.

Florida Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

May 19, 2008

Mrs. Carmen M. Ferrer, EIS Team Lead
Naval Surface Warfare Center PCD, Code XPF1
110 Vernon Avenue
Panama City, FL 32407-7001

RE: Department of the Navy – Draft Environmental Impact Statement/Overseas Environmental Impact Statement – Naval Surface Warfare Center Panama City Division (NSWC PCD) Mission Activities.
SAI # FL200804074156C

Dear Mrs. Ferrer:

The Florida State Clearinghouse, pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 95-359, the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended, has coordinated a review of the referenced Draft Environmental Impact Statement (EIS).

Based on the information contained in the Draft EIS and comments provided by our reviewing agencies, the state has determined that, at this stage, the proposed federal activities are consistent with the Florida Coastal Management Program.

Thank you for the opportunity to review this proposal. Should you have any questions regarding this letter, please contact Ms. Lauren P. Milligan at (850) 245-2170.

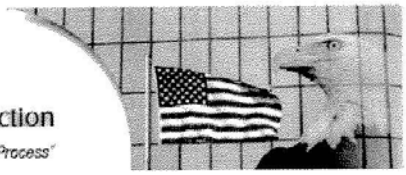
Yours sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/lm
Enclosures

Florida
Department of Environmental Protection
"More Protection, Less Process"



Categories

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Project Information	
Project:	FL200804074156C
Comments Due:	05/08/2008
Letter Due:	05/19/2008
Description:	DEPARTMENT OF THE NAVY - DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT - NAVAL SURFACE WARFARE CENTER PANAMA CITY DIVISION (NSWC PCD) MISSION ACTIVITIES - OF INTEREST TO THE STATE OF FLORIDA.
Keywords:	NAVY - DEIS, NAVAL SURFACE WARFARE CENTER PANAMA CITY MISSION ACTIVITIES
CFDA #:	99.300
Agency Comments:	
FISH and WILDLIFE COMMISSION - FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION	
NO COMMENT BY SCOTT SANDERS ON 4/16/08.	
STATE - FLORIDA DEPARTMENT OF STATE	
No Comment/Consistent	
ENVIRONMENTAL PROTECTION - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION	
No Comment	

For more information or to submit comments, please contact the Clearinghouse Office at:

3900 COMMONWEALTH BOULEVARD, M.S. 47
TALLAHASSEE, FLORIDA 32399-3000
TELEPHONE: (850) 245-2161
FAX: (850) 245-2190

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DATE: 4/7/2008
COMMENTS DUE DATE: 5/8/2008
CLEARANCE DUE DATE: 5/19/2008
SAI#: FL200804074156C
REFER TO: FL200409149841C

MESSAGE:

STATE AGENCIES	WATER MNGMNT. DISTRICTS	OPB POLICY UNIT	RPCS & LOC GOVS
ENVIRONMENTAL PROTECTION			
FISH and WILDLIFE COMMISSION			
X STATE			

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

_ **Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.**

X **Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.**

_ **Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.**

_ **Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.**

Project Description:

DEPARTMENT OF THE NAVY - DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT - NAVAL SURFACE WARFARE CENTER PANAMA CITY DIVISION (NSWC PCD) MISSION ACTIVITIES - OF INTEREST TO THE STATE OF FLORIDA.

To: Florida State Clearinghouse

AGENCY CONTACT AND COORDINATOR (SCH)
3900 COMMONWEALTH BOULEVARD MS-47
TALLAHASSEE, FLORIDA 32399-3000
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EO. 12372/NEPA
- [X] No Comment
- [ ] Comment Attached
- [ ] Not Applicable

Federal Consistency
- [X] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: Division of Historical Resources / Bureau of Historic Preservation

Reviewer: Samantha Earnest Laura A. Kammerer, Deputy SHPO

Date: 5/5/08 5.5.2008

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APPENDIX K

FEDERAL AGENCY COASTAL ZONE MANAGEMENT ACT (CZMA) CONSISTENCY DETERMINATION FOR ALABAMA

FEDERAL AGENCY COASTAL ZONE MANAGEMENT ACT (CZMA) CONSISTENCY DETERMINATION FOR ALABAMA

K.1 INTRODUCTION

This document provides the State of Alabama with the Department of the Navy's (DON) Consistency Determination under CZMA Section 307 and 15 Code of Federal Regulations (C.F.R.) Part 930 subpart C. The information in this Consistency Determination is provided pursuant to 15 C.F.R. Section 930.39.

Pursuant to Section 307 of the Coastal Zone Management Act, 16 USC § 1456, as amended, its implementing regulations at 15 C.F.R. Part 930, this is a Federal Consistency Determination for activities described within the Naval Surface Warfare Center (NSWC) Panama City Division (PCD), Florida, Environmental Impact Statement (EIS), Chapter 2.

K.1.1 Proposed Federal Agency Action

The Proposed Action is to improve NSWC PCD's capabilities to conduct new and increased mission operations for DoD and other users within the three military Operating Areas (W-155 [includes Pensacola Operating Area], W-151 [includes Panama City Operating Area], and W-470) in the northern Gulf of Mexico (GOM), and in the St. Andrews Bay (SAB), Florida, area (Figure 1-1 of the EIS).

The test operation occurring in these areas includes: air operations, surface operations, subsurface operations, sonar operations, electromagnetic operations, laser operations, ordnance operations, and projectile firing. Specific operational capabilities are further discussed in Chapter 2 of the EIS.

K.1.2 Federal Consistency Review

Provisions addressed as part of the Alabama Coastal Area Management Program (ACAMP) consistency review and considered in the analysis of the Proposed Action are discussed in Table K-1.

Pursuant to 15 C.F.R. § 930.41, the Alabama Department of Environmental Management (ADEM) has 60 days from receipt of this document in which to concur with or object to this Consistency Determination, or to request an extension, in writing, under 15 C.F.R. § 930.41(b). The Navy did not receive a response nor a request for an extension from the ADEM after the 90th day (approximately July 14, 2008) from receipt of this determination. Therefore the Navy concluded ADEM's concurrence with the Consistency Determination on July 31, 2008.

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Table K-1. Alabama Coastal Management Program Consistency Review

Statute	Consistency	Scope
Provision .01 *General Rules*	<u>Historical, Cultural, and Archaeological Resources:</u> The Proposed Action will not have impacts on the state of Alabama's historical resources as designated by the National Historic Preservation Act (NHPA). The Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area does not include submerged state lands of Alabama, and therefore no impacts to historical, cultural, archeological, resources will occur. Additionally, any known historical, archeological, and cultural resource sites located within the NSWC PCD Study Area will be avoided through prior identification and avoidance of those sites. <u>Water Resources:</u> Subsurface and surface operations and live detonations could potentially affect water quality; however, impacts are anticipated to be minimal. Analysis in Chapter 4 of the Environmental Impact Statement (EIS) addresses water quality in further detail. Additionally, the following best management practices will be utilized to minimize impacts to water resources. • Do not use depleted uranium rounds. • Collect ammunition casings and do not allow them to enter the water. • Minimize the number of bottom mine detonations. • Use the smallest amount of explosive material possible that will still achieve test objectives.	States that all uses subject to the Alabama Coastal Management Program (ACAMP) must abide by applicable air and water quality standards. The Alabama Department of Environmental Management shall consider the extent to which the use adversely impacts historical, cultural, archeological resources, or architectural sites; water resources; air quality; biological resources (including wildlife and fishery habitat); public access to tidal and submerged lands, navigable waters, beaches, and other public recreational resources; and designated special management areas.

Table K-1. Alabama Coastal Management Program Consistency Review Cont'd

Statute	Consistency	Scope
Provision .01 *General Rules* (continued)	Air Quality: Impacts to air quality from ordnance detonation, surface, and air operations will be minimal. Based on evaluation using various references including AP-42 values as well as the United States (U.S.) Air Force Inventory Guidance for Mobile Sources at Air Force Installations (AFIERA), the increase in emissions would not exceed the established 10% criterion for the total NSWC PCD Study Area counties emissions on an individual pollutant basis. It should be noted that air quality issues associated with the programmatic activities are a result of mobile and area sources. Specific details regarding the assumptions and calculations associated with the emissions estimates are located in the Air Quality Appendix of the EIS. Biological Resources: The Proposed Action may impact federally-listed species. A formal Section 7 consultation under the Endangered Species Act with the National Marine Fisheries Service, as well as a Letter of Authorization under the Marine Mammal Protection Act, will be completed before initiation of the Proposed Action. Public Access for Recreational Activities: Restricted access to tidal and submerged lands, navigable waters, beaches, and other public recreational resources; and designated special management areas are not significant. No impacts to artificial reefs are anticipated as a result of the Proposed Action. All EIS activities will avoid the known Alabama reef areas.	
Provision .02 *Dredging and/or Filling*	The Proposed Action does not involve any dredging and/or filling.	Permits dredging and/or filling of water bottoms or adjacent wetlands if in compliance with the several provisions. Requires specific procedures for dredging and/or filling activities.

Table K-1. Alabama Coastal Management Program Consistency Review Cont'd

Statute	Consistency	Scope
Provision .03 *Mitigation*	The Proposed Action would not address activities occurring in or affecting wetlands.	Requires approval of a mitigation plan for projects impacting wetlands.
Provision .04 *Marinas*	The Proposed Action does not involve the construction or expansion of a new or existing marina.	Requires approval of plans for construction and operation of a new marina or for expansion of an existing marina within the coastal area.
Provision .05 *Piers, Docks, and Boathouses*	The Proposed Action does not involve the construction of any piers, docks, boathouses, or other pile support structures.	Requires that piers, docks, boathouses, and other pile-supported structures shall be constructed on pilings that permit a reasonable unobstructed ebb and flow of the tide. Specifies construction requirements of structures to minimize impacts on wetlands and submersed grasslands.
Provision .06 *Shoreline Stabilization and Erosion Mitigation*	The Proposed Action does not involve construction of any jetties, groins, breakwaters, or placement of bulkheads and ripraps.	Requires specifications for bulkheads, riprap placement, and other structural shoreline armament. Permits jetties, groins, and breakwater and like structures only if they are necessary to protect an existing navigational channel or regional benefit use, there are no other feasible non-structural alternatives, and there are no significant impacts to adjacent shorelines.
Provision .07 *Canals, Ditches, and Boatslips*	The Proposed Action does not involve construction or expansion of any canals, drainage ditches, or excavation of any boatslips.	Addresses construction of expansion of canals, storm water drainage ditches, and excavated boatslips. Prevents such construction of new canals or expansions of existing canals through wetlands or uplands with the purpose or effect of creating new waterfront property.
Provision .08 *Construction and Other Activities on Gulf Beaches and Dunes*	The Proposed Action does not involve any construction on or near the construction control line. No impacts to on-site sewage systems or septic tanks would result from the Proposed Action. There would be no use of motorized vehicles on the beach or primary dune system.	Prevents alteration of the primary dune system or any existing or new structure associated with land between the mean high tide and the construction control line. Addresses areas where construction is not permissible and other construction requirements. Prevents operation of most motorized vehicles on the beach or primary dune system. Addresses placement of septic tanks and other on-site sewage disposal systems. Permits placement of daily-recreational-use items if they are removed prior to major storm events.

Table K-1. Alabama Coastal Management Program Consistency Review Cont'd

Statute	Consistency	Scope
Provision .09 *Groundwater Extraction*	The Proposed Action does not involve construction or extraction of groundwater wells.	Addresses the state's policy concerning groundwater wells.
Provision .10 *Siting, Construction and Operation of Energy Facilities*	The Proposed Action would not involve the construction of any new energy facilities and related appurtenances. There would be no discharge of any untreated products as a result of the Proposed Actions.	Addresses provisions governing siting, construction, and operation of new energy facilities and related appurtenances. Addresses state policy on discharge of untreated produced waters, drill muds, and drill cuttings.
Provision .11 *Commercial and Residential Development*	The Proposed Action would not involve any commercial or residential development.	Addresses new commercial and residential developments located wholly or partially within the coastal area.
Provision .12 *Discharges to Coastal Waters*	The Proposed Action would have a minimal impact on water quality and would not add appreciably to existing water quality impacts from other activities. Through the use of the best management practices discussed in Chapter 4 (Water Quality) of the EIS, discharges to coastal waters would be minimized.	Addresses permits for continuous or frequent discharge to coastal waters, existing permitted National Pollutant Discharge Elimination System (NPDES) discharges to coastal waters, and other discharges that may affect coastal resources.

APPENDIX L

DEFINITIONS AND METRICS FOR ACOUSTIC QUANTITIES

DEFINITIONS AND METRICS FOR ACOUSTIC QUANTITIES

This appendix provides reference materials on some of the more important metrics and units used in the report. It is intended to provide basic information, with references to further information.

L.1 SOME FUNDAMENTAL DEFINITIONS OF ACOUSTICS

Sound and Acoustics

Paraphrasing Beranek (1986), *sound* is defined as a disturbance propagated through an elastic medium, causing a change in pressure or a displacement of particles.

Sound is produced when an elastic medium is set into motion, often by a vibrating object within the medium. As the object vibrates, its motion is transmitted to adjacent "particles" of the medium. The motion of these particles is transmitted to adjacent particles, and so on. The result is a mechanical disturbance (the "sound wave") that moves away from the source and propagates at a medium-dependent speed (the "sound speed"). As the sound wave travels through the medium, the individual particles of the medium oscillate about their static positions but do not propagate with the sound wave. As the particles of the medium move back and forth they create small changes, or perturbations, about the static values of the medium density, pressure, and temperature.

Density

For a static, homogeneous volume of matter, *density* is the mass per unit volume. In seawater, the average density is about 1026 kilogram per cubic meter (kg/m^3) (2,262 lbs per 35.3 cubic feet), or 1.026 gram per cubic centimeter (g/cm^3) (.036 ounces per .061 cubic inch). In air, density varies substantially with altitude and with time. A typical value at sea level and 20 degrees Celsius (68 degrees Fahrenheit) is 1.21 kg/m^3 (2.67 lbs per .061 cubic inch) or 0.00121 g/cm^3 (4.27e-5 ounce per .061 cubic inch).

Pressure

Pressure (in mechanics) is a type of stress that is exerted uniformly in all directions; its measure is the force exerted per unit area (MHDPM, 1978).

In a fluid (gas or liquid), *pressure at a point* is defined as follows. For an arbitrarily small area containing the point, the pressure is the normal force applied to the small area divided by the size of the small area.

Static Pressure (in acoustics) is, at a point in a fluid (gas or liquid), the pressure that would exist if there were no sound waves present (Beranek, 1986).

Because pressure is a force applied to a unit area, it does not necessarily generate energy. Pressure is a scalar quantity; there is no direction associated with pressure, though a pressure wave may have a direction of propagation. *Pressure* has units of force/area. The SI derived unit

of pressure is the Pascal (Pa) defined as one newton per square meter (N/m^2). Alternative units are many (pounds per square feet [lbs/ft^2], bars, inches of mercury, etc.); some are listed at Section L.4 of this appendix.

Acoustic Pressure

Without limiting the discussion to small amplitude or linear waves, *acoustic pressure* is defined as the residual pressure over the "average" static pressure caused by a disturbance. As such, the "average" acoustic pressure is zero. Here the "average" is usually taken over time.

Mean-Square Pressure is usually defined as the short-term time average of the squared pressure:

$$\frac{1}{T}\int_{\tau}^{\tau+T} p^2(t)dt\,,$$

where *T* is on the order of several periods of the lowest frequency component of the time series.

RMS Pressure is the square root of the mean-square pressure.

Impedance

In general *impedance* measures the ratio of force amplitude to velocity amplitude. For plane waves, the ratio is ρc, where ρ is the fluid density and *c* the sound speed.

Equivalent Plane Wave Intensity

As noted by Bartberger (1965) and others, it is general practice to measure (and model) pressure (p) or rms pressure (p_{rms}), and then infer an intensity from the formula for plane waves in the direction of propagation:

$$\text{Intensity} = (p_{rms})^2/\rho c.$$

Such an inferred intensity should properly be labeled as the *equivalent plane-wave intensity in* the *propagation direction*.

Energy Flux Density (EFD)

Sound energy can be described by the sound energy flux density (EFD), which is the sound power flow per unit area, or the time integral of instantaneous intensity. For plane waves,

$$EFD = \frac{1}{\rho c}\int_{0}^{T} p^2(t)dt,$$

where ρc is the impedance and *t* is the duration of the signal. Units are Joule per square meter (J/m^2). Note that EFD is the time-averaged squared pressure multiplied by the averaging time.

L.2 DEFINITIONS RELATED TO SOUND SOURCES, SIGNALS, AND EFFECTS

Source Intensity

S*ource intensity*, $I(\theta,\phi)$, is the intensity of the projected signal referred to a point at unit distance from the source in the direction (θ,ϕ). (θ,ϕ) is usually unstated; in that case, it is assumed that propagation is in the direction of the axis of the main lobe of the projector's beam pattern.

Source Power

For an omni-directional source, the power radiated by the projector at range r is $I_r(4\pi r^2)$ where I_r is the radiated intensity at range r (in the far field). If intensity has SI units of watts per square meter (W/m^2), then the power has units of W. The result can be extrapolated to a unit reference distance if either I_1 is known or $I_r=I_1/r^2$. Then the *source power* at unit distance is $4\pi I_1$, where I_1 is the intensity (any direction) at unit distance in units of power/area.

Pure Tone Signal or Wave (related: Continuous Wave, CW, Monochromatic Wave, Unmodulated Signal)

Each term means a single-frequency wave or signal, but perhaps limited in time (gated). The actual bandwidth of the signal will depend on duration and context.

Narrowband Signal

Narrowband is a non-precise term. It is used to indicate that the signal can be treated as a single-frequency carrier signal, which is made to vary (is modulated) by a second signal whose bandwidth is smaller than the carrier frequency. In dealing with sonars, a bandwidth less than about 30 percent of center frequency is often spoken of as narrowband.

Hearing Threshold

"The *threshold of hearing* is defined as the sound pressure at which one, listening with both ears in a free field to a signal of waning level, can still just hear the sound, or if the signal is being increased from a level below the threshold, can just sense it" (Magrab, p. 29, 1975).

"A threshold of audibility for a specified signal is the minimum effective sound pressure of that signal that is capable of evoking an auditory sensation (in the absence of noise) in a specified fraction of trials" (Beranek, p. 394, 1986).

Temporary (Hearing) Threshold Shift (TTS)

"The diminution, following exposure to noise, of the ability to detect weak auditory signals is termed *temporary threshold shift* (TTS), if the decrease in sensitivity eventually disappears…" (Magrab, p. 35, 1975).

Permanent (Hearing) Threshold Shift (PTS)

"The diminution, following exposure to noise, of the ability to detect weak auditory signals is termed temporary threshold shift (TTS), if the decrease in sensitivity eventually disappears, and noise-induced permanent threshold shift (NIPTS) if it does not" (Magrab, p. 35, 1975).

L.3 DECIBELS AND SOUND LEVELS

Decibel (dB)

Because practical applications of acoustic power and energy involve wide dynamic ranges (e.g., from 1 to 1,000,000,000,000), it is common practice to use the logarithm of such quantities. The use of a logarithmic scale compresses the range of numerical values that must be used. For a given quantity Q, define the decibel as:

$$10 \log (Q/Q_0) \text{ dB re } Q_0$$

where Q_0 is a reference quantity and *log* is the base-10 logarithm.

When a numeric value is presented in decibels, it is important to also specify the numeric value and units of the reference quantity. Normally the numeric value is given, followed by the text "re", meaning "with reference to", and the numeric value and unit of the reference quantity (Harris, 1998). For example, a pressure of 1 Pa, expressed in decibels with a reference of 1 μPa, is written 120 dB re 1 μPa.

The word "level" usually indicates decibel quantity (e.g., *sound pressure level* or *spectrum level*). Some specific examples for this document follow.

Sound Pressure Level

For pressure p, the *sound pressure level* (SPL) is defined as follows:

$$\text{SPL} = 10 \log (p^2/p_0^{\,2}) \text{ dB re } 1\ p_0^{\,2},$$

where p_0 is the reference pressure (usually 1 μPa for underwater acoustics and 20 μPa for in-air acoustics). The convention is to state the reference as p_0 (with the square implicit).

For a pressure of 100 μPa, the SPL would be

$$10 \log [(100\ \mu\text{Pa})^2/ (1\ \mu\text{Pa})^2] \text{ dB re } 1\ \mu\text{Pa}$$

$$= 40 \text{ dB re } 1\ \mu\text{Pa}$$

This is about the lowest level that a dolphin can hear in water.

Source Level

Refer to source intensity above. Define *source level* as $SL(\theta,\phi) = 10 \log[I(\theta,\phi)/I_0]$, where I_o is the reference intensity (usually that of a plane wave of rms pressure 1 μPa). The reference pressure and reference distance must be specified. When SL does not depend on direction, then the source is said to be *omnidirectional;* otherwise it is *directive.*

Intensity Level

It is nearly universal practice to use SPL in place of intensity level. This makes sense as long as impedance is constant. In that case, intensity is proportional to short-term-average, squared pressure, with proportionality constant equal to the reciprocal of the impedance.

When the impedance differs significantly in space or time (as in noise propagation from air into water), the intensity level must specify the medium change and/or the changes in impedance.

Intensity Levels in Water and in Air as Functions of Pressure and SPL

Unlike pressure, the metrics for intensity depend on the acoustic impedance of the medium. Thus, for example, under the assumption of plane waves, the same pressure (first three columns) causes different intensities in water and in air:

Pressure (rms)	SPL (re 1 μPa)	SPL (re 20 μPa)		Intensity in Water (W/m^2)	Intensity in Air (W/m^2)
1 μPa = 10^{-5} dyn/cm^2	0 dB	-26 dB		$6.7\ 10^{-19}$	$2.4\ 10^{-15}$
20 μPa = 0.0002 μbar	26 dB	0 dB		$2.7\ 10^{-16}$	$9.6\ 10^{-13}$
$1.2\ 10^9$ μPa = 1.2 kPa	181.8 dB	155.8 dB		1	3600
1 psi = $6.9\ 10^9$ μPa	196.8 dB	170.8 dB		31.8	$1.1\ 10^5$
$1.77\ 10^{10}$ μPa	205 dB	179.0 dB		252.6	$8.7\ 10^5$
$3.2\ 10^{10}$ μPa = 66.7 psf	210 dB	184 dB		660.7	$2.4\ 10^6$
$3.2\ 10^{12}$ μPa = 3200 kPa	250 dB	224 dB		$6.6\ 10^6$	$2.4\ 10^{10}$

Energy (Flux Density) Level (EFDL) Referred to Pressure^2 Time

Note that the abbreviation "EFDL" is not in general usage, but is used here for convenience.

Just as the usual reference for intensity level is pressure (and not intensity itself), the reference often (but not always) used for EFDL is *pressure^2 time*. This makes sense when the impedance is constant. Some examples of conversions follow:

Suppose the integral of the plane-wave pressure-squared time is 1 μPa^2 s. Since impedance for water is $1.5\ 10^{12}$ μPa(s/m), the EFD is then

$$(1\ \mu Pa^2\ s)/(\ 1.5\ 10^{12}\ \mu Pa(s/m)) = 6.66\ 10^{-13}\ \mu Pa\text{-}m\ = 6.66\ 10^{-19}\ J/m^2$$

Thus an EFDL of 0 dB (re 1 μPa^2 s) corresponds to an EFD of $6.66\ 10^{-19}$ J/m^2 (in water).

It follows that thresholds of interest for impacts on marine life have values in water as follows:

190 dB (re 1 μPa^2 s) = 10^{19} x 6.66 10^{-19} J/m^2 = 6.7 J/m^2
195 dB (re 1 μPa^2 s) = 21.2 J/m^2
200 dB (re 1 μPa^2 s) = 66.7 J/m^2
205 dB (re 1 μPa^2 s) = 210.6 J/m^2
215 dB (re 1 μPa^2 s) = 2106.1 J/m^2

Given that 1 J = 1 Ws, notice that these energies are small. Applied to an area the size of a person, 215 dB would yield about 2000 J, or about 2 kW or about .0006 kW-hr.

L.4 SOME CONSTANTS AND CONVERSION FORMULAS

Speed of Sound in Water (c_w)

The speed of sound in water varies no more than 3 percent over geographic area, depth and season. For rough estimates of impedance and travel time, nominal values of 1,500 meters per second (m/s) and 5,000 feet per second (ft/s) are often used.

Typical Density and Sound Speed of Sea Water

Water Density (4°C) = $\rho_w \approx 1$ g/cm^3 = 10^3 kg/m^3 ≈ 1.94 slug/ft^3 ≈ 62.43 lb (mass)/ft^3

Sound Speed = $c_w \approx 1500$ m/s = 1.5 10^5 cm/s ≈ 4920 ft/s ≈ 59040 in/s

Characteristic Impedance of Water

$\rho_w c_w \approx 1.5\ 10^6$ kg/s m^2 = 1.5 10^6 rayl = 1.5 10^5 g/s cm^2
= 1.5 10^{12} µPa (s/m) = 1.5 10^5 (dyn/cm^2)(s/cm) ≈ 9544.8 slugs/ft^2 s
≈ 3.072 10^5 lb(mass)/ft^2 s

Length
1 NM = 1.85325 km
1 m = 3.2808 ft

Speed
1 knot = 0.514791 m/s = 1.85325 km/hr
1 m/s= 3.2808 ft/s = 196.85 ft/min
1 m/s = 1.94254 knots

Pressure
1 Pa = 1 N/m^2 = 1 J/m^3 = 1 kg/m s^2
1 Pa = 10^6 µ Pa = 10 dyn/cm^2 = 10 µbar
1 µPa = 10^{-5} dyn/cm^2 = 1.4504·10^{-10} psi
1 kPa = 1000 Pa = 10^9 µPa = 0.145 psi = 20.88 psf

Power
1 W = 1 J/s = 1 Nm/s = 1 kg m^2/s^2
1 W = 10^7 erg/s

Energy (Work)
1 J = 1 N m = 1 kg m^2/s^2
1 J= 10^7 g cm^2/s^2 = 1 W s

Acoustic Intensity
1 W/m^2= 1 Pa (m/s) = 10^6 µPa (m/s)
1 W/m^2= 1 J/(s m^2) = 1 N/m s

Energy (Work) Cont'd

Acoustic Intensity Cont'd

1 erg = 1 g cm^2/s^2 = 10^{-7} J
1 kW hr = (3.6) 10^6 J

1 psi in/s = 175 W/m^2 = 1.75 10^8 μPa (m/s)
1 lb/ft s = 14.596 J/m^2s = 14.596 W/m^2
1 W/m^2 = 10^7 erg/m^2s = 10^3 erg/cm^2s

Acoustic Energy Flux Density
1 J/m^2 = 1 N/m = 1 Pa m = 10^6 μPa m = 1 W s/m^2
1 J/m^2 = 5.7 10^{-3} psi in = 6.8 10^{-2} psf ft
1 J/cm^2 = 10^4 J/m^2 = 10^7 erg/cm^2
1 psi in = 175 J/m^2 = 1.75 10^8 μPa m

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APPENDIX M

SUPPLEMENTAL INFORMATION FOR UNDERWATER NOISE ANALYSIS

SUPPLEMENTAL INFORMATION FOR UNDERWATER NOISE ANALYSIS

M.1 ACOUSTIC SOURCES

The Naval Surface Warfare Center Panama City Division (NSWC PCD) research, development, test, and evaluation (RDT&E) acoustic sources are categorized as either broadband (producing sound over a wide frequency band) or narrowband (producing sound over a frequency band that that is small in comparison to the center frequency). Generally, the narrowband sources in these activities are active sonars and the broadband sources are explosives. This delineation of source types has a couple of implications. First, the transmission loss used to determine the impact ranges of narrowband active sonars can be adequately characterized by model estimates at a single frequency. Broadband explosives, on the other hand, produce significant acoustic energy across several frequency decades of bandwidth. Random-phase propagation loss is sufficiently sensitive to frequency as to require model estimates at a few frequencies over such a wide band; important coherent effects may require a significantly finer sampling in frequency.

Second, the types of sources have different sets of harassment metrics and thresholds. Energy metrics are defined for both types. However, explosives are impulsive sources that produce a shock wave that dictates additional pressure-related metrics (peak pressure and positive impulse). Detailed descriptions of both types of sources are provided in the following subsections.

M.1.1 Sonars

Operations in the NSWC PCD Study Area involve numerous types of band-limited, mid- and high-frequency sources. The permanent threshold shift (PTS) and temporary threshold shift (TTS) impact ranges for virtually all of these sources is less than the size of the source itself; the implication of the limited impact ranges is that the source is more likely to collide with a protected marine animal than harass it acoustically. This analysis focuses only on the loudest of these sources and demonstrates that even these sources yield few potential exposures (the Kingfisher being the lone significant exception). Exposure estimates are calculated for each source on a per-year basis. Table M-1 presents the frequency class and the reporting metric for each source, which represents the ranges of operating parameters of sonars typically used in RDT&E activities at NSWC PCD. Table M-2 and Table M-3 gives an overview of the number of operating hours for each of these representative systems in territorial and non-territorial waters, respectively.

Table M-1. Representative Active Sonars Employed for NSWC PCD RDT&E Activities

Sonar	Description	Frequency Class	Exposures Reported
AN/SQS-53/56 Kingfisher	Surface ship object detection and navigation sonar (a mode of the AN/SQS-53/56).	Mid-frequency	Per year
Sub-bottom profiler (2-9 kHz)	A towed body projecting sonar into the seafloor for substrate survey. The center frequency for this system is 4.5 kHz.	Mid-frequency	Per year
REMUS SAS-LF	Object detection and navigation sonar on a UUV. The center frequency for this system is 15 kHz.	High frequency	Per year
REMUS Modem	Acoustic communications modem on the REMUS UUV	Mid-frequency	Per year
Sub-bottom profiler (2-16 kHz)	A towed body projecting sonar into the seafloor for substrate survey. The center frequency for this system is 9 kHz.	Mid-frequency	Per year
AN/SQQ-32	Towed mine detection sonar on surface ships	High frequency	Per year
REMUS-SAS-LF	Object detection and navigation sonar on a UUV. The center frequency for this system is 25 kHz.	High frequency	Per year
SAS-LF	Object detection and navigation sonar. The center frequency for this system is 20 kHz.	High frequency	Per year
AN/WLD-1 RMS-ACL	The acoustic communications sonar of the ship-launched Remote Minehunting System UUV.	High frequency	Per year
BPAUV Sidescan	Battlespace Preparation Autonomous Underwater Vehicle sonar, an AUV used for mine detection. The center frequency for this system is 75 kHz.	High frequency	Per year
TVSS	Toroidal Volume Search Sonar, an experimental bottom moored system using toroidal beamforming	High frequency	Per year
F84Y	Tower-mounted parametric sonar used to simulate mine-like objects	High frequency	Per year
BPAUV Sidescan	Battlespace Preparation Autonomous Underwater Vehicle sonar, an AUV used for mine detection. The center frequency for this system is 102.5 kHz.	High frequency	Per year
REMUS-SAS-HF	Object detection and navigation sonar on a UUV.	High frequency	Per year
SAS-HF	Object detection and navigation sonar.	High frequency	Per year
AN/AQS-20	Helicopter-towed deep-water mine detection sonar	High frequency	Per year
BPAUV Sidescan	Battlespace Preparation Autonomous Underwater Vehicle sonar, an AUV used for mine detection. The center frequency for this system is 120 kHz.	High frequency	Per year

kHz = kilohertz; UUV = underwater unmanned vehicle; AUV = autonomous underwater vehicle

Table M-2 Hours of Representative Sonar Operations by System for Territorial Waters

System	No Action	Alternative 1	Alternative 2
AN/SQS-53/56 Kingfisher	1.5	3	3
Sub-bottom profiler (2-9 kHz)	6	20	21
REMUS SAS-LF	3	12	12
REMUS Modem	14.5	22	25
Sub-bottom profiler (2-16 kHz)	4	19	24
AN/SQQ-32	26.25	30	30
REMUS-SAS-LF	20	20	20
SAS-LF	19.75	27.75	35
AN/WLD-1 RMS-ACL	19.75	26.25	33.5
BPAUV Sidescan	10	25	25
TVSS	5	10	15
F84Y	10	10	15
BPAUV Sidescan	10	25	25
REMUS-SAS-HF	20	20	10
SAS-HF	17.5	21.5	26.5
AN/AQS-20	213.75	461	545
BPAUV Sidescan	10	25	30

Table M-3. Hours of Sonar Operations by Representative System for Non-Territorial Waters

System	No Action	Alternative 1	Alternative 2
AN/SQS-53/56 Kingfisher	0.5	1	1
Sub-bottom profiler (2-9 kHz)	0	0	1
REMUS SAS-LF	0	0	0
REMUS Modem	3	12	12
Sub-bottom profiler (2-16 kHz)	0.5	1	1
AN/SQQ-32	1	1	1
REMUS-SAS-LF	0	0	0
SAS-LF	4.375	5	15
AN/WLD-1 RMS-ACL	4.375	5	5
BPAUV Sidescan	19.5	32.5	38
TVSS	10	11.5	16.5
F84Y	10	10	15
BPAUV Sidescan	0	0	0
REMUS-SAS-HF	10	25	25
SAS-HF	5	10	15
AN/AQS-20	10	10	15
BPAUV Sidescan	10	25	25

The acoustic modeling that is necessary to support the exposure estimates for each of these sonars relies upon a generalized description of the manner of the sonar's operating modes. This description includes the following:

- "Effective" energy source level – The total energy across the band of the source, scaled by the pulse length (10 log10 [pulse length]), and corrected for source beam width so that it reflects the energy in the direction of the main lobe. The beam pattern correction consists of two terms:
    - Horizontal directivity correction: $10 \log_{10} (360 / \text{horizontal beam width})$

- Vertical directivity correction: $10 \log_{10} (2 / [\sin(\theta_1) - \sin(\theta_2)])$, where θ_1 and θ_2 are the 3-decibel (dB) down points on the main lobe.

- Source depth – Depth of the source in meters.
- Nominal frequency – Typically the center band of the source emission. These are frequencies that have been reported in open literature and are used to avoid classification issues. Differences between these nominal values and actual source frequencies are small enough to be of little consequence to the output impact volumes.
- Source directivity – The source beam is modeled as the product of a horizontal beam pattern and a vertical beam pattern. Two parameters define the horizontal beam pattern:
  - Horizontal beam width – Width of the source beam (degrees) in the horizontal plane (assumed constant for all horizontal steer directions).
  - Horizontal steer direction – Direction in the horizontal in which the beam is steered relative to the direction in which the platform is heading.

The horizontal beam is rectangular with constant response across the width of the beam and with flat, 20 dB down sidelobes. (Note that steer directions ϕ, $-\phi$, $180^o - \phi$, and $180^o + \phi$ all produce equal impact volumes.)

- Similarly, two parameters define the vertical beam pattern:
  - Vertical beam width (D/E) – Width of the source beam (degrees) in the vertical plane measured at the 3 dB down point. (The width is that of the beam steered towards broadside and not the width of the beam at the specified vertical steer direction.)
  - Vertical steer direction – Direction in the vertical plane that the beam is steered relative to the horizontal (upward looking angles are positive).

To avoid sharp transitions that a rectangular beam might introduce, the power response at vertical angle θ is

$$\max \{ \sin^2 [n(\theta_s - \theta)] / [n \sin (\theta_s - \theta)]^2, \ 0.01 \}$$

where $n = 180^o / \theta_w$ is the number of half-wavelength-spaced elements in a line array that produces a main lobe with a beam width of θ_w. θ_s is the vertical beam steer direction.

- Ping spacing – Distance between pings. For most sources this is generally just the product of the speed of advance of the platform and the repetition rate of the sonar. Animal motion is generally of no consequence as long as the source motion is greater than the speed of the animal (nominally, three knots). For stationary (or nearly stationary) sources, the "average" speed of the animal is used in place of the platform speed. The attendant assumption is that the animals are all moving in the same constant direction.

These parameters are defined for each of the active sonars in the following table:

Table M-4. Source Description of NSWC PCD RDT&E Active Sonars

System	Center Frequency (kHz)	Sound Pressure Level (dB)	Pulse Length (sec)	Emission Spacing (m)	D/E Angle (^{o})	D/E Width (^{o})	Azimuth Angle (^{o})	Azimuth Width (^{o})
AN/SQS-53/56 Kingfisher	3.5	235	0.1	9.0	42	20	0	120
Sub-bottom profiler (2-9 kHz)	4.5	205	0.007	3.0	Omni	Omni	90	90
REMUS Modem	10	186	5	45.0	0	60	0	Omni
Sub-bottom profiler (2-16 kHz)	9	200	0.02	0.2	45	20	90	20
REMUS SAS-LF	15	205	0.01	1.9	60	30	80	50
REMUS-SAS-LF	25	215	0.01	1.9	60	Omni	80	240
SAS-LF	20	212	0.0001	0.6	60	30	80	50
AN/WLD-1 RMS-ACL	20	215	0.004	360.0	45	90	90	30
BPAUV Sidescan	75	210	0.013	0.2	10	70	90	0.8
TVSS	68	220	0.0001	4.0	90	3	0	Omni
F84Y	65	232	0.004	1.5	0	Omni	0	Omni
BPAUV Sidescan	102.5	226	0.002	0.4	0	55	90	0.5
REMUS SAS-HF	180	220	0.01	1.9	25	9	9	15
SAS-HF	180	214	0.000033	0.6	25	9	9	15
AN/AQS-20	35	212	0.00432	6.0	45	90	90	30
BPAUV Sidescan	120	210	0.0083	0.1	10	70	90	0.8

kHz = kilohertz; dB = decibels; sec = seconds; m = meters; ^{o} = degrees

M.1.2. Explosives

Explosives detonated underwater introduce loud, impulsive, broadband sounds into the marine environment. Three source parameters influence the effect of an explosive: the weight of the explosive warhead, the type of explosive material, and the detonation depth. The net explosive weight (or net explosive weight [NEW]) accounts for the first two parameters. The NEW of an explosive is the weight of only the explosive material in a given round, referenced to the explosive power of trinitrotoluene (TNT).

The detonation depth of an explosive is particularly important due to a propagation effect known as surface-image interference increasingly. For sources located near the sea surface, a distinct interference pattern arises from the coherent sum of the two paths that differ only by a single reflection from the pressure-release surface. As the source depth and/or the source frequency decreases, these two paths increasingly, destructively interfere with each other, reaching total cancellation at the surface (barring surface-reflection scattering loss). For the NSWC PCD Study Area there are three types of explosive sources: demolition charges, mines, and mine-clearing

line charges. Table M-5 provides an overview of the ordnance used in NSWC PCD RDT&E activities along with their NEW and detonation depth. Consistent with earlier VAST/IMPASS modeling, a source depth of 0.3 meters (m) (1 foot [ft]) is used for gunnery round.

Table M-5. Explosive Sources for NSWC PCD RDT&E Activities

Ordnance	NEW kilograms (pounds)	Depth in meters (feet)	Location
MK-58 Line Charge	793.8 (1,750)	Bottom	Surf zone
5-inch HE projectile	4.32 (9.54)	0.305 (1.00)	Outside 22.2 km (12 NM) territorial limit
Explosive	4.5 (10)	15.2 (50)	100-1,000 ft of water
Mine	34 (75)	15.2 (50)	On-shelf outside 22.2 km (12 NM) territorial limit
Mine	199.6 (440)	Bottom	On-shelf outside 22.2 km (12 NM) territorial limit
Mine	272.2 (600)	36.6 (120)	On-shelf outside 22.2 km (12 NM) territorial limit

ft = feet; km = kilometers; NM = nautical miles

The harassments expected to result from these ordnances are computed on a per in-water explosive basis. The cumulative effect of a series of explosives can often be derived by simple addition if the detonations are spaced widely in time or space, allowing for sufficient animal movement as to ensure that a different population of animals is considered for each detonation.

M.2 IMPACT VOLUMES AND IMPACT RANGES

Naval actions include the potential to injure or harass marine animals in the neighboring waters through noise emissions. The number of animals exposed to potential harassment in any such action is dictated by the propagation field and the characteristics of the noise source.

The impact volume associated with a particular activity is defined as the volume of water in which some acoustic metric exceeds a specified threshold. The product of this impact volume with a volumetric animal density yields the expected value of the number of animals exposed to that acoustic metric at a level that exceeds the threshold. The acoustic metric can either be an energy term (energy flux density, either in a limited frequency band or across the full band) or a pressure term (such as peak pressure or positive impulse). The thresholds associated with each of these metrics define the levels at which half of the animals exposed will experience some degree of harassment (ranging from behavioral change to mortality).

Impact volume is particularly relevant when trying to estimate the effect of repeated source emissions separated in either time or space. Impact range, which is defined as the maximum range at which a particular threshold is exceeded for a single source emission, is used to define the range to which marine mammal activity is monitored in order to meet mitigation requirements.

With the exception of explosive sources, the sole relevant measure of potential harm to the marine wildlife due to sonar operations is the accumulated (summed over all source emissions)

energy flux density received by the animal over the duration of the activity. Harassment measures for explosive sources include energy flux density and pressure-related metrics (peak pressure and positive impulse).

Regardless of the type of source, estimating the number of animals that that may be exposed to the potential risk of harassment in a particular environment entails the following steps.

- Each source emission is modeled according to the particular operating mode of the sonar. The "effective" energy source level is computed by integrating over the bandwidth of the source, scaling by the pulse length, and adjusting for gains due to source directivity. The location of the source at the time of each emission must also be specified.
- For the relevant environmental acoustic parameters, transmission loss (TL) estimates are computed, sampling the water column over the appropriate depth and range intervals. TL data are sampled at the typical depth(s) of the source and at the nominal center frequency of the source. If the source is relatively broadband, an average over several frequency samples is required.
- The accumulated energy within the waters that the source is "operating" is sampled over a volumetric grid. At each grid point, the received energy from each source emission is modeled as the effective energy source level reduced by the appropriate propagation loss from the location of the source at the time of the emission to that grid point and summed. For the peak pressure or positive impulse, the appropriate metric is similarly modeled for each emission. The maximum value of that metric (over all emissions) is stored at each grid point.
- The impact volume for a given threshold is estimated by summing the incremental volumes represented by each grid point for which the appropriate metric exceeds that threshold.
- Finally, the number of exposures is estimated as the "product" (scalar or vector, depending upon whether an animal density depth profile is available) of the impact volume and the animal densities.

This section describes in detail the process of computing impact volumes (that is, the first four steps described above). This discussion is presented in two parts: active sonars and explosive sources. The relevant assumptions associated with this approach and the limitations that are implied are also presented. The final step, computing the number of exposures is discussed in Subsection A.5.

M.2.1 Computing Impact Volumes for Active Sonars

This section provides a detailed description of the approach taken to compute impact volumes for active sonars. Included in this discussion are:

- Identification of the underwater propagation model used to compute transmission loss data, a listing of the source-related inputs to that model, and a description of the output parameters that are passed to the energy accumulation algorithm.
- Definitions of the parameters describing each sonar type.

- Description of the algorithms and sampling rates associated with the energy accumulation algorithm.

The following bullets provide an overview of the steps in simplistic terms followed by detailed information for the calculations.

- Step 1. Environmental Provinces. The NSWC PCD Study Area is divided into 16 environmental provinces, and each has a unique combination of environmental conditions. These represent various combinations of eight bathymetry provinces, one Sound Velocity Profile (SVP) province, and three Low-Frequency Bottom Loss geo-acoustic provinces and two High-Frequency Bottom Loss classes. These are addressed by defining environments in two seasons that span the variety of depths, bottom types, sound speed profiles, and sediment thicknesses found in the NSWC PCD Study Area. The two seasons encompass winter and summer, which are the two extremes and for the GOM the acoustic propagation characteristics do not vary significantly between the two. Each marine modeling area can be quantitatively described as a unique combination of these environments.

- Step 2. Transmission Loss. Since sound propagates differently in these environments, separate transmission loss calculations must be made for each, in both seasons. The transmission loss is predicted using CASS-GRAB sound modeling software.

- Step 3. Exposure Volumes. The transmission loss, combined with the source characteristics, gives the energy field of a single ping. The energy of over 10 hours of pinging is summed, carefully accounting for overlap of several pings, so an accurate average exposure of an hour of pinging is calculated for each depth increment. At more than ten hours, the source is too far away and the energy is negligible. In addition, the acoustic modeling takes into account the use of a single system. Only one source will operate at any one time during NSWC PCD RDT&E activities.
- Repeating this calculation for each environment in each season gives the hourly ensonified volume, by depth, for each environment and season. This step begins the method for risk function modeling.

- Step 4. Marine Mammal Densities. The marine mammal densities were given in two dimensions, but using peer-reviewed literature sources (published literature and agency reports) described in the following subsection, the depth regimes of these marine mammals are used to project the two dimensional densities (expressed as the number of animals per area where all individuals are assumed to be at the water's surface) into three dimensions (a volumetric approach whereby two-dimensional animal density incorporates depth into the estimates).

- Step 5. Exposure Calculations. Each marine mammal's three-dimensional density is multiplied by the calculated impact volume—to that marine mammal depth regime. This value is the number of exposures per hour for that particular marine mammal. In this way, each marine mammal's exposure count per hour is based on its density, depth habitat, and the ensonified volume by depth.

Transmission Loss Calculations

TL data are pre-computed for each of two seasons in the five environmental provinces described in the previous subsection using the Gaussian Ray Bundle (GRAB) propagation loss model (Keenan, 2000). The use of GRAB is predicated on the following factors:

- GRAB is certified as a Navy-standard transmission loss model over the frequency regime of interest.
- GRAB describes the propagation field parametrically by a set of eigenrays (propagation paths connecting source to receiver), which affords the following modeling efficiencies:
  - The source vertical directivity does not need to be included at the time of the TL calculation, allowing alternative source directivities to be modeled without additional TL calculations.
  - TL estimates at a given frequency can be extrapolated to other "nearby" frequencies by simply correcting for differences in absorption loss thus potentially reducing the number of TL calculations.
  - The coherent effects of surface-image interference that persist over range can be accounted for with a simple model that does not require an unwieldy number of TL model runs across frequency.

The TL output consists of data describing each significant eigenray (or propagation path) including the departure angle from the source (used to model the source vertical directivity later in this process), the propagation time from the source to the animal (used to make corrections to absorption loss for minor differences in frequency and to incorporate a surface-image interference correction at low frequencies), and the transmission loss suffered along the eigenray path.

The frequency TL inputs are specified in Table M-6. In most cases, the actual frequency of the source is somewhat different from the input frequency of the TL calculation. To account for this difference, the TL for each eigenray is adjusted for the difference in absorption loss between the two frequencies. The path length of the eigenray is estimated as the product of the eigenray's travel time and a nominal sound speed of 1,500 meters per second (m/sec). Generally, this correction is relatively small at the ranges of interest and only becomes significantly large at ranges that are well beyond the impact range.

Table M-6. TL Frequency by Sonar Type

Sonar	TL Input Frequency
Kingfisher	3.5 kHz
Sub-bottom Profiler (2-9 kHz)	3.5 kHz
SAS-LF	15 kHz
REMUS Modem	7.5 kHz
Sub-bottom Profiler (2-16 kHz)	7.5 kHz
AN/SQQ-32	35 kHz
REMUS-SAS-LF	35 kHz
SAS-LF	15 kHz
RMS-ACL	15 kHz
BPAU Sidescan (75 kHz)	75 kHz

Sonar	TL Input Frequency
TVSS	75 kHz
F84Y	75 kHz
BPAU Sidescan (95-110 kHz)	75 kHz
REMUS-SAS-HF	150 kHz
SAS-HF	150 kHz
AN/AQS-20	35 kHz
BPAU Sidescan	150 kHz

TL = transmission loss; kHz = kilohertz

In the NSWC PCD EFDL analysis, only four sources were determined to have TTS take estimates. These sources were modeled at their source frequencies. Risk function calculations rely on long-distance impact ranges, and depend on pre-computed transmission loss data.

In order to consolidate the efforts of modeling such a wide variety of sources for the risk function, transmission loss (TL) data were calculated at approximately octave-spaced frequencies starting at 1 kHz, stopping near 200 kHz. Behavioral exposure estimates from the risk function for a given source employed the pre-computed TL with the nearest (rounded down) source frequency along with the source level supplied as GFI.

The eigenray data for a single GRAB model run are sampled at uniform increments in range out to a maximum range for a specific "animal" (or "target" in GRAB terminology) depth. Multiple GRAB runs are made to sample the animal depth dependence. The depth and range sampling parameters are summarized in Table M-7. Note that these parameters are a function of the TL input frequency; Table M-7 can be used to map them to a particular sonar source.

Table M-7. TL Depth and Range Sampling Parameters by Sonar Type

Frequency	Range Step	Maximum Range	Animal Depth Step
3.5 kHz	10 m (32.8 ft)	150 km (80.9 NM)	5 m (16.4 ft)
7.5 kHz	10 m (32.8 ft)	100 km (53.96 NM)	5 m (16.4 ft)
15 kHz	10 m (32.8 ft)	50 km 926.98 NM)	5 m (16.4 ft)
35 kHz	10 m (32.8 ft)	20 km (10.8 NM)	5 m (16.4 ft)
75 kHz	10 m (32.8 ft)	10 km (5.4 NM)	5 m (16.4 ft)
150 kHz	10 m (32.8 ft)	5 km (2.7 NM)	5 m (16.4 ft)

kHz = kilohertz; ft = feet; km = kilometers; NM = nautical miles; m = meters

Although GRAB provides the option of including the effect of source directivity in its eigenray output, this capability is not exercised. By preserving data at the eigenray level, this allows source directivity to be applied later in the process and results in fewer TL calculations.

The other important feature that storing eigenray data supports is the ability to model the effects of surface-image interference that persist over range. However, this is primarily important at frequencies lower than those associated with the sonars considered in this subsection. A detailed description of the modeling of surface-image interference is presented in the subsection on explosive sources.

Energy Summation

The summation of energy flux density over multiple pings in a range-independent environment is a straight forward exercise for the most part. A volumetric grid that covers the waters in and around the area of sonar operation is initialized. The source then begins its set of pings. For the first ping, the TL from the source to each grid point is determined (summing the appropriate eigenrays after they have been modified by the vertical beam pattern), the "effective" energy source level is reduced by that TL, and the result is added to the accumulated energy flux density at that grid point. After each grid point has been updated, the accumulate energy at grid points in each depth layer is compared to the specified threshold. If the accumulated energy exceeds that threshold, then the incremental volume represented by that grid point is added to the impact volume for that depth layer. Once all grid points have been processed, the resulting sum of the incremental volumes represents the impact volume for one ping.

The source is then moved along one of the axes in the horizontal plane by the specified ping separation range and the second ping is processed in a similar fashion. Again, once all grid points have been processed, the resulting sum of the incremental volumes represents the impact volume for two pings. This procedure continues until the maximum number of pings specified has been reached.

Defining the volumetric grid over which energy is accumulated is the trickiest aspect of this procedure. The volume must be large enough to contain all volumetric cells for which the accumulated energy is likely to exceed the threshold but not so large as to make the energy accumulation computationally unmanageable.

Determining the size of the volumetric grid begins with an iterative process to determine the lateral extent to be considered. Unless otherwise noted, throughout this process the source is treated as directional and the only animal depth that is considered is the TL target depth that is closest to the source depth (placing source and receiver at the same depth is generally an optimal TL geometry).

The first step is to determine the impact range for a single ping. The impact range in this case is the maximum range (R_{max}) at which the effective energy source level reduced by the transmission loss is greater than the threshold. Next the source is moved along a straight-line track and energy flux density is accumulated at a point that has a Closest Points of Approach (CPA) range of R_{max} at the mid-point of the source track. That total energy flux density summed over all pings is then compared to the prescribed threshold. If it is greater than the threshold (which, for the first R_{max}, it must be) then R_{max} is increased by ten percent, the accumulation process is repeated, and the total energy is again compared to the threshold. This continues until R_{max} grows large enough to ensure that the accumulated energy flux density at that lateral range is less than the threshold. The lateral range dimension of the volumetric grid is then set at twice R_{max}, with the grid centered along the source track. In the direction of advance for the source, the volumetric grid extends of the interval from [$-R_{max}$, 3 R_{max}] with the first source position located at zero in this dimension. Note that the source motion in this direction is limited to the interval [0, 2 R_{max}]. Once the source reaches 2 R_{max} in this direction, the incremental volume contributions have approximately reached their asymptotic limit and further pings add essentially the same amount. This geometry is demonstrated in Figure M-1.

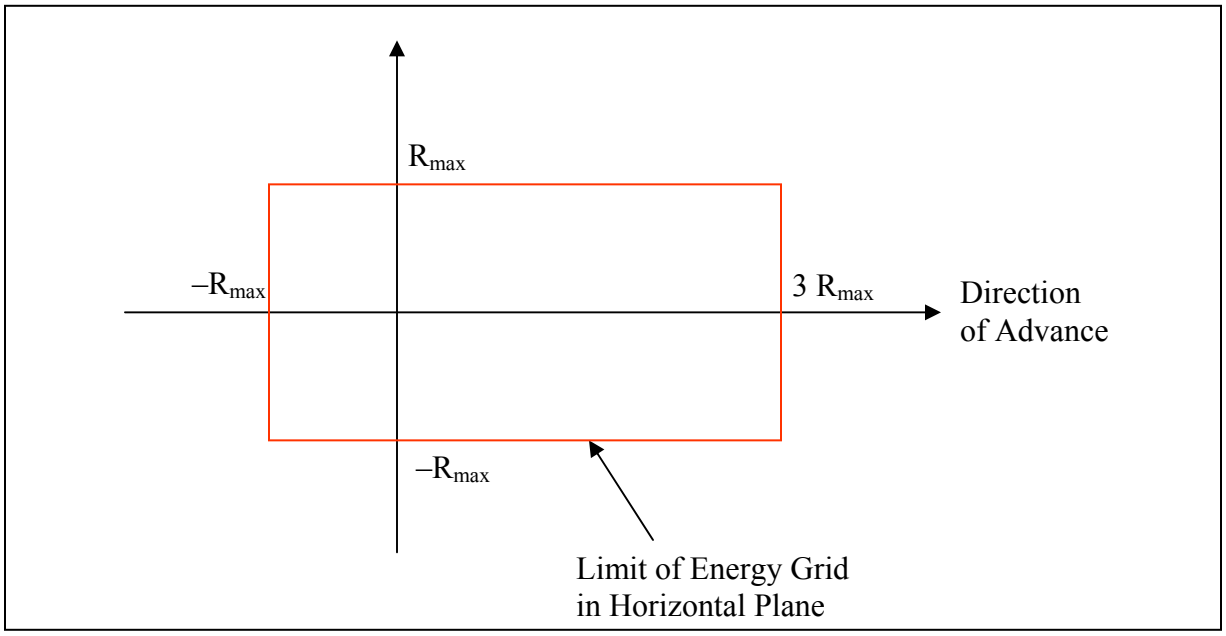


Figure M-1. Horizontal Plane of Volumetric Grid for Omni-Directional Source

If the source is directive in the horizontal plane, then the lateral dimension of the grid may be reduced and the position of the source track adjusted accordingly. For example, if the main lobe of the horizontal source beam is limited to the starboard side of the source platform, then the port side of the track is reduced substantially as demonstrated in Figure M-2.

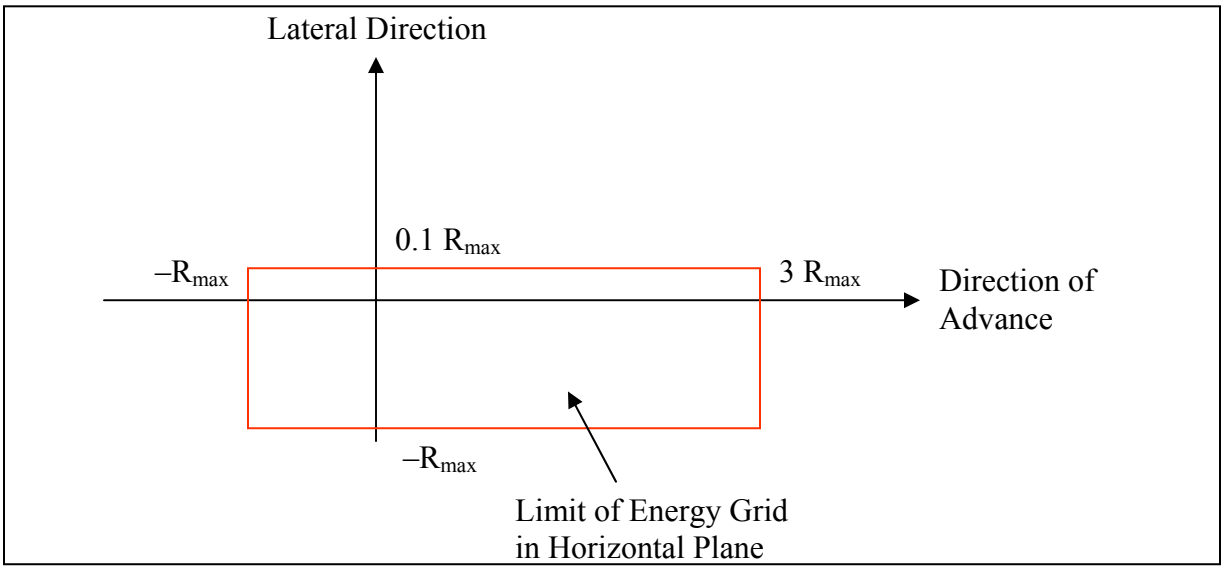


Figure M-2. Horizontal Plane of Volumetric Grid for Starboard Beam Source

Once the extent of the grid is established, the grid sampling can be defined. In the both dimensions of the horizontal plane the sampling rate is approximately $R_{max}/100$. The round-off error associated with this sampling rate is roughly equivalent to the error in a numerical integration to determine the area of a circle with a radius of R_{max} with a partitioning rate of

$R_{max}/100$ (approximately one percent). The depth-sampling rate of the grid is comparable to the sampling rates in the horizontal plane but discretized to match an actual TL sampling depth. The depth-sampling rate is also limited to no more than 10 m (33 ft) to ensure that significant TL variability over depth is captured.

Impact Volume per Hour of Sonar Operation

The impact volume for a sonar moving relative to the animal population increases with each additional ping. The rate at which the impact volume increases varies with a number of parameters but eventually approaches some asymptotic limit. Beyond that point the increase in impact volume becomes essentially linear, as depicted in the Figure M-3.

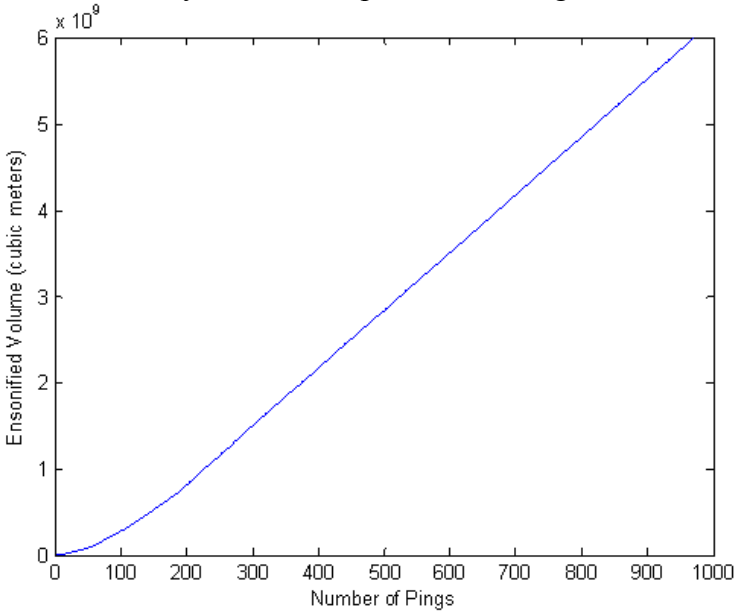


Figure M-3. 53C Impact Volume by Ping

The slope of the asymptotic limit of the impact volume at a given depth is the impact volume added per ping. This number multiplied by the number of pings in an hour gives the hourly impact volume for the given depth increment. Completing this calculation for all depths in a province, for a given source, gives the hourly impact volume vector, v_n, which contains the hourly impact volumes by depth for province n. Figure M-4 provides an example of an hourly impact volume vector for a particular environment.

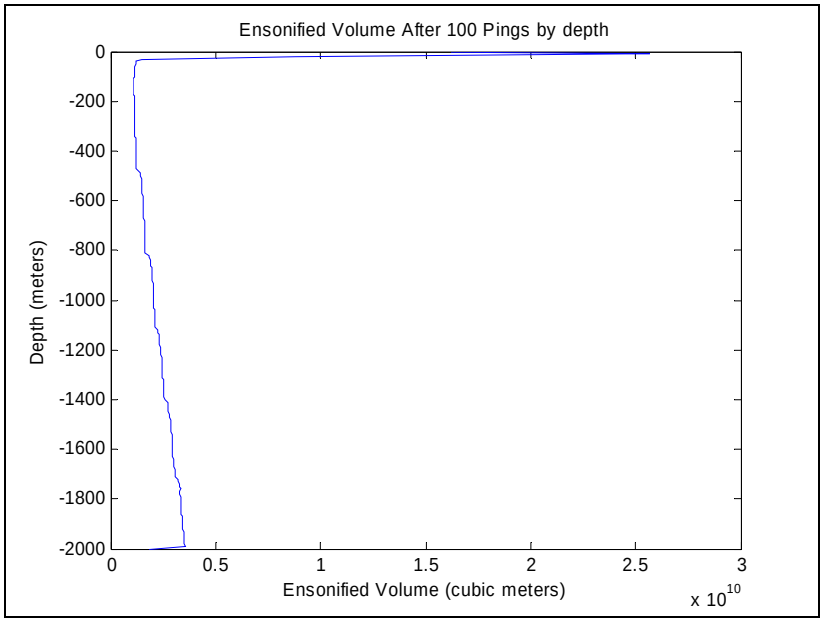


Figure M-4. Example of an Impact Volume Vector

M.2.2 Computing Impact Volumes for Explosive Sources

This section provides the details of the modeling of the explosive sources. This energy summation algorithm is similar to that used for sonars, only differing in details such as the sampling rates and source parameters. These differences are summarized in the following subsections. A more significant difference is that the explosive sources require the modeling of additional pressure metrics: (1) peak pressure, and (2) "modified" positive impulse. The modeling of each of these metrics is described in detail in a following subsection on special considerations for the MK-58 line charge.

Transmission Loss Calculations

Modeling impact volumes for explosive sources span requires the same type of TL data as needed for active sonars. However unlike active sonars, explosive ordnances are very broadband, contributing significant energy from tens of Hertz (Hz) to tens of kilohertz (kHz). To accommodate the broadband nature of these sources, TL data are sampled at seven frequencies from 10 Hz to 40 kHz, spaced every two octaves. This rather coarse sampling in frequency is justified as long as path-level transmission loss varies smoothly with frequency and random-phase addition of eigenrays is used.

An important consideration for coherent propagation loss, particularly at low frequencies, is the effect of surface-image interference. As either source or target approach the surface, pairs of paths that differ in history by a single surface reflection set up an interference pattern that ultimately causes the two paths to perfectly cancel each other when the source or target is at the surface. A fully coherent summation of the eigenrays produces such a result but also introduces extreme fluctuations at all depths that would have to be highly sampled in range and depth, and then smoothed to give meaningful results. An alternative approach is to implement what is sometimes called a *semi-coherent* summation. A semi-coherent sum attempts to capture significant effects of surface-image interference (namely the reduction of the field as the source

or target approach the surface) without having to deal with the more rapid fluctuations associated with a fully coherent sum. The semi-coherent sum is formed by a random-phase addition of paths that have already been multiplied by the expression:

$$\sin^2 [4\pi f z_s z_a / (c^2 t)]$$

where f is the frequency, z_s is the source depth, z_a is the animal depth, c is the sound speed and t is the travel time from source to animal along the propagation path. For small arguments of the sine function this expression varies directly as the frequency and the two depths. It is this relationship that causes the propagation field to go to zero as the depths approach the surface or the frequency approaches zero.

A final important consideration is the broadband nature of explosive sources. This is handled by sampling the TL field at a limited number of frequencies. However, the image-interference correction given above varies substantially over that frequency spacing. To avoid possible under sampling, the image-interference correction is finely sampled and averaged over each frequency interval.

Source Parameters

Unlike active sonars, explosive sources are defined by only two parameters: (1) net explosive weight, and (2) source detonation depth. Values for these source parameters are defined earlier in the section on explosive acoustic sources.

The effective energy source level, which is treated as a de facto input for the sonar sources, is instead modeled directly for explosives. The energy source level is comparable to the model used for other explosives [Arons (1954), Weston (1960), McGrath (1971), Urick (1983), Christian and Gaspin (1974)]. For a source with an NEW of w points, the energy source level over a one-third-octave band with a center frequency of f is

$$10 \log_{10} (0.26 f) + 10 \log_{10} (2 p_{max}^2 / [1/\theta^2 + 4 \pi f^2]) + 197 \text{ dB}$$

where the peak pressure for the shock wave at 1 m is defined as

$$p_{max} = 21600 (w^{1/3} / 3.28)^{1.13} \text{ psi} \quad \text{(M-1)}$$

and the time constant is defined as:

$$\theta = [(0.058) (w^{1/3}) (3.28 / w^{1/3})^{0.22}] / 1000 \text{ msec} \quad \text{(M-2)}$$

Special Considerations for MK-58 Line Charge

The MK-58 line charge differs from the other explosive sources in three significant aspects:

- The MK-58 is exclusively used in very shallow water.
- The source is not a single explosive but rather a large number of explosives.
- These explosives are arranged in a line and fired more or less simultaneously.

Limiting the deployment of the MK-58 to very shallow water, specifically the surf zone, serves to emphasize the importance of surface-image interference. Placement in the surf zone, modeled here as being 2 m (6.6 ft) deep, emphasizes the decoupling due to surface-image interference that arises from source or receiver (or in this case both) being located near the surface. With source and receiver both within 2 m (6.6 ft) of the sea surface, propagation loss is affected up to relatively high frequencies (5 kHz or more), including the peak in the spectrum of this source. Given the prominence of surface-image interference in this problem, it is critical to consider what factors might limit this effect.

The expression used to model surface-image interference is based on the assumption that surface reflection loss is negligible for the propagation paths of interest. If this is not the case, then the pairs of paths that would be modeled as canceling each other might, in fact, be different enough in amplitude to make the cancellation far less than complete, leading to more favorable propagation and greatly extending the impact range of the source. By way of example, modifying the expression use to model surface-image interference to include surface loss of as little as 0.1 dB increases the impact area (and hence the number of animal exposures) by as much as nearly a factor of three. Similarly, including a surface loss of 1 dB can increase the impact area by more than a factor of 1,000, while a totally random phase addition of these paths would increase the impact area by a factor several orders of magnitude greater.

This sensitivity to surface loss is of particular importance given that the sea surface is hardly placid in the surf zone. Breaking waves produce a reflecting surface that is rougher than what would normally be predicted for the specified wind speed; a rougher surface necessarily implies greater scattering loss. In addition, the layer of near-surface bubbles that are created by the breaking waves serves to further scatter and attenuate propagating sound.

On the other hand, the concern about surface loss is at least partially mitigated by the fact that the dominant propagation paths quickly become quite shallow as range increases (less than 2 degrees at 1 kilometer (0.54 nautical mile [NM]) and shallow-angle paths generally tend to suffer very little surface loss. Furthermore, the entire area of interest

Given the complexity of the competing forces, this analysis used the same model of surface-image interference for the MK-58 source as for the other explosive sources. It is recognized that this may result in an underestimate of the number of animal exposures, but short of a carefully conducted measurement (clearly beyond the scope of this effort) to validate this or some other model any other approach is equally arbitrary.

At low frequencies, modeling in such shallow water must focus on propagation through the sediment layer(s) rather than treating the bottom as a boundary with a particular reflection loss. As frequency increases though, absorption loss within the sediment increases thus reducing the importance of bottom-penetrating paths. The sandy bottom that is characteristic of the area of interest has an attenuation rate of more than 28 dB / kilometer [0.54 NM] at 1 kHz, with the rate varying directly with frequency and increasing linearly with depth within the sediment.

The second significant aspect is that the MK-58 line charge consists of 350 explosives, each with an explosive weight of 2.27 kilograms (kg) (5 pounds [lbs]), arranged in a line and spaced at 0.3 m (1 ft). This yields a total net explosive weight for the line charge of 794 kg (1,750 lbs).

For the pressure metrics (peak pressure and modified positive impulse), the source is modeled according to its physical characteristics. The impact range, R, for a single 2.27 kg (5 lbs) explosive is derived and the impact area for that single explosive is computed as πR^2. If the explosives are sufficiently far apart (that is, the spacing is greater than 2R), then the collective impact area for the 350 explosives would simply by 350 πR^2. However, if the impact areas of neighboring explosives do overlap, then the amount of overlap of each consecutive pair, given by the expression

$$2\ R^2\ \text{acos}(0.5/R) - \ \text{sqrt}\ (R^2 - 0.25),$$

must be removed, yielding a collective impact area of

$$350\ \pi R^2 - 349\ [2\ R^2\ \text{acos}(0.5/R) - \ \text{sqrt}\ (R^2 - 0.25)].$$

For the energy metrics, a similar view of the collective source mass is appropriate to an extent. The energy source spectrum is defined for a single 2.27 kg (5 lbs) explosive (see previous subsection), which is then scaled by the number of explosives (350 or 10 $\log_{10}(350)$ in dB-space). This results in an energy source spectrum with a peak one-third-octave level in the neighborhood of 1,500 Hz, rather than a peak near 300 Hz as is characteristic of a 794 kg (1,750 lbs) source.

Next, the configuration and firing of the MK-58 explosives is such that the line charge acts like a horizontal line array with a main lobe near broadside to either side of the array. (The burn rate of the det cord that is used to ignite the sources introduces a delay in their firing that results in a main lobe that is steered roughly ten degrees off broadside. However, this steering makes no appreciable difference in this analysis.) The beam pattern of this array is modeled as a "square beam" (that is, the main lobe has a constant beam power over the width of the beam) with a constant sidelobe level that is 30 dB below that of the main lobe. The width of the main lobe (in radians) is defined as λ / L, where λ is the acoustic wave length and L is the length of the array (107 m, or 350 ft). The beam power response on the main lobe is adjusted as a function of frequency to ensure that the total power in the beam pattern is equal to that of an omnidirectional source with a beam power response of unity.

The impact range for the 182 dB threshold is greatest for the one-third-octave that is centered near 1.8 kHz. At this frequency, propagation is effectively limited to very shallow paths that have little interaction with a bottom that has an absorption loss of greater than 50 dB per kilometer. While this absorption rate diminishes with frequency, the improvement in propagation is counterbalanced by increases in the surface decoupling.

Impact Volumes for Various Metrics

The impact of explosive sources on marine wildlife is measured by three different metrics, each with its own thresholds. The energy metric, peak one-third-octave, is treated in similar fashion as the energy metric used for the active sonars, including the summation of energy if there are multiple source emissions. The other two, peak pressure and positive impulse, are not accumulated but rather the maximum levels are taken.

Peak One-Third-Octave Energy Metric

The computation of impact volumes for the energy metric follows closely the approach taken to model the energy metric for the active sonars. The only significant difference is that energy flux density is sampled at several frequencies in one-third-octave bands and only the peak one-third-octave level is accumulated.

Peak Pressure Metric

The peak pressure metric is a simple, straightforward calculation at each range/animal depth combination. First, the transmission ratio, modified by the source level in a one-octave band and beam pattern is averaged across frequency on an eigenray-by-eigenray basis. This averaged transmission ratio (normalized by the total broadband source level) is then compared across all eigenrays with the maximum designated as the peak arrival. Peak pressure at that range/animal depth combination is then simply the product of:

- The square root of the averaged transmission ratio of the peak arrival,
- The peak pressure at a range of one meter (given by equation M-1), and
- The similitude correction (given by $r^{-0.13}$, where r is the slant range along the eigenray estimated as tc with t the travel time along the dominant eigenray and c the nominal speed of sound.

If the peak pressure for a given grid point is greater than the specified threshold, then the incremental volume for the grid point is added to the impact volume for that depth layer.

"Modified" Positive Impulse Metric

The modeling of positive impulse follows the work of Goertner (Goertner, 1982). The Goertner model defines a "partial" impulse as

$$\int_0^{T_{min}} p(t)\, dt$$

where $p(t)$ is the pressure wave from the explosive as a function of time t, defined so that $p(t) = 0$ for $t < 0$. This pressure wave is modeled as

$$p(t) = p_{max}\, e^{-t/\theta}$$

where p_{max} is the peak pressure at one meter (see, equation B-1), and θ is the time constant defined as

$$\theta = 0.058\, w^{1/3}\, (r/w^{1/3})^{0.22} \text{ seconds}$$

with w the net explosive weight (pounds), and r the slant range between source and animal.

The upper limit of the "partial" impulse integral is

$$T_{min} = min\ \{T_{cut},\ T_{osc}\}$$

where T_{cut} is the time to cutoff and T_{osc} is a function of the animal lung oscillation period. When the upper limit is T_{cut}, the integral is the definition of positive impulse. When the upper limit is defined by T_{osc}, the integral is smaller than the positive impulse and thus is just a "partial" impulse. Switching the integral limit from T_{cut} to T_{osc} accounts for the diminished impact of the positive impulse upon the animals lungs that compress with increasing depth and leads to what is sometimes call a "modified" positive impulse metric.

The time to cutoff is modeled as the difference in travel time between the direct path and the surface-reflected path in an isospeed environment. At a range of r, the time to cutoff for a source depth z_s and an animal depth z_a is

$$T_{cut} = 1/c\ \{\ [r^2 + (z_a + z_s)^2]^{1/2} - [r^2 + (z_a - z_s)^2]^{1/2}\ \}$$

where c is the speed of sound.

The animal lung oscillation period is a function of animal mass M and depth z_a and is modeled as

$$T_{osc} = 1.17\ M^{1/3}\ (1 + z_a/33)^{-5/6}$$

where M is the animal mass (in kg) and z_a is the animal depth (in feet [ft]).

The modified positive impulse threshold is unique among the various injury and harassment metrics in that it is a function of depth and the animal weight. So instead of the user specifying the threshold, it is computed as $K\ (M/42)^{1/3}\ (1 + z_a / 33)^{1/2}$. The coefficient K depends upon the level of exposure. For the onset of slight lung injury, K is 20; for the onset of extensive lung hemorrhaging (1 percent mortality), K is 43.

Although the thresholds are a function of depth and animal weight, sometimes they are summarized as their value at the sea surface for a typical calf dolphin (with an average mass of 12.2 kg [27 lbs]). For the onset of slight lung injury, the threshold at the surface is approximately 13 pounds per square inch per millisecond (psi-msec); for the onset of extensive lung hemorrhaging (1 percent mortality), the threshold at the surface is approximately 31 psi-msec.

As with peak pressure, the "modified" positive impulse at each grid point is compared to the derived threshold. If the impulse is greater than that threshold, then the incremental volume for the grid point is added to the impact volume for that depth layer.

Impact Volume per Explosive Detonation

The detonations of explosive sources are generally widely spaced in time and/or space. This implies that the impact volume for multiple firings can easily be derived by scaling the impact volume for a single detonation. Thus the typical impact volume vector for an explosive source is presented on a per detonation basis.

Impact Volume by Region

The NSWC PCD Study Area is described by eleven environmental provinces. The hourly impact volume vector for operations involving any particular source is a linear combination of the eleven impact volume vectors with the weighting determined by the distribution of those eleven environmental provinces within the source's operation area. Unique hourly impact volume vectors for winter and summer are calculated for each type of source and each metric/threshold combination.

M.3 RISK FUNCTION: THEORETICAL AND PRACTICAL IMPLEMENTATION

This section discusses the recent addition of a risk response "threshold" for the acoustic effects analysis procedure. This approach includes two parts: a new metric and a function to map exposure level under the new metric to probability of harassment. The following subsections discuss what these two parts mean, how they affect exposure calculations, and how they are implemented.

M.3.1 Calculation of Expected Exposures

Determining the number of expected exposures for disturbance is the object of this analysis.

$$\text{Expected exposures in volume } V = \int_V \rho(V) D(m_a(V)) dV$$

Where ρ is the animal density at a given point, or set of points.

For this analysis, $m_a = m_{\max SPL}$, so

$$\int_V \rho(V) D(m_a(V) dV = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} \rho(x,y,z) D(m_{\max SPL}(x,y,z)) dxdydz$$

In this analysis, the densities are constant over the *x*-*y* plane, and the *z* dimension is always negative, so this reduces to

$$\int_{-\infty}^{0} \rho(z) \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z)) dxdydz$$

M.3.2 Numeric Integration

Numeric integration of $\int_{-\infty}^{\infty} \rho(z) \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z)) dxdydz$ can be involved because, although the bounds are infinite, *D* is nonnegative out to 120 dB, which, depending on the environmental specifics, can drive propagation loss calculations and their numerical integration out to more than 100 km.

The first step in the solution is to separate out the *x*-*y* plane portion of the integral:

$$\text{Define f(z)= } \int_{-\infty-\infty}^{\infty}\int^{\infty} D(m_{\max SPL}(x,y,z))dxdy \text{ .}$$

Calculation of this integral is the most involved and time-consuming part of the calculation. Once it is complete,

$$\int_{-\infty}^{0}\rho(z)\int_{-\infty-\infty}^{\infty}\int^{\infty} D(m_{\max SPL}(x,y,z))dxdydz = \int_{-\infty}^{0}\rho(z)f(z)dz\,,$$

which, when numerically integrated, is a simple dot product of two vectors.

Thus, the calculation of *f(z)* requires the majority of the computation resources for the numerical integration. The rest of this subsection outlines the steps to calculate *f(z)* and preserve the results efficiently.

The concept of numerical integration is, instead of integrating over continuous functions, to sample the functions at small intervals and sum the samples to approximate the integral. The smaller the size of the intervals, the closer the approximation but the longer the calculation; thus, a balance between accuracy and time is determined in the decision of step size. For this analysis, *z* is sampled in 5 m (16.4 ft) steps to 1,000 m (3,281 ft) deep and 10 m (33 ft) steps to 2,000 m (6,562 ft), which is the limit of animal depth in this analysis. The step size for *x* is 5 m (16.4 ft), and *y* is sampled with an interval that increases as the distance from the source increases.

Mathematically,

$$\begin{aligned} z \in Z &= \{0,5,...1000,1010,...,2000\} \\ x \in X &= \{0,\pm 5,...,\pm 5k\} \\ y \in Y &= \left\{0,\pm 5(1.005)^0,5 \pm (1.005)^1,\pm 5(1.005)^2,...,5(1.005)^j\right\} \end{aligned}$$

for integers *k, j*, which depend on the propagation distance for the source. For this analysis, $k = 20{,}000$ and $j = 600$.

With these steps, $f(z_0) = \int_{-\infty-\infty}^{\infty}\int^{\infty} D(m_{\max SPL}(x,y,z_0))dxdy$ is approximated as

$$\sum_{z\in Y}\sum_{x\in X} D(m_{\max SPL}(x,y,z_0))\Delta x\Delta y$$

where *X, Y* are defined as above.

This calculation must be repeated for each $z_0 \in Z$, to build the discrete function *f(z)*.

With the calculation of *f(z)* complete, the integral of its product with $\rho(z)$ must be calculated to complete evaluation of

$$\int_{-\infty}^{\infty} \rho(z) \int_{-\infty-\infty}^{\infty\infty} D(m_{\max SPL}(x,y,z))dxdydz = \int_{-\infty}^{0} \rho(z) f(z) dz$$

Since *f(z)* is discrete, and $\rho(z)$ can be readily made discrete,

$\int_{-\infty}^{0} \rho(z) f(z) dz$ is approximated numerically as $\sum_{z \in Z} \rho(z) f(z)$, a dot product.

Preserving Calculations for Future Use

Calculating *f(z)* is the most time-consuming part of the numerical integration, but the most time-consuming portion of the entire process is calculating $m_{\max SPL}(x,y,z)$ over the area range required for the minimum cutoff value (120 dB). The calculations usually require propagation estimates out to over 100 km, and those estimates, with the beam pattern, are used to construct a sound field that extends 200 km × 200 km (124 miles x 124 miles), or 40,000 km^2 (15,444 square miles), with a calculation at the steps for every value of *X* and *Y*, defined above. This is repeated for each depth, to a maximum of 2,000 m (6,562 ft).

Saving the entire $m_{\max SPL}$ for each *z* is unrealistic, requiring great amounts of time and disk space. Instead, the different levels in the range of $m_{\max SPL}$ are sorted into bins of 0.5 dB; the volume of water at each bin level is taken from $m_{\max SPL}$ and associated with its bin. Saving this, the amount of water ensonified at each level, at 0.5-dB resolution, preserves the ensonification information without using the space and time required to save $m_{\max SPL}$ itself. Practically, this is a histogram of occurrence of level at each depth, with 0.5-dB bins. Mathematically, this is simply defining the discrete functions $V_z(L)$, where $L = \{.5a\}$ for every positive integer a, for all $z \in Z$. These functions, or histograms, are saved for future work. The information lost by saving only the histograms is *where* in space the different levels occur, although *how often* they occur is saved. But the thresholds (risk function curves) are purely a function of level, not location, so this information is sufficient to calculate *f(z)*.

Applying the risk function to the histograms is a dot product:

$$\sum_{\ell \in L_1} D(\ell) V_{z_0}(\ell) \approx \int_{-\infty-\infty}^{\infty\infty} D(m_{\max SPL}(x,y,z_0))dxdy$$

Once the histograms are saved, neither $m_{\max SPL}(x,y,z)$ nor *f(z)* must be recalculated to generate $\int_{-\infty}^{0} \rho(z) \int_{-\infty-\infty}^{\infty\infty} D(m_{\max SPL}(x,y,z))dxdydz$ for a new threshold function.

The following subsection includes an in-depth discussion of the method, software, and other details of the *f(z)* calculation.

Software Details

The risk-function metric uses the aforementioned Feller function to determine the probability that an animal is affected by a given sound pressure level. The acoustic quantity of interest is the maximum sound pressure level (SPL) experienced over multiple pings in a range-independent environment. The procedure for calculating the impact volume at a given depth is relatively simple. In brief, given the SPL of the source and the transmission loss (TL) curve, the received SPL is calculated on a volumetric grid. For a given depth, volume associated with each SPL interval is calculated. Then, this volume is multiplied by the probability that an animal will be affected by that sound pressure level. This gives the impact volume for that depth, which can be multiplied by the animal densities at that depth, to obtain the number of animals affected at that depth. The process repeats for each depth to construct the impact volume as a function of depth.

The case of a single emission of sonar energy, one ping, illustrates the computational process in more detail. First, the sound pressure levels are segregated into a sequence of bins that cover the range encountered in the area. The sound pressure levels are used to define a volumetric grid of the local sound field. The impact volume for each depth is calculated as follows: for each depth in the volumetric grid, the sound pressure level at each *x*-*y* plane grid point is calculated using the sound pressure level of the source, the TL curve, the horizontal beam pattern of the source, and the vertical beam patterns of the source. The sound pressure levels in this grid become the bins in the volume histogram. Figure M-5 shows a volume histogram for a low-power sonar. Level bins are 0.5 dB in width and the depth is 50 m (164 ft) in an environment with water depth of 100 m (328 ft). The oscillatory structure at very low levels is due to the flattening of the TL curve at long distances from the source, which magnifies the fluctuations of the TL as a function of range. The "expected" impact volume for a given level at a given depth is calculated by multiplying the volume in each level bin by the risk probability function at that level. Total expected impact volume for a given depth is the sum of these "expected" volumes. Figure M- 6 is an example of the impact volume as a function of depth at a water depth of 100 m (328 ft).

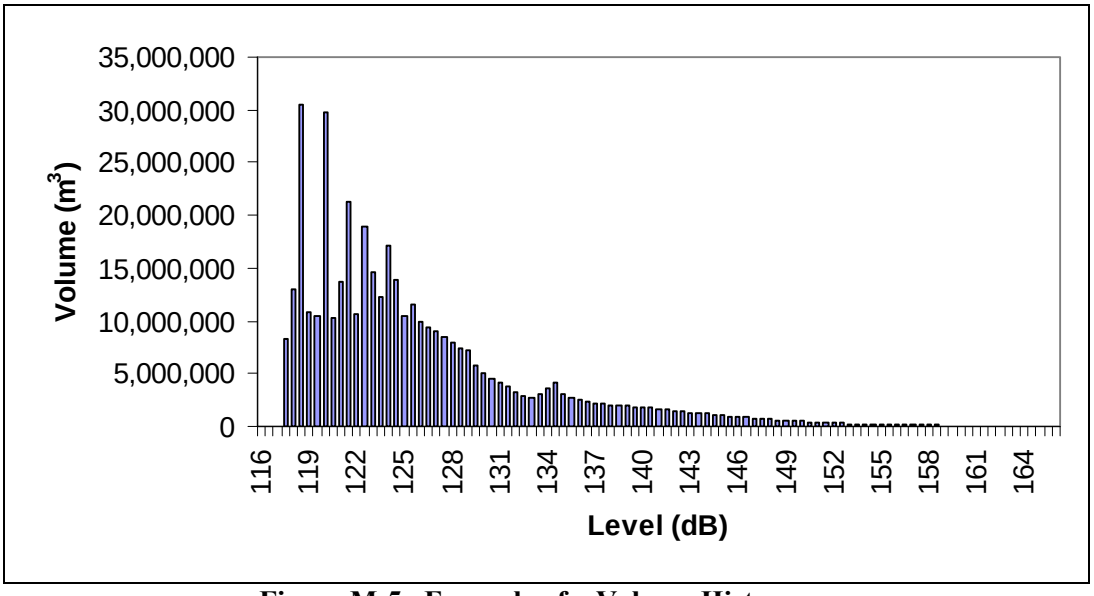


Figure M-5. Example of a Volume Histogram

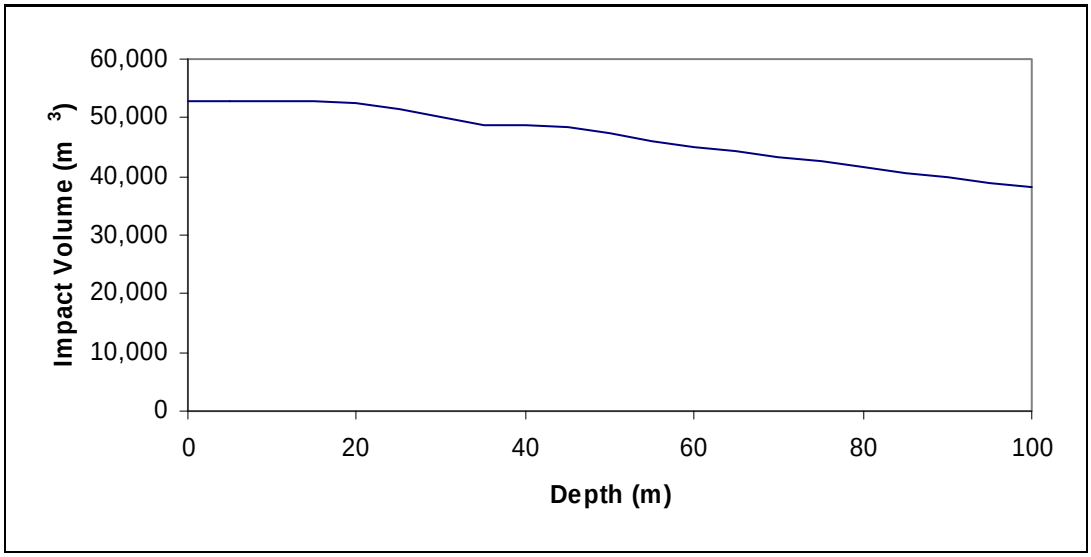


Figure M- 6. Example of the Dependence of Impact Volume

The volumetric grid covers the waters in and around the area of sonar operation. The grid for this analysis has a uniform spacing of 5 m (16.4 ft) in the *x* coordinate and a slowly expanding spacing in the *y* coordinate that starts with 5 m (16.4 ft) spacing at the origin. The growth of the grid size along the *y* axis is a geometric series. Each successive grid size is obtained from the previous by multiplying it by 1 + *Ry*, where *Ry* is the *y* axis growth factor. This forms a geometric series. The nth grid size is related to the first grid size by multiplying by $(1+Ry)^{(n-1)}$. For an initial grid size of 5 m (16.4 ft) and a growth factor of 0.005, the 100th grid increment is 8.19 m (26.9 ft). The constant spacing in the *x* coordinate allows greater accuracy as the source moves along the *x* axis. The slowly increasing spacing in *y* reduces computation time, while maintaining accuracy, by taking advantage of the fact that TL changes more slowly at longer distances from the source. The *x* and *y* coordinates extend from $-R_{max}$ to $+R_{max}$, where R_{max} is the maximum range used in the TL calculations. The *z* direction uses a uniform spacing of 5 m (16.4 ft) down to 1,000 m (3,281 ft) and 10 m (33 ft) from 1,000 to 2,000 m (3,281 to 6,562 ft). This is the same depth mesh used for the effective energy metric as described above. The depth mesh does not extend below 2,000 m (6,562 ft), on the assumption that animals of interest are not found below this depth.

Figure M-7, Figure M-8, and Figure M- 9 indicate how the accuracy of the calculation of impact volume depends on the parameters used to generate the mesh in the horizontal plane. Figure M-7 shows the relative change of impact volume for one ping as a function of the grid size used for the *x* axis. The *y* axis grid size is fixed at 5 m (16.4 ft), and the *y* axis growth factor is 0, i.e., uniform spacing. The impact volume for a 5 m (16.4 ft) grid size is the reference. For grid sizes between 2.5 and 7.5 m (8.3 and 24.6 ft), the change is less than 0.1 percent. A grid size of 5 m (16.4 ft) for the *x* axis is used in the calculations. Figure M-8 shows the relative change of impact volume for one ping as a function of the grid size used for the *y* axis. The *x* axis grid size is fixed at 5 m (16.4 ft), and the *y* axis growth factor is 0. The impact volume for a 5 m (16.4 ft) grid size is the reference. This figure is very similar to that for the *x* axis grid size. For grid sizes between 2.5 and 7.5 m (8.2 and 24.6 ft), the change is less than 0.1 percent. A grid size of 5 m (16.4 ft) is used for the *y* axis in our calculations. Figure M-9 shows the relative change of impact volume for one ping as a function of the *y* axis growth factor. The *x* axis grid size is fixed

at 5 m and the initial *y* axis grid size is 5 m (16.4 ft). The impact volume for a growth factor of 0 is the reference. For growth factors from 0 to 0.01, the change is less than 0.1 percent. A growth factor of 0.005 is used in the calculations.

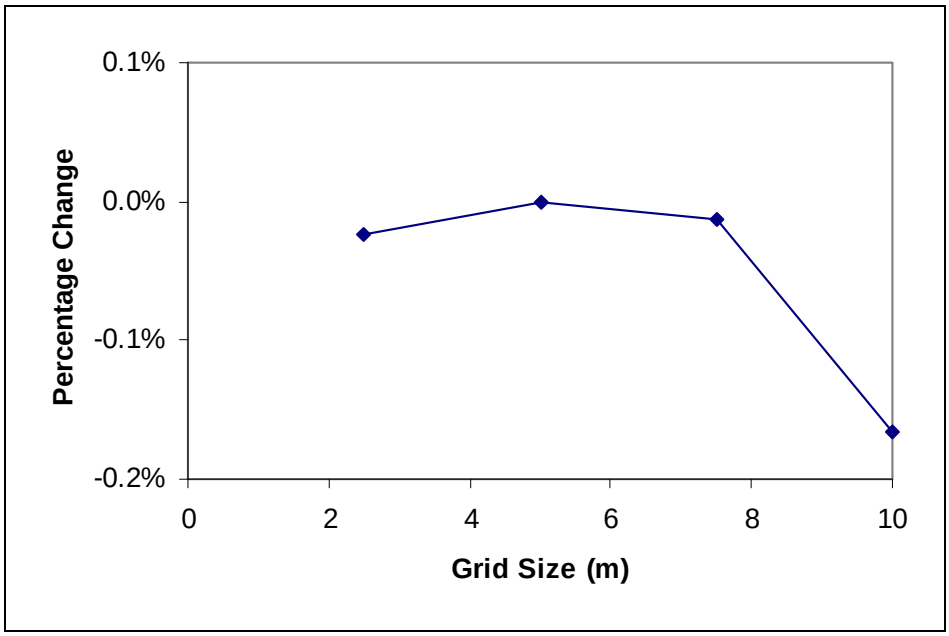


Figure M-7. Change of Impact Volume as a Function of *X* Axis Grid Size

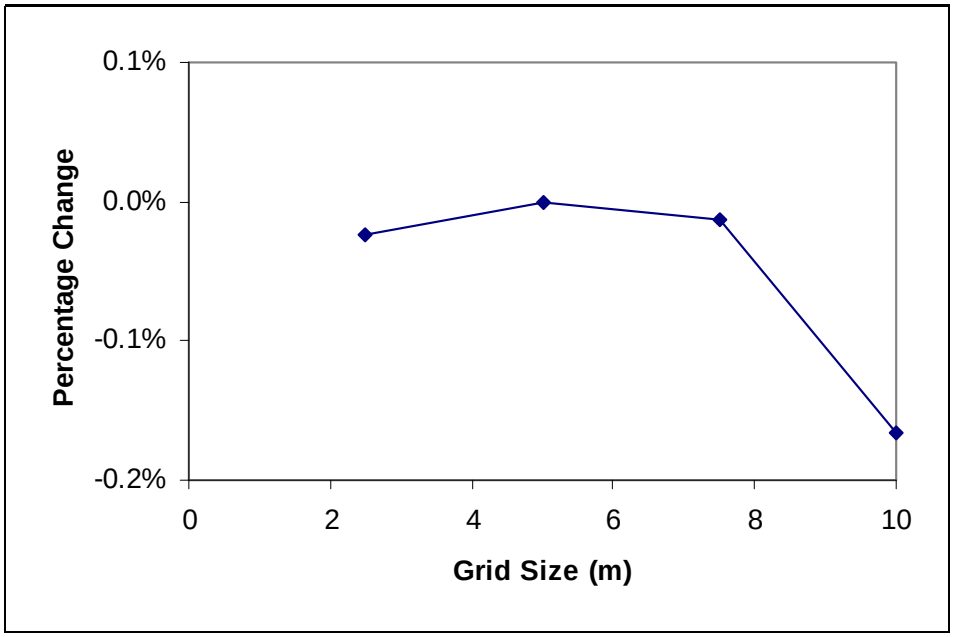


Figure M-8. Change of Impact Volume as a Function of *Y* Axis Grid Size

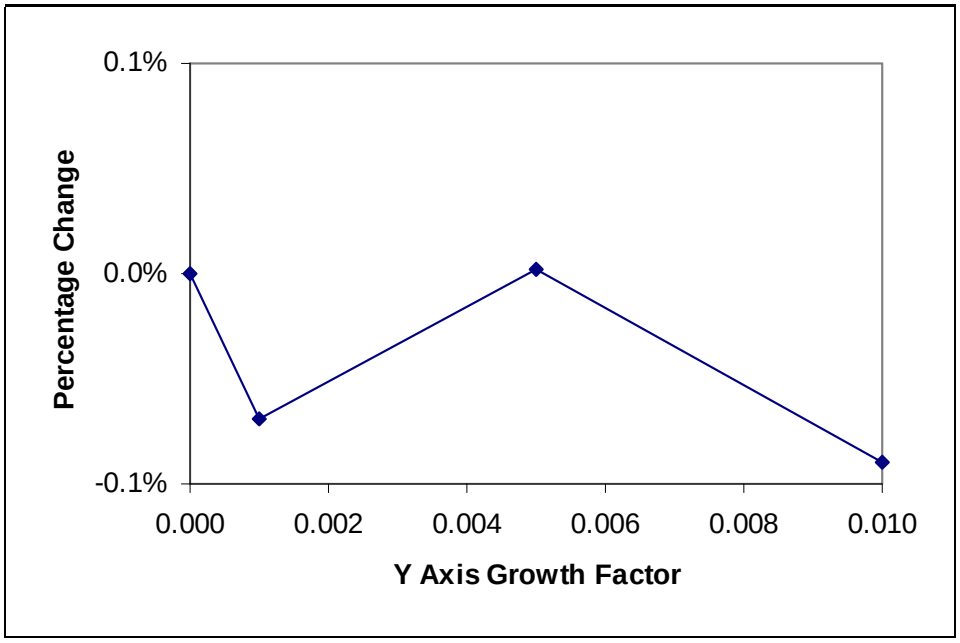


Figure M- 9. Change of Impact Volume as a Function of *Y* Axis Growth Factor

Another factor influencing the accuracy of the calculation of impact volumes is the size of the bins used for sound pressure level. The sound pressure level bins extend from 100 dB (far lower than required) up to 300 dB (much higher than that expected for any sonar system). Figure M-10 shows the relative change of impact volume for one ping as a function of the bin width. The *x* axis grid size is fixed at 5 m (16.4 ft), the initial *y* axis grid size is 5 m (16.4 ft), and the *y* axis growth factor is 0.005. The impact volume for a bin size of 0.5 dB is the reference. For bin widths from 0.25 dB to 1.00 dB, the change is about 0.1 percent. A bin width of 0.5 is used in our calculations.

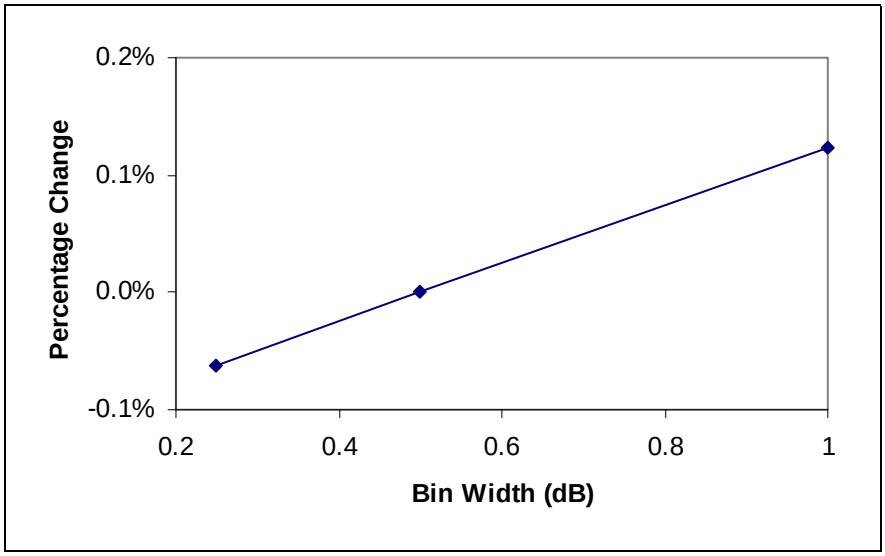


Figure M-10. Change of Impact Volume as a Function of Bin Width

Two other issues for discussion are the maximum range (R_{max}) and the spacing in range and depth used for calculating TL. The TL generated for the energy accumulation metric is used for

risk function analysis. The same sampling in range and depth is adequate for this metric because it requires a less-demanding computation (i.e., maximum value instead of accumulated energy).

The process of obtaining the maximum sound pressure level at each grid point in the volumetric grid is straightforward. The active sonar starts at the origin and moves at constant speed along the positive *x* axis, emitting a burst of energy, a ping, at regularly spaced intervals. For each ping, the distance and horizontal angle connecting the sonar to each grid point is computed. Calculating the TL from the source to a grid point involves several steps. The TL is made up of the sum of many eigenrays connecting the source to the grid point. The beam pattern of the source is applied to the eigenrays based on the angle at which they leave the source. After summing the vertically beam-formed eigenrays on the range mesh used for the TL calculation, the vertically beam-formed TL for the distance from the sonar to the grid point is derived by interpolation. Next, the horizontal beam pattern of the source is applied using the horizontal angle connecting the sonar to the grid point. To avoid problems in extrapolating TL, only use grid points with distances less than R_{max} are used. To obtain the sound pressure level at a grid point, the sound pressure level of the source is reduced by that TL. For the first ping, the volumetric grid is populated by the calculated sound pressure level at each grid point. For the second ping and subsequent pings, the source location increments along the *x* axis by the spacing between pings and the sound pressure level for each grid point is again calculated for the new source location. Since the risk function metric uses the maximum of the sound pressure levels at each grid point, the newly calculated sound pressure level at each grid point is compared to the sound pressure level stored in the grid. If the new level is larger than the stored level, the value at that grid point is replaced by the new sound pressure level.

For each bin, a volume is determined by summing the ensonified volumes with a maximum SPL in the bin's interval. This forms the volume histogram shown in Figure M-5. Multiplying by the risk probability function for the level at the center of a bin gives the impact volume for that bin. The result can be seen in Figure M-6, which is an example of the impact volume as a function of depth.

The impact volume for a sonar moving relative to the animal population increases with each additional ping. The rate at which the impact volume increases for the risk function metric is essentially linear with the number of pings. Figure M-11 shows the dependence of impact volume on the number of pings. The function is linear; the slope of the line at a given depth is the impact volume added per ping. This number multiplied by the number of pings in an hour gives the hourly impact volume for the given depth increment. Completing this calculation for all depths in a province, for a given source, gives the hourly impact volume vector, which contains the hourly impact volumes by depth for a province. Figure M-12 provides an example of an hourly impact volume vector for a particular environment. Given the speed of the sonar, the hourly impact volume vector could be displayed as the impact volume vector per kilometer of track.

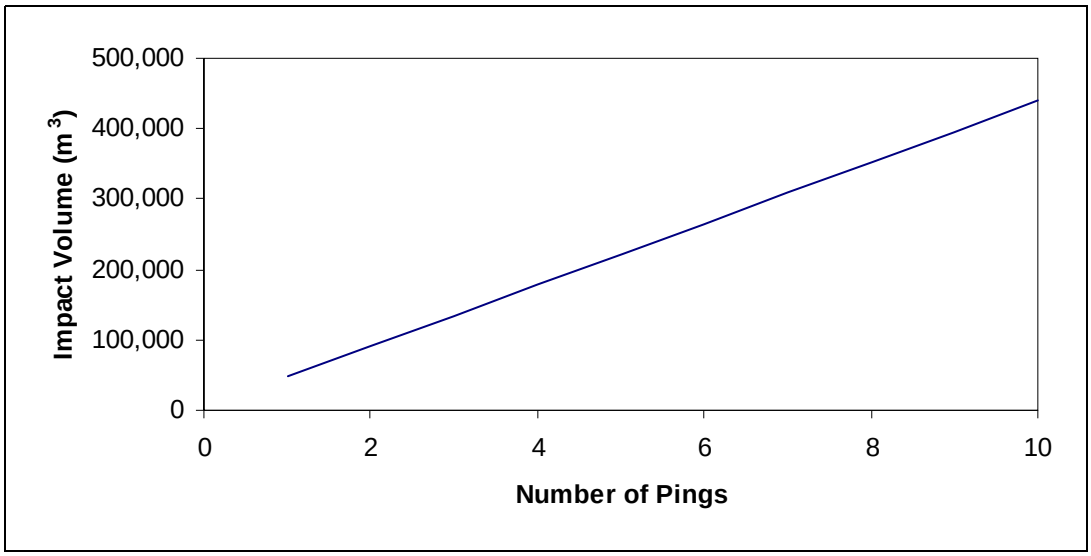


Figure M-11. Dependence of Impact Volume on the Number of Pings

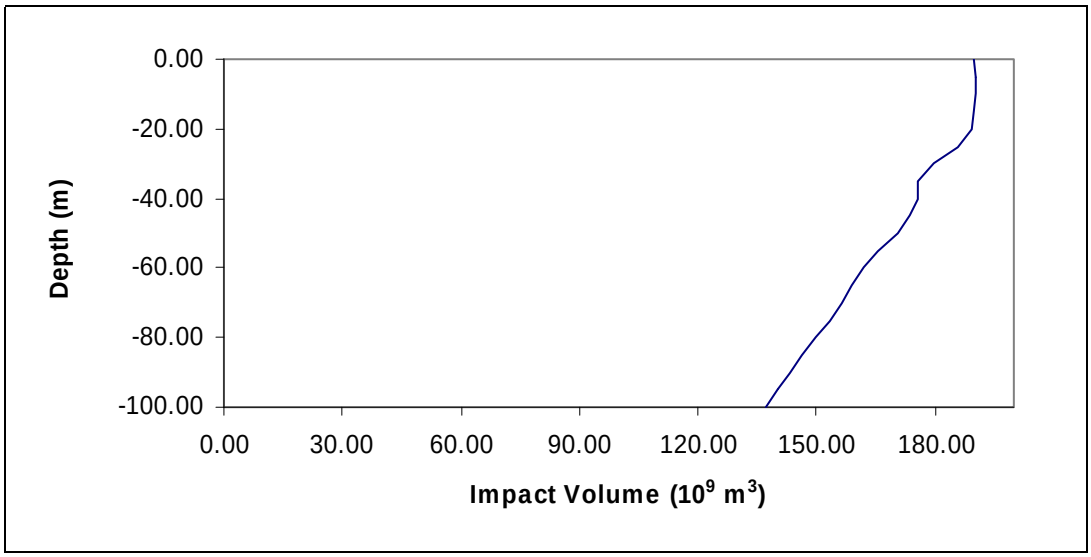


Figure M-12. Example of an Hourly Impact Volume Vector

M.4 ADDITIONAL MODELING CONSIDERATIONS IN A GENERAL MODELING SCENARIO

When modeling the effect of sound projectors in the water, the ideal task presents modelers with complete *a priori* knowledge of the location of the source(s) and transmission patterns during the times of interest. In these cases, calculation inputs include the details of source path, proximity of shoreline, high-resolution density estimates, and other details of the scenario. However, in the NSWC PCD Study Area, there are sound-producing events for which the source locations and transmission patterns are unknown, but still require analysis to predict effects. For these cases, a more general modeling approach is required: "We will be operating somewhere in this large area for X hours. What are the potential effects on average? "

Modeling these general scenarios requires a statistical approach to incorporate the scenario nuances into harassment calculations. For example, one may ask: "If an animal receives 130 dB SPL when the source passes at closest point of approach (CPA) on Tuesday morning, how do we know it doesn't receive a higher level on Tuesday afternoon?" This question cannot be answered without knowing the path of the source (and several other facts). Because the path of the source is unknown, the number of an individual's re-exposures cannot be calculated directly. But it can, on average, be accounted for by making appropriate assumptions.

Table M-8 lists unknowns created by uncertainty about the specifics of a future proposed action, the portion of the calculation to which they are relevant, and the assumption that allows the effect to be computed without the detailed information.

Table M-8. Unknowns and Assumptions

Unknowns	Relevance	Assumption
Path of source(esp. with respect to animals)	Ambiguity of multiple exposures, Local population: upper bound of harassments	Most conservative case: sources can be anywhere within Area
Source locations	Ambiguity of multiple exposures, land shadow	Equal distribution of action in each modeling area
Direction of sonar transmission	Land shadow	Equal probability of pointing any direction

The following sections discuss two topics that require action details, and describe how the modeling calculations used the general knowledge and assumptions to overcome the future-action uncertainty with respect to re-exposure of animals, and land shadow.

M.4.1 Multiple Exposures in General Modeling Scenario

Consider the following hypothetical scenario. A box is painted on the surface of a well-studied ocean environment with well-known propagation. A sonar-source and 1000 whales are inserted into that box and a curtain is drawn. What will happen? This is the general scenario. The details of what will happen behind the curtain are unknown, but the existing knowledge, and general assumptions, can allow for a general calculation of average affects.

For the first period of time, the source is traveling in a straight line and pinging at a given rate. In this time, it is known how many animals, on average, receive their max SPLs from each ping. As long as the source travels in a straight line, this calculation is valid. However, after an undetermined amount of time, the source will change course to a new and unknown heading.

If the source changes direction 180 degrees and travels back through the same swath of ocean, all the animals the source passes at closest point of approach (CPA) before the next course change have already been exposed to what will be their maximum SPL, so the population is not "fresh." If the direction does not change, only new animals will receive what will be their maximum SPL from that source (though most have received sound from it), so the population is completely "fresh." Most source headings lead to a population of a mixed "freshness," varying by course direction. Since the route and position of the source over time are unknown, the freshness of the

population at CPA with the source is unknown. This ambiguity continues through the remainder of the exercise.

What is known? The source and, in general, the animals remain in the NSWC PCD Study Area. Thus, if the farthest range to a possible effect from the source is X km, no animals farther than X km outside of the NSWC PCD Study Area can be harassed. The intersection of this area with a given animal's habitat multiplied by the density of that animal in its habitat represents the maximum number of animals that can be harassed by activity in the NSWC PCD Study Area, which shall be defined as "the local population." Two details: first, this maximum should be adjusted down if a risk function is being used, because not 100 percent of animals within X km of the NSWC PCD Study Area border will be harassed. Second, it should be adjusted up to account for animal motion in and out of the area.

The ambiguity of population freshness throughout the exercise means that multiple exposures cannot be calculated for any individual animal. It must be dealt with generally at the population level.

Solution to the Ambiguity of Multiple Exposures in the General Modeling Scenario

At any given time, each member of the population has received a maximum SPL (possibly zero) that indicates the probability of harassment in the exercise. This probability indicates the contribution of that individual to the expected value of the number of harassments. For example, if an animal receives a level that indicates 50% probability of harassment, it contributes 0.5 to the sum of the expected number of harassments. If it is passed later with a higher level that indicates a 70 percent chance of harassment, its contribution increases to 0.7. If two animals receive a level that indicates 50 percent probability of harassment, they together contribute 1 to the sum of the expected number of harassments. That is, we statistically expect exactly one of them to be harassed. Let the expected value of harassments at a given time be defined as "the harassed population" and the difference between the local population (as defined above) and the harassed population be defined as "the unharassed population." As the exercise progresses, the harassed population will never decrease and the unharassed population will never increase.

The unharassed population represents the number of animals statistically “available” for harassment. Since we do not know where the source is, or where these animals are, we assume an average (uniform) distribution of the unharassed population over the area of interest. The densities of unharassed animals are lower than the total population density because some animals in the local population are in the harassed population.

Density relates linearly to expected harassments. If action A in an area with a density of two animals per square kilometer produces 100 expected harassments, then action A in an area with one animal per square kilometer produces 50 expected harassments. The modeling produces the number of expected harassments per ping starting with 100 percent of the population unharassed. The next ping will produce slightly fewer harassments because the pool of unharassed animals is slightly less.

For example, consider the case where one animal is harassed per ping when the local population is 100, 100 percent of which are initially unharassed. After the first ping, 99 animals are unharassed, so the number of animals harassed during the second ping are

$10\left(\frac{99}{100}\right) = 1(.99) = 0.99$ animals and so on for the subsequent pings.

Mathematics

A closed form function for this process can be derived as follows.

Define $P_n =$ unharassed population after ping n
Define $H =$ number of animals harassed in a ping with 100% unharassed population
$P_0 =$ local population
$P_1 = P_0 - H$

$$P_2 = P_1 - H\left(\frac{P_1}{P_0}\right)$$

...

$$P_n = P_{n-1} - H\left(\frac{P_{n-1}}{P_0}\right)$$

Therefore,

$$P_n = P_{n-1}\left(1-\left(\frac{H}{P_0}\right)\right) = P_{n-2}\left(1-\left(\frac{H}{P_0}\right)\right)^2 = \ldots = P_0\left(1-\left(\frac{H}{P_0}\right)\right)^n$$

Thus, the total number of harassments depends on the per-ping harassment rate in an unharassed population, the local population size, and the number of operation hours.

Local Population: Upper Bound on Harassments

As discussed above, Navy planners have confined period of sonar use to operation areas. The size of the harassed population of animals for an action depends on animal re-exposure, so uncertainty about the precise source path creates variability in the "harassable" population. Confinement of sonar use to a sonar operating area allows modelers to compute an upper bound, or worst case, for the number of harassments with respect to location uncertainty. This is done by assuming that there is a sonar transmitting from each point in the confined area throughout the action length.

NMFS has defined a 24 hour "refresh rate," or amount of time in which an individual can be harassed no more than once. Navy has determined that, in a 24 hour period, all sonar operations in the NSWC PCD Study Area transmit for a subset of that time (Table M-9).

Table M-9. Duration of Sonar Use During 24-hour Period

System	Longest continuous interval (in hrs)
AN/SQS-53/56 Kingfisher	0.5
Sub-bottom profiler (2-9 kHz)	2
REMUS SAS-LF	2
REMUS Modem	4
Sub-bottom profiler (2-16 kHz)	2
AN/SQQ-32	4
REMUS-SAS-LF	4
AN/BLQ-11	4
SAS-LF	4
AN/WLD-1 RMS-ACL	2
BPAUV Sidescan	4
TVSS	2
F84Y	2
BPAUV Sidescan	4
REMUS-SAS-HF	2
SAS-HF	2
AN/AQS-20	4
BPAUV Sidescan	4

Creating the most conservative source position by assuming that a sonar transmits from each point in the NSWC PCD Study Area simultaneously can produce an upper bound on harassments for a single ping, but animal motion over the period in the above table can bring animals into range that otherwise would be out of the harassable population.

Animal Motion Expansion

Though animals often change course to swim in different directions, straight-line animal motion would bring more animals into the harassment area than a "random walk" motion model. Since precise and accurate animal motion models exist more as speculation than documented fact and because the modeling requires an undisputable upper bound, calculation of the upper bound for modeling areas uses a straight-line animal motion assumption. This is a conservative assumption.

For a circular area, the straight-line motion with initial random direction assumption produces an identical result to the initial fixed direction. Since the NSWC PCD Study Area consists of operating areas that are non-circular polygons, choosing the initial fixed direction as perpendicular to the longest diagonal produces greater results than the initial random direction. Thus, the product of the longest diagonal and the distance the animals move in the period of interest gives an overestimate of the expansion in NSWC PCD modeling areas due to animal motion. The NSWC PCD expansions use this overestimate for the animal-motion expansion.

Figure M-13 shows an example that illustrates the overestimation, which occurs during the second arrow.

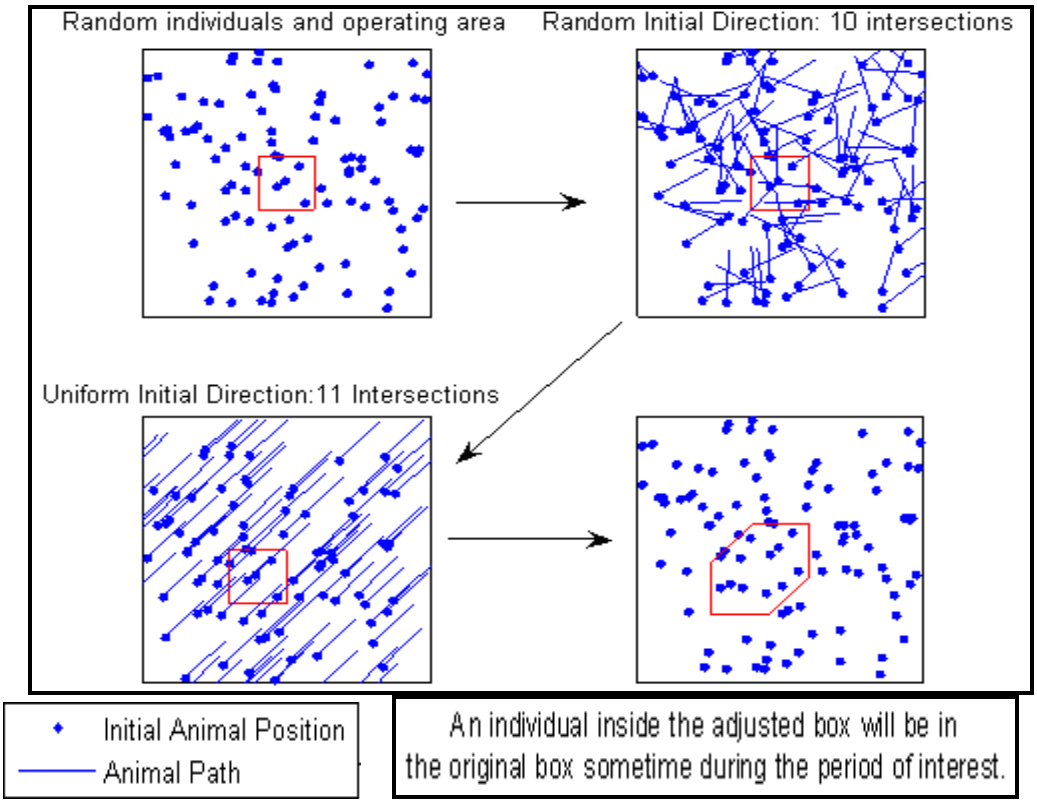


Figure M-13. Process of Overestimating Individuals Present in Area at Any Time.

Risk Function Expansion

The expanded area contains the number of animals that will enter the NSWC PCD Study Area over the period of interest. However, an upper bound on harassments must also include animals outside the area that would be affected by a source transmitting from the area's edge. A gross overestimation could simply include all area with levels greater than the risk function cutoff. In the case of the NSWC PCD Study Area, this would include all areas within approximately 65 km from the edge of the adjusted box. This basic method would give a crude and inaccurately high upper bound, since only a fraction of the population is affected in much of that area. A more refined upper bound on harassments can be found by maintaining the assumption that a sonar is transmitting from each point in the adjusted box and calculating the expected ensonified area.

The expected lateral range from the edge of a polygon to the cutoff range can be expressed as,

$$\int_0^{L^{-1}(120\,dB)} D(L(r))dr \,,$$

where D is the risk function with domain in level and range in probability, L is the SPL function with domain in range and range in level, and r is the range from the sonar operating area.

At the corners of the polygon, additional area can be expressed as

$$\frac{[\pi - \theta] \int_0^{L^{-1}(120\,dB)} D(L(r))rdr}{2\pi}$$

with D, L, and r as above, and θ the inner angle of the polygon corner, in radians.

For the risk function and transmission loss of the NSWC PCD Study Area, this method adds an area equivalent to expanding the boundaries of the adjusted box by four kilometers. The resulting shape, the adjusted box with a boundary expansion of 4 km, does not possess special meaning for the problem. But the number of individuals contained by that shape, as demonstrated above, is an overestimate of the number of harassments that would occur if sonars transmitted continuously from each point in the NSWC PCD Study Area over the test activities' length, an upper bound on harassments for that operation.

Plots shown in Figure M-14 illustrate the growth of area for the sample case above. The shapes of the boxes are unimportant. The area after the final expansion, though, gives an upper bound on the "harassable," or unharassed population.

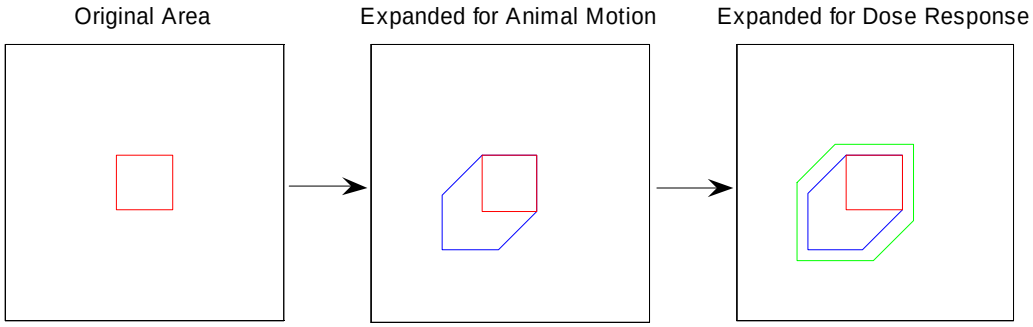


Figure M-14. Process of Expanding Area to Create Upper Bound of Harassments

Example Case

For the most powerful source, the Kingfisher, the expected summer rate of harassment for pantropical spotted dolphins is approximately 0.000097 harassments per ping, with pings per hour of operation.

The Panama City area has an area of approximately 9,033 square kilometers and a diagonal of 300 km. Adjusting this with straight-line (upper bound) animal motion brings the total upper-bound of the affected area to 12,033 square km.

For this analysis, pantropical spotted dolphins have an average density of approximately 0.0399 animals per square kilometer, so the upper bound number of pantropical spotted dolphins that can be affected by Kingfisher activity in the Panama City area during a 24 hour period is 12,033 *0.0399 = 480.1167 dolphins.

In the first ping, 0.000097 pantropical spotted dolphins will be harassed. Using the formula derived above, after 1 hour of continuous operation, the remaining **unharassed** population is

$$P_{1200} = P_0\left(1-\left(\frac{h}{P_0}\right)\right)^{1200} = 480.1167\left(1-\left(\frac{0.000097}{480.1167}\right)\right)^{1200} \approx 480.0003$$

So the **harassed** population will be 480.1167 – 480.0003 = 0.1164 animals.

The results are not dramatically different compared to linear accumulation for this case, but the calculation still ensures that animals are not double-counted. In other cases where the ratio of per-ping-harassment to harassable population is larger, then the dilution's effect is more pronounced.

M.4.2 Land Shadow

The risk function considers harassment possible if an animal receives 120 dB sound pressure level, or above. In the NSWC PCD Study Area, this occurs as far away as 65 km, so over a large ”effect” area, sonar sound could, but does not necessarily, harass an animal. The harassment calculations for a general modeling case must assume that this effect area covers only water fully populated with animals, but in some portions of the NSWC PCD Study Area, land partially encroaches on the area, obstructing sound propagation.

As discussed in the introduction of Section M.4, Navy planners do not know the exact location and transmission direction of the sonars at future times. These factors however, completely determine the interference of the land with the sound, or “land shadow,” so a general modeling approach does not have enough information to compute the land shadow effects directly. However, modelers can predict the reduction in harassments at any point due to land shadow for different pointing directions and use expected probability distribution of activity to calculate the average land shadow for operations in the NSWC PCD Study Area.

For the NSWC PCD Study Area, the land shadow is computed over a dense grid in each operations area, as shown in Figure M-15. The dense grid is shown by the near-continuous green dots. For illustrative purposes, every 25th point is shown as a red cross.

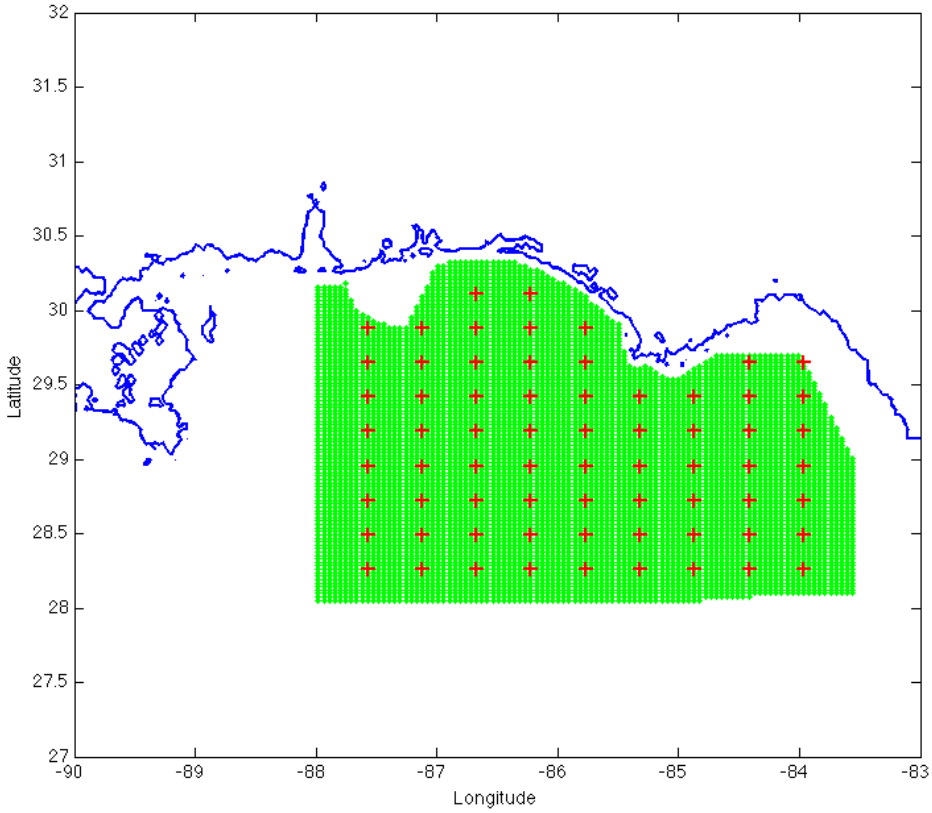


Figure M-15. Grid for the NSWC PCD Study Area.

For each grid point, the land shadow is computed by combining the distance to land and the azimuth coverage. The process finds all of the points within 65 km of the gridpoint. Figure M-16 gives an example. The red box is the operations area. The red X is one grid point, with the green circle corresponding to a radius of 65 km from the grid point.

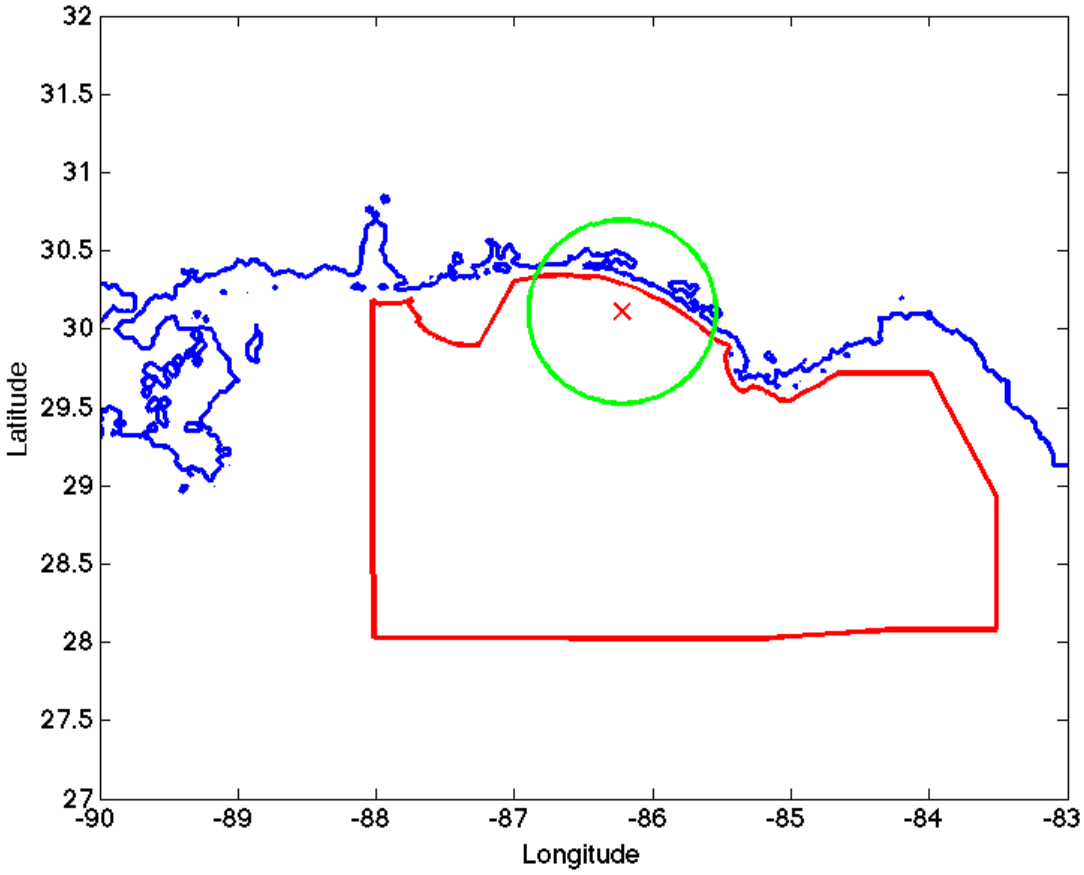


Figure M-16. Example of 65 km gridpoint.

For each of the coastal points that are within 65 km of the grid, the azimuth and distance is computed. In the computation, only the minimum range at each azimuth is computed. Figure M-17 shows the minimum range compared with the azimuth for the sample point. The nearest point at each azimuth (with 1° spacing) to a sample grid point (red X) is shown by the green lines.

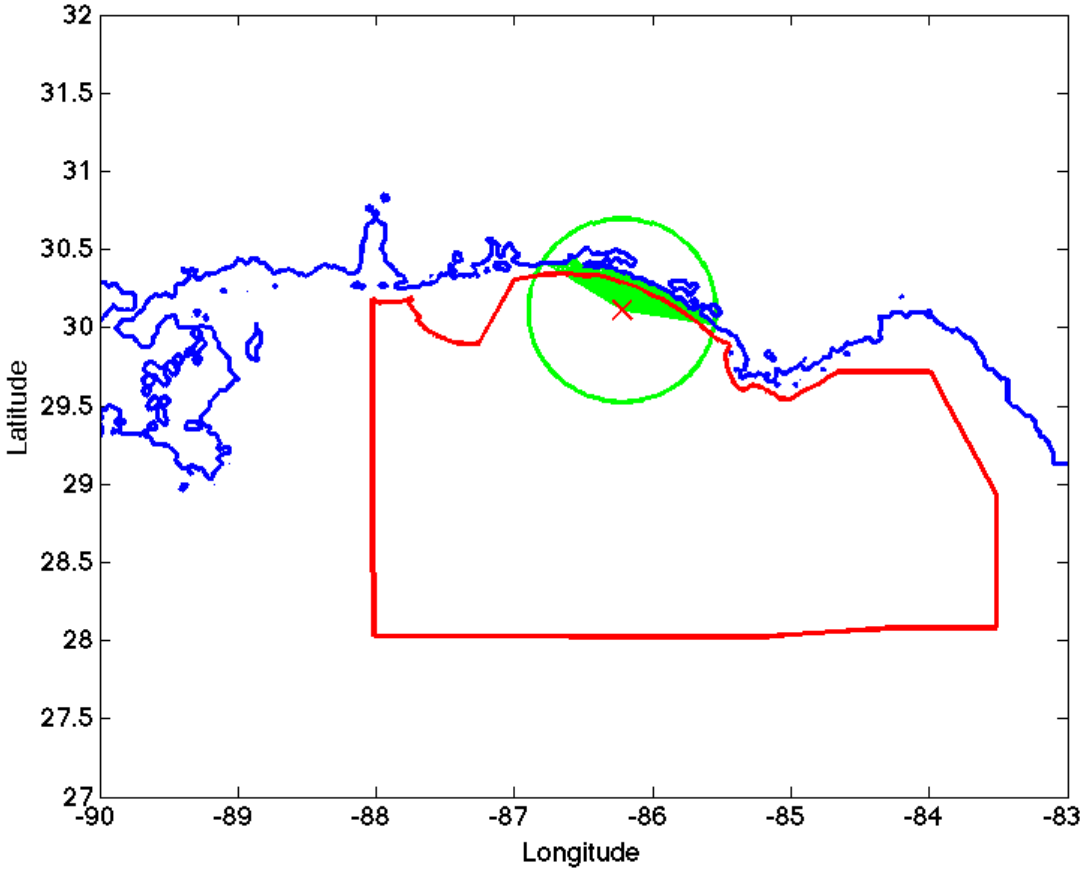


Figure M-17. Depiction of nearest point at each azimuth.

Now, the average of the distances to shore, along with the angular profile of land is computed (by summing the unique azimuths that intersect the coast) for each grid point. The values are then used to compute the land shadow for the grid points.

Computing the Land Shadow Effect at Each Grid Point

The effect of land shadow is computed by determining the levels, and thus the distances from the sources, that the harassments occur (Table M- 10). Figure M-18 shows the percentage of behavioral harassments for every 5 degree band of received level from the Kingfisher.

Table M- 10. Harassments at each Received Level Band from Kingfisher

Received Level (dB SPL)	Distance at which Levels Occur in the NSWC PCD Study Area	Percent of Harassments Occurring at Given Levels
Below 140	5.9 km – 65 km	<< 1 %
140>Level>150	2.4 km – 5.9 km	2 %
150>Level>160	1.0 km – 2.5 km	16 %
160>Level>170	400 m – 1000 m	38%
170>Level>180	160 m – 400 m	28 %
180>Level>190	64 m - 160 m	13 %
Above 190	0 m – 64 m	3%

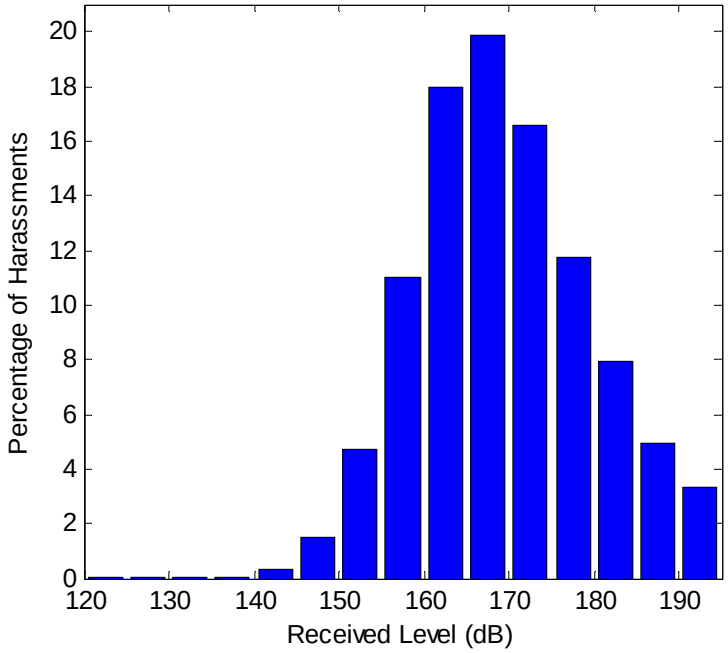


Figure M-18. Percentage of behavioral harassments from Kingfisher.

With the data used to produce the previous figure, the average effect reduction across season for a sound path blocked by land can be calculated. For example, since approximately 97 percent of harassments occur within 2 kilometers of the source, a sound path blocked by land at 2 kilometers will, on average, cause approximately 97 percent of the effect of an unblocked path (Figure M-19).

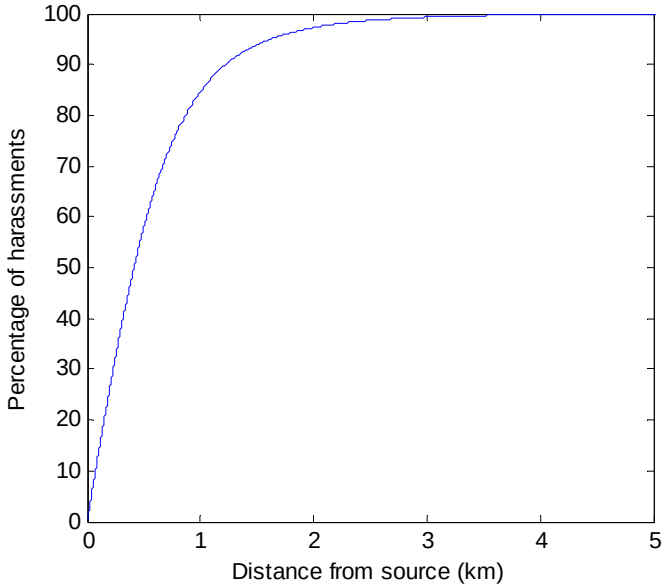


Figure M-19. Average Percentage of Harassments Occurring Within a Given Distance

As described above, the mapping process determines the angular profile of and distance to the coastline(s) from each grid point. The distance, then, determines the reduction due to land shadow when the sonar is pointed in that direction. The angular profile, then, determines the probability that the sonar is pointed at the coast.

Define θ_n = angular profile of coastline at point n in radians
Define r_n = mean distance to shoreline
Define A(r) = average effect adjustment factor for sound blocked at distance r

The land shadow at point n can be approximated by $A(r_n)\theta_n/(2\pi)$. The following plots give the land shadow reduction factor at each point in the NSWC PCD Study Area (Figure M-20). The white portions of the plot indicate the areas outside the NSWC PCD Study Area. The land shadow effects for most points burgundy or about 100 percent effect (0 percent reduction due to shadow).

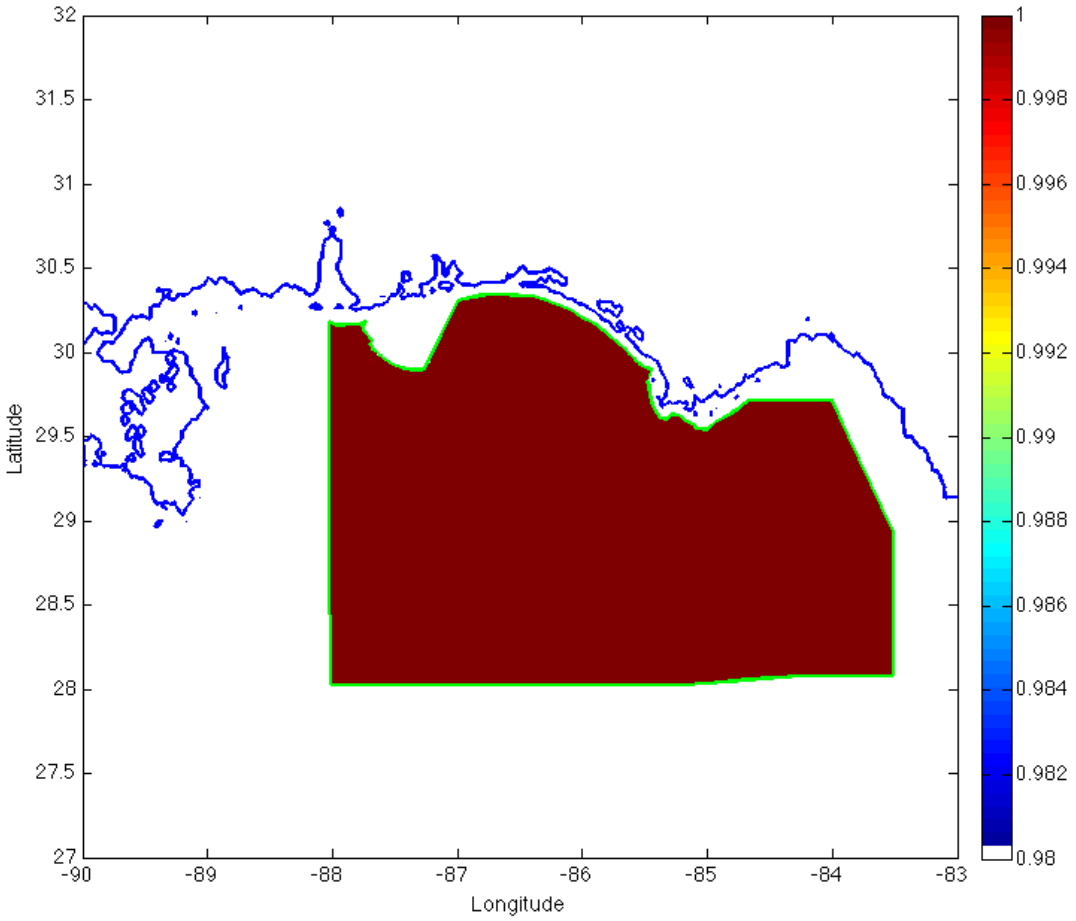


Figure M-20. Land Shadow Factor for the NSWC PCD Study Area.

To the naked eye, there is no portion of the NSWC PCD Study Area that has less than negligible effect. The following plot zooms in on part of the area to make visible a sliver of area that has a small reduction due to land shadow (Figure M-21).

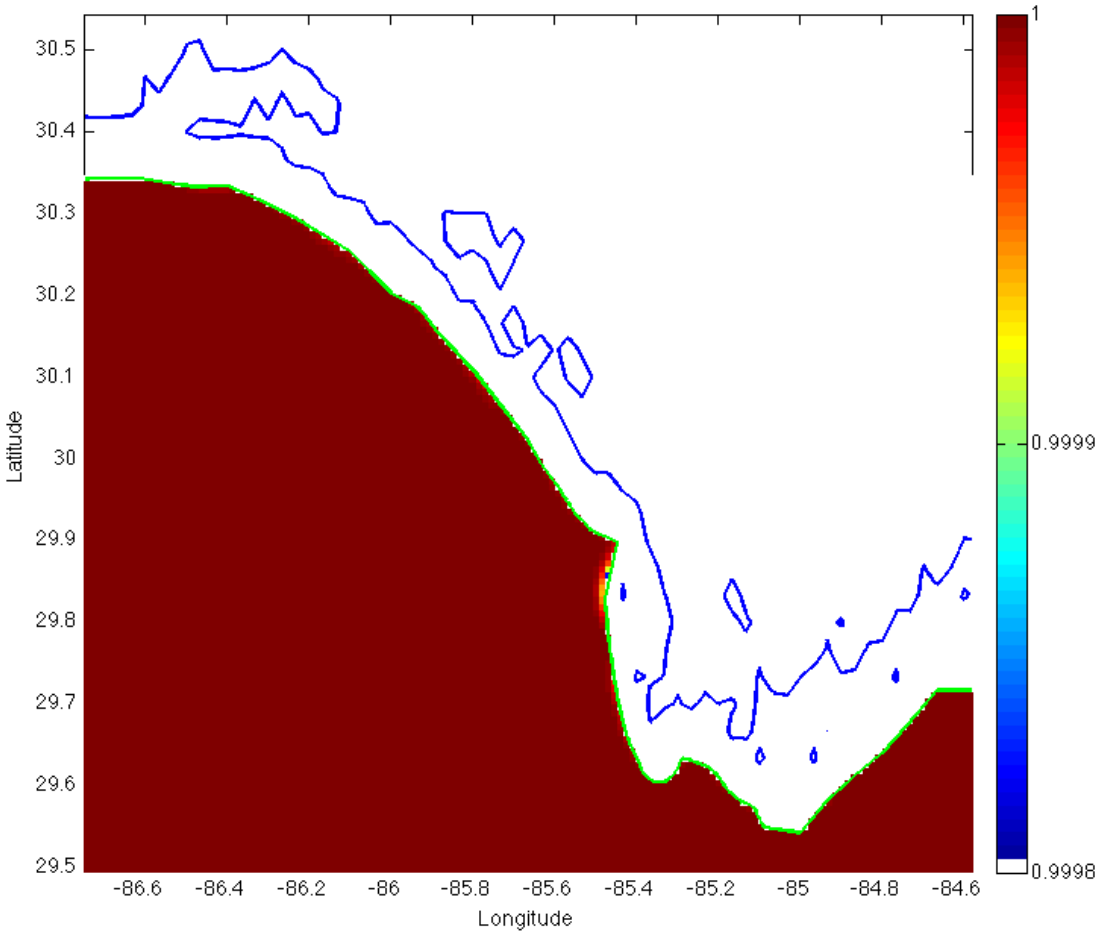


Figure M-21. Zoom in on the NSWC PCD Study Area.

Note the scaling on Figure M-22: even for this sliver, the reduction due to land shadow is less than 0.01 percent. On average, across the NSWC PCD Study Area, the reduction in effect due to land shadow is zero.

M.5 HARASSMENTS

This section defines the animal densities and their depth distributions for the NSWC PCD Study Area. A short discussion is presented on how harassments are calculated from the ensonification volumes, two dimensional animal densities, and animal depth distributions.

M.5.1 Marine Mammal Density and Depth Distribution for NSWC PCD Study Area, Eastern Gulf of Mexico

Marine mammal species occurring regularly in the eastern Gulf of Mexico (GOM) include baleen whales (mysticetes) and toothed whales (odontocetes); sirenians (manatees) are rarely seen. This section first addresses the densities used from the Navy Operating Area Density Estimates (NODE) reports and then details the depth distribution data incorporated to provide the three dimensional aspect to the modeling of exposure estimates. All density information is taken directly from the GOMEX NODE report (DON, 2007).

M.5.1.1 Densities

MYSTICETES

Blue whale, *Balaenoptera musculus* – Extralimital

There is no abundance or density estimate.

Fin whale, *Balaenoptera physalus* – Extralimital

There is no abundance or density estimate.

Sei whale, *Balaenoptera borealis* – Extralimital

There is no abundance or density estimate.

Bryde's whale, *Balaenoptera edeni*

Distribution and habitat preferences:

- In the GOMEX, all Bryde's whale sightings have been predominantly near the shelf break in and near DeSoto Canyon and off western Florida.
- The Bryde's whale may occur throughout the year in the GOMEX.

Density and abundance estimates

- The "best" estimate of abundance for this species came from the SAR (Warring et al., 2007) based on analyses by Mullin and Fulling (2003). For the purpose of this document, this estimate was applied to the entire NSWC PCD Study Area and across all seasons.

Minke whale, *Balaenoptera acutorostrata* - Extralimital

There is no abundance or density estimate.

Humpback whale, *Megaptera novaeangliae* - Extralimital

There is no abundance or density estimate.

North Atlantic right whale, *Eubalaena glacialis* - Extralimital

There is no abundance or density estimate.

ODONTOCETES

Sperm whale, *Physeter catodon*

Distribution and habitat preferences:

- Sperm whales occur year-round in the GOMEX, aggregating along the continental slope and in canyon regions. GulfCet surveys found that most sperm whales were concentrated around the 1,000 m (3,280 ft) isobath, south of the Mississippi River Delta. This area has been recognized for high densities of sperm whales and represents a habitat where they can be predictably found.
- Tagging data demonstrated that some individuals spend several months at a time in the Mississippi River Delta and the Mississippi Canyon for several months, while other individuals move to other locations the rest of the year. Segregation between the sexes was noted during one year of survey by Jochens et al. (2006). Females and immatures showed high site fidelity to the region south of the Mississippi River Delta and Mississippi Canyon on the upper continental slope and in the western GOMEX. Males were found on the upper continental slope, but also move more often into the central GOMEX and into areas of the lower continental slope and abyssal (depths greater than 3,000 m [9,843 ft]) region. Males were mainly found in the DeSoto Canyon and along the Florida slope.
- In the GOMEX, higher numbers of sperm whales are found in areas of cyclonic circulation and cyclone-anticylone confluence. Data suggest that sperm whales appear to adjust their movements to stay in or near cold-core rings. This trend would demonstrate that sperm whales shift their movements in relation to prey concentrations.

***Kogia* sp, including pygmy (*Kogia breviceps*) and dwarf (*Kogia sima*) sperm whales**

Two species make up this category: the pygmy sperm whale (*Kogia breviceps*) and the dwarf sperm whale (*Kogia sima*).

Distribution and habitat preferences:

- Globally, both species of *Kogia* generally occur in waters along the continental shelf break and over the continental slope.
- In the GOMEX, *Kogia* spp. are distributed mostly over the upper continental slope.
- Fulling and Fertl (2003) reported that 67 percent of *Kogia* spp. sightings in the GOMEX were between the shelf break and the 2,000 m (6,562 ft) isobath; 46 percent of these were on the upper continental slope between the 500 and 1,000 m (1,640 and 3,280 ft) isobaths. Although there has been little survey effort seaward of the 3,000 m (9,843 ft) isobath, there were some sightings of individuals in those very deep waters.
- There is no evidence that Kogia regularly occur in continental shelf waters of the GOMEX, however, there were some sighting records in waters over the continental shelf.
- Fulling and Fertl (2003) remarked on the noticeable concentration of sightings in continental slope waters near the MS River Delta.

Beaked Whales (Family Ziphiidae)

Three species of beaked whales may occur in the GOMEX, including the Cuvier's, Gervais', and Blainville's beaked whales. Only one stranding record exists for the Sowerby's beaked whale (*Mesoplodon bidens*); this species is considered to be more northerly distributed and, therefore, extralimital to the GOMEX.

Distribution and habitat preferences:

- The Cuvier's beaked whale is the most widely distributed beaked whale species. It is probably the most common beaked whale species occurring in the GOMEX. The Blainville's beaked whale is the most widely distributed of the Mesoplodon spp.; it is considered to inhabit all tropical, sub-tropical and warm-temperate waters, with occasional occurrences in cold-temperate areas. The Gervais' beaked whale is endemic to the warm-temperate to tropical Atlantic.
- World-wide, beaked whales normally inhabit continental slope and deep oceanic waters (>200 m [656 ft]). Areas of steep bathymetry, such as submarine canyons have also been described as important habitat. Beaked whales in the eastern tropical Pacific are found in waters over the continental slope to the abyssal plain, ranging from well-mixed to highly stratified.
- Beaked whales are expected to occur year-round throughout the GOMEX in waters off the continental shelf break. The northern GOMEX continental shelf margins recently were identified as known key areas for beaked whales. Habitat characterization modeling for the GOMEX predicted areas greater than 1,000 m (3,280 ft) in bottom depth as potential beaked whale habitat. The probability of beaked whale presence reaches a maximum along the slope, decreasing towards the continental shelf and deep abyssal region.
- World-wide, beaked whales only rarely stray over the continental shelf. In the GOMEX, a few beaked whale sightings on the continental shelf are reported.

Killer whale, *Orcinus orca*

Distribution and habitat preferences:

- Globally, killer whales are found in the open sea, as well as in coastal areas.
- Killer whales are sighted year-round in the northern GOMEX. Sightings are generally clumped in a broad region south of the MS River Delta, in waters ranging in bottom depth from 42 to 2,571 m (138 to 8,435 ft). Mullin and Fulling (2004) reported that killer whales were sighted primarily west of Mobile Bay.
- Sightings also have been made in waters over the continental shelf (including close to shore).

Density and abundance estimates:

- The "best" estimate of abundance for this species came from the SAR (Waring et al. 2007) based on analyses by Mullin and Fulling (2003). For the purpose of this document, this estimate was applied to the entire NSWC PCD Study Area and across all seasons.

False killer whale, *Pseudorca crassidens*

Distribution and habitat preferences:

- This species is found primarily in oceanic and offshore areas world-wide.
- Most sightings of false killer whales in the GOMEX are on the upper continental slope.
- False killer whales sometimes make their way into shallower waters. There have been sightings from over the continental shelf. Many sightings were reported by sport fishermen in the mid-1960s of "blackfish" (most likely false killer whales based on the descriptions) in waters offshore of Pensacola and Panama City, Florida.
- Most false killer whale sightings in the GOMEX are east of Mobile Bay.

Pygmy killer whale, *Feresa attenuata*

Distribution and habitat preferences:

- This species does not appear to be common in the GOMEX.
- In the northern GOMEX, this species is found primarily in deeper waters off the continental shelf and over the abyssal region. Sightings are typically over the upper continental slope.

Density and abundance estimates:

- The "best" estimate of abundance for this species came from the SAR (Waring et al. 2007) based on analyses by Mullin and Fulling (2003). For the purpose of this document, this estimate was applied to the entire NSWC PCD Study Area and across all seasons.

Short-finned pilot whale, *Globicephala macrorhynchus*

Based on known distribution and habitat preferences of pilot whales, it is assumed that all of the pilot whale records in the northern GOMEX are of the short-finned pilot whale.

Distribution and habitat preferences:

- Pilot whales are typically found over the continental shelf break, in slope waters, and in areas with steep bottom topography. A number of studies have suggested that the distribution and movements of Globicephala spp. coincide closely with the abundance of squid.
- Sightings in the GOMEX are primarily on the upper continental slope.
- While pilot whales are typically distributed along the continental shelf break, movements over the continental shelf are commonly observed in the northeastern U.S. In the GOMEX, pilot whales are sometimes seen in waters over the continental shelf.
- Mullin and Fulling (2004) reported that short-finned pilot whales were sighted primarily west of Mobile Bay.
- There is a preponderance of pilot whales in the historical records for the northern GOMEX. Pilot whales, however, are less often reported during recent surveys, such as GulfCet. The reason for this apparent decline is not known, but Jefferson and

Schiro (1997) suggested that abundance or distribution patterns might have changed over the past few decades, perhaps due to changes in available prey species.

Density and abundance estimates:

- The "best" estimate of abundance for this species came from the SAR (Waring et al. 2007) based on analyses by Mullin and Fulling (2003). For the purpose of this document, this estimate was applied to the entire NSWC PCD Study Area and across all seasons.

Melon-headed whale, *Peponocephala electra*

Distribution and habitat preferences:

- Little information is available on the general habitat preferences of this species. Most melonheaded whale sightings in the GOMEX are in deep waters, well beyond the continental shelf break and out over the abyssal region.
- Mullin and Fulling (2004) reported that melon-headed whales were sighted primarily west of Mobile Bay.

Density and abundance estimates:

- The "best" estimate of abundance for this species came from the SAR (Waring et al. 2007) based on analyses by Mullin and Fulling (2003). For the purpose of this document, this estimate was applied to the entire NSWC PCD Study Area and across all seasons.

Risso's dolphin, *Grampus griseus*

Distribution and habitat preferences:

- A number of studies world-wide have noted that Risso's dolphins are found along the continental slope.
- There is a strong correlation between Risso's dolphin distribution and the steeper portions (200 to 1,000 m [656 to 3,280 ft]) of the upper continental slope in the GOMEX. This correlation is most likely the result of cephalopod distribution in the same area.

Rough-toothed dolphin, *Steno bredanensis*

Distribution and habitat preferences:

- In the GOMEX, the rough-toothed dolphin occurs primarily over the deeper waters (bottom depths of 950 to 1,100 m [3,117 to 3,609 ft]) off the continental shelf.
- Occurrences over the continental shelf, off the Florida Panhandle and central Texas in northeastern GOMEX, are known from tagging and survey data. Two separate mass strandings of rough-toothed dolphins occurred in the Florida Panhandle during December 1997 and 1998. Four stranded rough-toothed dolphins (three with satellite-linked transmitters) were rehabilitated and released in 1998 off the Gulf Coast of Florida. Water depth at tracking locations of these individuals averaged 195 m (640 ft) off the Florida Panhandle.
- During May 2005, seven more rough-toothed dolphins (stranded in the Florida Keys in March 2005 and rehabilitated) were tagged (two with satellite, the others with very high

frequency [VHF]) and released by the Marine Mammal Conservancy in the Florida Keys. During an initial period of apparent disorientation in the shallow waters west of Andros Island, they continued to the east, then moved north through Crooked Island Passage, and paralleled the West Indies. The last signal placed them northeast (NE) of the Lesser Antilles. During September 2005, two more individuals (stranded with the previous group in the Florida Keys in March 2005 and rehabilitated) were satellite-tagged and released east of the Florida Keys by the Marine Mammal Conservancy. The tagging data demonstrated that these individuals proceeded south to a deep trench close to the north coast of Cuba.

Bottlenose dolphin, *Tursiops truncates*

The category for bottlenose dolphins includes both the coastal (nearshore) and the offshore forms. As noted by Mullin and Fulling (2004), if genetic structure for this species in the GOMEX is similar to that for the species in the western North Atlantic (offshore from ≥34 km [18 NM] from shore and bottom depth greater than 34 m [112 ft]), then all bottlenose dolphins in oceanic waters are the offshore ecotype.

Distribution and habitat preferences:

- The bottlenose dolphin is regularly found in shallow waters of the continental shelf. The bottlenose dolphin is the most widespread and most common cetacean in coastal waters of the GOMEX.
- Mullin et al. (2004) reported sighting bottlenose dolphins in waters with bottom depths averaging less than 300 m (984 ft). Bottlenose dolphins appear to have an almost bimodal distribution in the GOMEX: the shallow continental shelf (0 to 150 m [0 to 492 ft]) and just seaward of the shelf break (200 to 750 m [656 to 2,461 ft]). These regions may represent the individual depth preferences for the nearshore and offshore forms. Baumgartner et al. (2001) hypothesized a potential association of bottlenose dolphins with oceanographic fronts at the shelf break.
- Mullin and Fulling (2004) reported encountering bottlenose dolphins primarily in upper continental slope waters less than 1,000 m (3,280 ft) in bottom depth, with highest densities in the northeastern GOMEX.
- Mullin and Fulling (2004) reported that groups of bottlenose dolphins were generally confined to the shelf break except in the northeastern GOMEX, where their distribution extended well seaward of the shelf break.

Atlantic spotted dolphin, *Stenella frontalis*

Distribution and habitat preferences:

- This species primarily occurs on the continental shelf in the GOMEX.
- Griffin and Griffin (2003) specifically noted a mid-shelf (20 to 180 m [66 to 591 ft]) habitat preference in the eastern GOMEX.
- In their less common habitat of oceanic waters of the GOMEX, Atlantic spotted dolphins usually occur near the shelf break in waters less than 500 m (1,640 ft) in bottom depth.

Pantropical spotted dolphin, *Stenella attenuata*

Distribution and habitat preferences:

- Most sightings of this species in the GOMEX extend from the upper continental slope out over the abyssal region. Mullin et al. (2004) reported that sightings for this species were made in waters with a mean bottom depth of greater than 1,000 m (3,280 ft).
- The pantropical spotted dolphin is rarely found on the continental shelf in the GOMEX.
- Baumgartner et al. (2001) reported that pantropical spotted dolphins in the GOMEX do not appear to have a preference for any one habitat (within the Loop Current, inside a cold-core eddy, or along the continental slope), while Davis et al. (2000; 2002) reported finding oceanic stenellids more often over the lower continental slope and abyssal regions in areas of cyclonic or confluence circulation. Baumgartner et al. (2001) noted that while no such relationship was detected in their study, other factors including temporal variability in habitat associations could easily account for this difference in the study results.

Striped dolphin, *Stenella coeruleoalba*

Distribution and habitat preferences:

- Striped dolphins are usually found outside the continental shelf, typically over the continental slope out to oceanic waters, often associated with convergence zones and waters influenced by upwelling.
- Davis et al. (2000; 2002) reported finding oceanic stenellids more often over the lower continental slope and abyssal regions in areas of cyclonic or confluence circulation.

Spinner dolphin, *Stenella longirostris*

Distribution and habitat preferences:

- Most of the spinner dolphin sightings in the GOMEX are east of the MS River.
- Distribution in the GOMEX is primarily in deeper waters (bottom depth greater than 2,000 m [6,562 ft]).
- Davis et al. (2000; 2002) reported finding oceanic stenellids more often over the lower continental slope and abyssal regions in areas of cyclonic or confluence circulation.

Clymene dolphin, *Stenella clymene*

Distribution and habitat preferences:

- There are more Clymene dolphin records from the GOMEX than from the rest of this species'range combined.
- Clymene dolphins are typically sighted in offshore waters offshore of the shelf break; Fertl et al. (2003) reported that Clymene dolphins were sighted in waters with a mean bottom depth of 1,870 m (6,135 ft), throughout their range. There has not been much survey effort in waters with a bottom depth greater than 3,000 m (9,843 ft) in the GOMEX, yet there are documented sightings.
- In a study of habitat preferences in the GOMEX, oceanic stenellids were found more often on the lower continental slope and in deepwater areas in regions of cyclonic or confluence circulation.

- Mullin and Fulling (2004) noted that Clymene dolphins were sighted primarily west of Mobile Bay.

Density and abundance estimates

- The "best" estimate of abundance for this species came from the SAR (Waring et al. 2007) based on analyses by Mullin and Fulling (2003). For the purpose of this document, this estimate was applied to the entire NSWC PCD Study Area and across all seasons.

Fraser's dolphin, *Lagenodelphis hosei*

Distribution and habitat preferences:

- Fraser's dolphins are not sighted regularly in the GOMEX.
- This species generally prefers oceanic waters. Sightings in the GOMEX have been seaward of the continental shelf break.

Density and abundance estimates

- The "best" estimate of abundance for this species came from the SAR (Waring et al. 2007) based on analyses by Mullin and Fulling (2003). For the purpose of this document, this estimate was applied to the entire NSWC PCD Study Area and across all seasons.

SIRENIANS

West Indian manatee, *Trichechus manatus* – Extralimital

There is no abundance or density estimate.

M.5.1.2 Depth Distribution

Baleen and toothed whales, collectively known as cetaceans, spend their entire lives in the water and spend most of the time (>90 percent for most species) entirely submerged below the surface. When at the surface, cetacean bodies are almost entirely below the water's surface, with only the blowhole exposed to allow breathing. This makes cetaceans difficult to locate visually and also exposes them to underwater noise, both natural and anthropogenic, essentially 100 percent of the time because their ears are nearly always below the water's surface. Manatees also spend their entire lives in the water, and usually raise only the nostrils above the water's surface to breathe. All marine mammals in the eastern Gulf of Mexico would be exposed to effects from explosions 100 percent of the time.

For the purposes of this analysis, the Department of the Navy (DON) has adopted a conservative approach to underwater noise and marine mammals:

- Cetaceans – assume 100 percent of time is spent underwater and therefore exposed to noise.
- Sirenians – assume 100 percent of time is spent underwater and therefore exposed to noise.

There are limited depth distribution data for most marine mammals. This is especially true for cetaceans, as they must be tagged at-sea and by using a tag that either must be implanted in the skin/blubber in some manner or adhere to the skin. There is slightly more data for some pinnipeds, as they can be tagged while on shore during breeding or molting seasons and the tags can be glued to the pelage rather than implanted. There are a few different methodologies/techniques that can be used to determine depth distribution percentages, but by far the most widely used technique currently is the time-depth recorder. These instruments are attached to the animal for a fairly short period of time (several hours to a few days) via a suction cup or glue, and then retrieved immediately after detachment or (for pinnipeds) when the animal returns to the beach. Depth information is also collected via satellite tags, sonic tags, digital tags, and, for sperm and beaked whales, via acoustic tracking of sounds produced by the animal itself.

There are somewhat suitable depth distribution data for some marine mammal species. Sample sizes are usually extremely small, nearly always fewer than ten animals total and often only one or two animals. Depth distribution information can also be interpreted from other dive and/or preferred prey characteristics, and from methods including behavioral observations, stomach content analysis and habitat preference analysis. Depth distributions for species for which no data are available are extrapolated from similar species.

Table M-11 provides depth information for each of the species in the NSWC PCD Study Area. Detailed depth information for marine mammal species in the NSWC PCD Study Area is given below. This document is organized into taxonomic categories: Mysticetes and Odontocetes. Nomenclature was adopted from the Integrated Taxonomic Information System (ITIS, 2008).

MYSTICETES

Bryde's whale, *Balaenoptera edeni*

Bryde's whales feed on pelagic schooling fish, small crustaceans including euphausiids and copepods, and cephalopods (Kato, 2002). Feeding appears to be regionally different. Off South Africa, the inshore form feeds on epipelagic fish while the offshore form feeds on mesopelagic fish and euphausiids (Best, 1977; Bannister, 2002). Stomach content analysis from whales in the southern Pacific and Indian Oceans indicated that most feeding apparently occurred at dawn and dusk, and primarily consisted of euphausiids (Kawamura, 1980). There have been no depth distribution data collected on Bryde's whales. In lieu of depth data, minke whale depth distribution percentages will be extrapolated to Bryde's whales. Minke whales feed on small schooling fish and krill. The only depth distribution data for this species are reported from a study on daily energy expenditure conducted off northern Norway and Svalbard (Blix and Folkow, 1995). The limited depth information available (from Figure 2 in Blix and Folkow, 1995) is representative of a 75-min diving sequence where the whale was apparently searching for capelin, then foraging, then searching for another school of capelin. Search dives were mostly to about 20 m (66 ft), while foraging dives were to 65 m (213 ft). Based on this very limited depth information, rough estimates for percentage of time at depth are as follows: 53 percent at <20 m (66 ft) and 47 percent at 20-65 m (66 – 213 ft).

ODONTOCETES

Sperm whale, *Physeter catodon*

Unlike other cetaceans, there is a preponderance of dive information for this species, most likely because it is the deepest diver of all cetacean species, which generates a lot of interest. Sperm whales feed on large and medium-sized squid, octopus, rays and sharks, on or near the ocean floor. Some evidence suggests that they do not always dive to the bottom of the sea floor (likely if food is elsewhere in the water column), but that they do generally feed at the bottom of the dive. Davis et al. (2007) report that dive-depths (100 – 500 m [328 – 1,640 ft]) of sperm whales in the Gulf of California overlapped with depth distributions (200 – 400 m [656 – 1,312 ft]) of jumbo squid, based on data from satellite-linked dive recorders placed on both species, particularly during daytime hours. Their research also showed that sperm whales foraged throughout a 24-hour period, and that they rarely dove to the sea floor bottom (>1,000 m [3,280 ft]). The most consistent sperm whale dive type is U-shaped, whereby the whale makes a rapid descent to the bottom of the dive, forages at various velocities while at depth (likely while chasing prey) and then ascends rapidly to the surface. Amano and Yoshioka (2003) attached a tag to a female sperm whale near Japan in an area where water depth was 1,000 – 1,500 m (3,280 – 4,921 ft). Based on values derived by Amano and Yoskioka (2003 [Table 1]) for dives with active bottom periods, the total mean dive sequence was 45.9 min (mean surface time plus dive duration). Mean post dive surface time divided by total time (8.5 min/45.9 min), plus time at surface between deep dive sequences yields a percentage of time at the surface (<10 m [33 ft]) of 31 percent. Mean bottom time divided by total time (17.5 min/45.9 min) and adjusted to include the percentage of time at the surface between dives, yields a percentage of time at the bottom of the dive (in this case >800 m [2,625 ft] as the mean maximum depth was 840 m [2,756 ft]) of 34 percent. Total time in the water column descending or ascending equals duration of dive minus bottom time (37.4 min-17.5 min) or about 20 min. Assuming a fairly equal descent and ascent rate (as shown in the table) and a fairly consistent descent/ascent rate over depth, the DON assumes 10 min each for descent and ascent and equal amounts of time in each depth gradient in either direction. Therefore, 0 – 200 m (0 – 656 ft) = 2.5 min one direction (which correlates well with the descent/ascent rates provided) and, therefore, 5 min for both directions. This derivation is the same for 201 – 400 m (659 – 1,312 ft), 401 – 600 m (1,316 – 1,969 ft) and 601 – 800 m (1,972 – 2,625 ft). Therefore, the depth distribution for sperm whales based on information in the Amano paper is: 31 percent in <10 m (33 ft), eight percent in 10 – 200 m (33 – 656 ft), nine percent in 201 – 400 m (659 – 1,312 ft), nine percent in 401 – 600 m (1,316 – 1,969 ft), nine percent in 601 – 800 m (1,972 – 2,625 ft) and 34 percent in >800 m (2,625 ft). The percentages derived above from data in Amano and Yoshioka (2003) are fairly close in agreement with those derived from Table 1 in Watwood et al. (2006) for sperm whales in the Ligurian Sea, Atlantic Ocean and Gulf of Mexico.

Kogia sp, including pygmy (*Kogia breviceps*) and dwarf (*Kogia sima*) sperm whales

There are no depth distribution data for this species. An attempt to record dive information on a rehabilitated pygmy sperm whale failed when the time-depth-recorder (TDR) package was never recovered (Scott et al., 2001). Prey preference, based on stomach content analysis from Atlantic Canada (McAlpine et al., 1997) and New Zealand (Beatson, 2007), appears to be mid and deep water cephalopods, crustaceans and fish. There is some evidence that *Kogia* may use suction

feeding and feed at or near the bottom. They may also take advantage of prey undergoing vertical migrations to shallower waters at night (Beatson, 2007). In lieu of any other information, Blainville's beaked whale depth distribution data will be extrapolated to pygmy sperm whales as the two species appear to have similar prey preferences and are closer in size than either is to sperm or Cuvier's beaked whales. Blainville's undertake shallower non-foraging dives in-between deep foraging dives. Blainville's beaked whale depth distribution data, taken from Tyack et al. (2006) and summarized in greater depth later in this document is: 26 percent at <2 m (7 ft), 41 percent at 2 – 71 m (7 – 233 ft), two percent at 72 – 200 m (236 – 656 ft), four percent at 201 – 400 m (659 – 1,312 ft), four percent at 401 – 600 m (1,316 – 1,969 ft), four percent at 601 – 835 m (1,972 – 2,740 ft) and 19 percent at >835 m (2,740 ft).

Unidentified beaked whales, Family *Ziphiidae*

Ziphiids feed primarily on mesopelagic squid and some fish, with most prey likely caught at >200 m (656 ft) (Pitman, 2002b). Most are believed to be suction feeders. There are no depth distribution data for the entire family, however good dive information has been collected for a few species, e.g., Cuvier's beaked whales (*Ziphius cavirostris*). Cuvier's beaked whales feed on meso-pelagic or deep water benthic organisms, particularly squid (Heyning, 2002). Stomach content analysis indicates that they take advantage of a larger range of prey species than other deep divers do (e.g., Santos et al., 2001; Blanco and Raga, 2000). Cuvier's, like other beaked whales, are likely suction feeders based on the relative lack of teeth and enlarged hyoid bone and tongue muscles. Foraging dive patterns appear to be U-shaped, although inter-ventilation dives are shallower and have a parabolic shape (Baird et al., 2006a). Depth distribution studies in Hawaii (Baird et al., 2005a; Baird et al., 2006a) found that Cuvier's beaked whales undertook three or four different types of dives, including intermediate (to depths of 292 – 568 m [958 – 1,864 ft]), deep (>1,000 m [3,280 ft]) and short-inter-ventilation (within 2 – 3 m [7 – 10 ft] of surface); this study was of a single animal. Studies in the Ligurian Sea indicated that Cuvier's beaked whales dived to >1,000 m (3,280 ft) and usually started "clicking" (actively searching for prey) around 475 m (1,558 ft) (Johnson et al., 2004; Soto et al., 2006). Clicking continued at depths and ceased once ascent to the surface began, indicating active foraging at depth. In both locations, Cuvier's spent more time in deeper water than did Blainville's beaked whale, although maximum dive depths were similar. There was no significant difference between day and night diving indicating that preferred prey likely does not undergo vertical migrations.

Dive information for Cuvier's beaked whales was collected in the Ligurian Sea (Mediterranean) via DTAGs on a total of seven animals (Tyack et al., 2006). Despite the geographic difference and the author's cautions about the limits of the data set, the Ligurian Sea dataset represents a more complete snapshot than that from Hawaii (Baird et al., 2006a). Cuvier's conducted two types of dives – U-shaped deep foraging dives (DFD) and shallow duration dives. Dive cycle commenced at the start of a DFD and ended at the start of the next DFD, and included shallow duration dives made in between DFD.

Mean length of dive cycle = 121.4 min (mean DFD plus mean Inter-deep dive interval)
Number of DFD recorded = 28
Mean DFD depth = 1,070 m (3,510 ft) (range 689 – 1,888 m [2,260 – 6,194 ft])
Mean length DFD = 58.0 min
Mean Vocal phase duration = 32.8 min
Mean inter-deep dive interval = 63.4 min
Mean shallow duration dive = 221 m (725 ft) (range 22 – 425 m [72 – 1,394 ft])
Mean # shallow duration dives per cycle = 2 (range 0-7)
Mean length of shallow duration dives = 15.2 min

Total time at surface (0 – 2 m [0 – 7 ft]) was calculated by subtracting the mean length of DFD and two shallow duration dives from the total dive cycle (121.4 - 58.0 – 30.4 = 33 min). Total time at deepest depth was taken from the vocal phase duration time, as echolocation clicks generally commenced when animals were deepest, and was 32.8 min. The amount of time spent descending and ascending on DFDs was calculated by subtracting the mean vocal phase duration time from the mean total DFD (58.0 - 32.8 = 25.2 min) and then dividing by five (# of 200 m [656 ft] depth categories between surface and 1,070 m [3,510 ft]) which equals about five min per 200 m (656 ft). The five-minute value was applied to each 200 m (656 ft) depth category from 400 – 1,070 m (1,312 – 3,510 ft); for the 2 – 220 m (7 – 722 ft) category, the mean length of shallow duration dives was added to the time for descent/ascent (30.4 + 5 = 35.4 min). Therefore, the depth distribution for Cuvier's beaked whales based on best available information from Tyack et al. (2006) is: 27 percent at <2 m (7 ft), 29 percent at 2 – 220 m (7 – 722 ft), four percent at 221 – 400 m (725 – 1,312 ft), four percent at 401 – 600 m (1,316 – 1,969 ft), four percent at 601 – 800 m (1,972 – 2,625 ft), five percent at 801 – 1,070 m (2,628 – 3,510 ft) and 27 percent in >1,070 m (3,510 ft).

Killer whale, *Orcinus orca*

Killer whales feed on a variety of prey, including salmon, herring, cod, tuna and cephalopods (Ford, 2002). "Transient" stocks of killer whales feed on other marine mammals, including other whales, pinnipeds (e.g., London, 2006) and sea otters (e.g., Estes et al., 1998). Diving studies on killer whales have been undertaken mainly on "resident" (fish-eating) killer whales in Puget Sound and may not be applicable across all populations of killer whales. Diving is usually related to foraging, and mammal-eating killer whales may display different dive patterns. Killer whales in one study (Baird et al., 2005b) dove as deep as 264 m (866 ft), and males dove more frequently and more often to depths >100 m (328 ft) than females, with fewer deep dives at night. Dives to deeper depths were often characterized by velocity bursts which may be associated with foraging or social activities. Using best available data from Baird et al. (2003a), it would appear that killer whales spend about four percent of time at depths >30 m (98 ft) and 96 percent of time at depths 0 – 30 m (0 – 98 ft).

False killer whale, *Pseudorca crassidens*

False killer whales feed on oceanic fish and squid, and have been known to prey on smaller marine mammals (Baird, 2002a; Koen Alonso et al., 1999; Santos and Haimovici, 2001). The only study conducted on diving of false killer whales in Hawaii has not been published in any detail (Ligon and Baird, 2001), but an abstract provide limited information. False killer whales

did not dive deep and instead recorded maximum dives of 22, 52 and 53 m (72, 171, and 174 ft) in near-shore Hawaiian waters. In lieu of other information, the depth distribution for killer whales will be extrapolated to this species: four percent of time at depths >30 m (98 ft) and 96 percent of time at depths 0 – 30 m (0 – 98 ft).

Pygmy killer whale, *Feresa attenuata*

Pygmy killer whales feed on cephalopods, small fish and small delphinids (Donohue and Perryman, 2002; Santos and Haimovici, 2001). There have not been any studies of diving patterns specific to this species. In lieu of other information, the depth distribution for killer whales will be extrapolated to this species: four percent of time at depths >30 m (98 ft) and 96 percent of time at depths 0 – 30 m (0 – 98 ft).

Pilot whales including short-finned pilot whale, *Globicephala macrorhynchus*

Short-finned pilot whales feed on squid and fish. Stomach content analysis of pilot whales in the southern California Bight consisted entirely of cephalopod remains (Sinclair, 1992). The most common prey item identified by Sinclair (1992) was Loligo opalescens, which has been documented in spawning concentrations at depths of 20 – 55 m (66 – 180 ft). Stomach content analysis from the closely related long-finned pilot whale (Globicephala melas) from the U.S mid-Atlantic coast demonstrated preference for cephalopods as well as a relatively high diversity of prey species taken (Gannon et al., 1997). Stomach content analysis from G. melas off New Zealand did not show the same diversity of prey (Beatson et al., 2007) which indicates that pilot whales may differ significantly in prey selection based on geographic location. The only study conducted on short-finned pilot whales in Hawaii has not been published in any detail (Baird et al., 2003b), but an abstract indicated that there were significant differences between day and night diving; dives of >100m (328 ft) were far more frequent at night, likely to take advantage of vertically-migrating prey; night dives regularly went to 300 – 500 m (984 – 1,640 ft). Deepest dives were during the day, however, perhaps because prey was deeper. A diving study on G. melas also showed marked differences in daytime and nighttime diving in studies in the Ligurian Sea (Baird et al., 2002b), but there was no information on percentage of time at various depth categories. A study following two rehabilitated and released long-finned pilot whales provides a breakdown of percentage of time at depth distribution for two whales (Nawojchik et al., 2003), although this data may be skewed due to the unique situation. Heide-Jorgensen et al. (2002) studied diving behavior of long-finned pilot whales near the Faroe Islands in the north Atlantic. Most diving activity occurred at depth of less than 36 m (118 ft) and >90 percent of dives were within 12 – 17 m (39 – 56 ft). Based on this information, the following are estimates of time at depth for both species of pilot whale: 60 percent at <7 m (23 ft), 36 percent at 7 – 17 m (23 – 56 ft) and four percent at 18 – 828 m (59 – 2,717 ft).

Melon-headed whale, *Peponocephala electra*

Melon-headed whales feed on squid, fish and occasionally crustaceans in the water column (Perrin, 2002c). Their prey is known to occur at depths to 1,500 m (4,921 ft), although there is no direct evidence that the whales feed to that depth. Stomach content analysis suggests that they feed on prey similar to Fraser's dolphins (Jefferson and Barros, 1997). Diet composition analyzed by Pauly et al. (1998) indicated that most of diet (70 percent) was small and large squids with the remaining composition including small pelagics, mesopelagics and

miscellaneous fishes. There are no depth distribution data for this species; the depth distribution for Fraser's dolphins will be extrapolated to melon-headed whales: Daytime, 100 percent at 0 – 50 m (0 – 164 ft); Nighttime, 100 percent at 0 – 700 m (0 – 2,297 ft).

Risso's dolphin, *Grampus griseus*

There are no depth distribution data for this species. They are primarily squid eaters and feeding is presumed to take place at night. A study undertaken in the Gulf of Mexico demonstrated that Risso's are distributed non-uniformly with respect to depth and depth gradient (Baumgartner, 1997), utilizing mainly the steep sections of upper continental slope bounded by the 350 m (1,148 ft) and 975 m (3,199 ft) isobaths. Those data agree closely with Blanco et al. (2006), who collected stomach samples from stranded Risso's dolphins in the western Mediterranean. Their results indicated that, based on prey items, Risso's fed on the middle slope at depths ranging from 600 – 800 m (1,969 – 2.625 ft). Stomach content analysis from three animals elsewhere in the Mediterranean indicated that Risso's fed on species that showed greater vertical migrations than those ingested by striped dolphins (Ozturk et al., 2007). In lieu of depth distribution information or information on shape of dives, the following are rough estimates of time at depth based on habitat and prey distribution: 50 percent at <50 m (164 ft), 15 percent at 51 – 200 m (167 – 656 ft), 15 percent at 201 – 400 m (659 – 1,312 ft), ten percent at 401 – 600 m (1,317 – 1,969 ft) and ten percent at >600 m (1,969 ft).

Rough-toothed dolphin, *Steno bredanensis*

Rough-toothed dolphins feed on fish and cephalopods, both oceanic and coastal species (Jefferson, 2002b). Based on anatomy, they appear to be adapted to deep diving (Miyazaki and Perrin, 1994), although the maximum record dive is to only 70 m (230 ft) (Jefferson, 2002b). There have been no depth distribution studies done on this species. In lieu of other information, the following is a rough estimation of time at depth: 100 percent at 0 – 70 m (0 – 230 ft).

Bottlenose dolphin, *Tursiops truncatus*

Bottlenose dolphins feed on a large variety of fish and squid (Wells and Scott, 2002). Several studies on bottlenose dolphin feeding preferences illustrate variation at different geographic locations. Rossbach and Herzing (1997) observed bottlenose dolphins in the Bahamas feeding on the bottom (7 – 13 m [23 – 43 ft]) by orienting their heads down and moving from side to side, and several species regularly fed on prey along the sea floor (Wells and Scott, 2002). Corkeron and Martin (2004) reported on two dolphins that spent 66 percent of time in top 5 m (16 ft) of water surface; maximum dive depth was greater than 150 m (492 ft) and there was no apparent diurnal pattern. Stomach content analysis from Brazil indicated that small and medium-sized cephalopods were primary prey of animals found in shelf regions (Santos and Haimovici, 2001), while off Tasmania, bottlenose dolphin prey consisted of oceanic species that were known to commonly occur on the shelf as well (Gales et al. 1992). Klatsky et al. (2007) reported on dive data of dolphins tagged at the Bermuda Pedestal in the north Atlantic. Dolphins dove to at least 492 m (1,614 ft) depth, with deep dives (>100 m [328 ft]) occurring exclusively at night. Dives during the day were to shallower than at night, with 90 percent of all dives to within 50 m (164 ft) of the surface. Based on data presented in Klatsky et al. (2007; Figure 3), the following depth distribution has been estimated for bottlenose dolphins: Daytime: 96 percent at <0 – 50 m

(0 – 164 ft), four percent at >50 m (164 ft); Nightime: 51 percent at <50 m (164 ft), eight percent at 50 – 100 m (164 – 328 ft), 19 percent at 101 – 250 m (331 – 820 ft), 13 percent at 251 – 450 m (823 – 1,476 ft) and nine percent at >450 m (1,476 ft). Data on time spent at the surface were not published; therefore surface time was included in the least shallow depth category published.

Atlantic spotted dolphin, *Stenella frontalis*

Atlantic spotted dolphins feed on epipelagic and meso-pelagic fish, squid and benthic invertebrates, and there is some evidence for nocturnal feeding (Perrin, 2002e; Richard and Barbeau, 1994). Stomach contents from animals collected off Brazil yielded small and medium-sized cephalopods (Santos and Haimovici, 2001). Davis et al. (1996) attached a satellite-linked time-depth recorder to a single animal in the Gulf of Mexico. Most dives were shallow regardless of the time of day, with the deepest dives to 40 – 60 m (131 – 197 ft). Based on this limited information, the depth distribution for Atlantic spotted dolphins is 76 percent at <10 m (33 ft), 20 percent at 10 – 20 m (33 – 66 ft) and four percent at 21 – 60 m (69 – 197 ft).

Pantropical spotted dolphin, *Stenella attenuata*

Pantropical spotted dolphins feed on small epipelagic fishes, squids and crustaceans, and may vary their preferred prey seasonally (Perrin, 2002a; Wang et al., 2003). Stomach contents of dolphins collected near Taiwan indicated that the distribution of primary prey was 0 – 200 m (0 – 656 ft) at night and >300 m (984 ft) during the day, indicating that these animals feed at night (Wang et al., 2003). One study on this species, conducted in Hawaii, contains dive information (Baird et al., 2001). The biggest differences recorded were in the increase in dive activity at night. During the day, 89 percent of time was spent within 0 – 10 m (0 – 33 ft), most of the rest of the time was 10 – 50 m (33 – 164 ft), and the deepest dive was to 122 m (400 ft). At night, only 59 percent of time was spent from 0 – 10 m (0 – 33 ft) and the deepest dive was to 213 m (699 ft); dives were especially pronounced at dusk. The following depth distributions are applicable: Daytime, 89 percent at 0 – 10 m (0 – 33 ft), ten percent at 11 – 50 m (36 – 164 ft) and one percent at 51 – 122 m (167 – 400 ft); Nighttime, 80 percent at 0 – 10 m (0 – 33 ft), eight percent at 11 – 20 m (36 – 66 ft), two percent at 21 – 30 m (69 – 98 ft), two percent at 31 – 40 m (102 – 131 ft), two percent at 41 – 50 m (135 – 164 ft), and six percent at 51 – 213 m (167 – 699 ft) .

Striped dolphin, *Stenella coeruleoalba*

Striped dolphins feed on pelagic fish and squid and may dive during feeding to depths exceeding 200 m (656 ft) (Archer, 2002). However, studies are rare on this species. Stomach content remains from three dolphins in the Mediterranean near Turkey included several species of cephalopod as well as some fish, and suggested that striped dolphins may not feed quite as deep as Risso's dolphins in the same area (Ozturk et al., 2007). Blanco et al. (1995) analyzed stomach content remains from the western Mediterranean, and identified a mixed diet of muscular and gelatinous body squids of pelagic and bathypelagic origin. There is some evidence that striped dolphins feed at night to take advantage of vertical migrations of the deep scattering layer. In lieu of other information, pantropical spotted dolphin depth distribution data will be extrapolated to striped dolphins: Daytime, 89 percent at 0 – 10 m (0 – 33 ft), ten percent at 11 – 50 m (36 – 164 ft), and one percent at 51 – 122 m (167 – 400 ft); Nighttime, 80 percent at 0 – 10 m (0 – 33

ft), eight percent at 11 – 20 m (36 – 66 ft), two percent at 21 – 30 m (69 – 98 ft), two percent at 31 – 40 m (102 – 131 ft), two percent at 41 – 50 m (135 – 164 ft), and six percent at 51 – 213 m (167 – 699 ft) (Baird et al., 2001).

Spinner dolphin, *Stenella longirostris*

Spinner dolphins feed on small mesopelagic fishes, and likely feed at night (Perrin, 2002d; Benoit-Bird and Au, 2003). Stomach content analysis of spinner dolphins collected in the Sulu Sea, Philippines, indicated that they fed on mesopelagic crustaceans, cephalopods and fish that undertake vertical migrations to ~250 m (820 ft) (Dolar et al., 2003). There was also evidence that they preyed on non-vertical migrating species found at ~400 m (1,312 ft), and that they likely did not have the same foraging range as Fraser's dolphins in the same area (to 600 m [1,969 ft]). Studies on spinner dolphins in Hawaii have been carried out using active acoustics (fish-finders) (Benoit-Bird and Au, 2003). These studies show an extremely close association between spinner dolphins and their prey (small, mesopelagic fishes). Mean depth of spinner dolphins was always within 10 m (33 ft) of the depth of the highest prey density. These studies have been carried out exclusively at night, as stomach content analysis indicates that spinners feed almost exclusively at night when the deep scattering layer moves toward the surface bringing potential prey into relatively shallower (0 – 400 m [0 – 1,312 ft]) waters. Prey distribution during the day is estimated at 400 – 700 m (1,312 – 2,297 ft). Based on these data, the following are very rough order estimates of time at depth: Daytime: 100 percent at 0 – 50 m (0 – 164 ft); Nighttime: 100 percent at 0 – 400 m (0 – 1,312 ft).

Clymene dolphin, *Stenella clymene*

There is little information on the feeding habits of Clymene dolphins, and no diving studies have been carried out. They apparently feed on mesopelagic fish and squids that are vertical migrators, which indicate feeding at night. In lieu of the lack of information specific to this species, the depth distributions for spinner dolphins will be adopted for clymene: Daytime: 100 percent at 0 – 50 m (0 – 164 ft); Nighttime: 100 percent at 0 – 400 m (0 – 1,312 ft) (Benoit Bird and Au, 2003).

Fraser's dolphin, *Lagenodelphis hosei*

Fraser's dolphins prey on mesopelagic fish, crustaceans and cephalopods, and take advantage of vertically migrating prey at night (Dolar, 2002). Stomach contents from dolphins in the Sulu Sea, Philippines, contained crustaceans, cephalopods and myctophid fish (Dolar et al., 2003). Fraser's dolphins took larger prey than spinner dolphins feeding in the same area, and likely foraged to depths of at least 600 m (1,969 ft), based on prey composition and behavior. This species has also been observed herding fish and feeding at the surface, taking short dives and surfacing in the middle of the herded fish school (Watkins et al., 1994). Based on this very limited information, the following are very rough order estimates of time at depth: Daytime, 100 percent at 0 – 50 m (0 – 164 ft); Nighttime, 100 percent at 0 – 700 m (0 – 2,297 ft).

Table M-11. Summary of Depth Information for Marine Mammal Species with Densities in the NSWC PCD Study Area

Common Name	Scientific Name	Depth Distribution	Reference
MYSTICETES - Baleen whales			
Fin whale	*Balaenoptera physalus*	44% in <50m (164 ft); 23% in 50 – 225 m (164 – 738 ft); 33% at >225 m (738 ft)	Goldbogen et al (2006)
Sei whale	*B. borealis*	53% at <20 m (66 ft); 47% at 21 – 65 m (69 – 213 ft)	Extrapolated from minke whale
Bryde's whale	*B. edeni*	53% at <20 m (66 ft); 47% at 21 – 65 m (69 – 213 ft)	Extrapolated from minke whale
Minke whale	*B. acutorostrata*	53% at <20 m (66 ft); 47% at 21 – 65 m (69 – 213 ft)	Blix and Folkow (1995)
Humpback whale	*Megaptera novaeangliae*	37% of time in <4 m (13 ft), 25% of time in 4 – 20 m (13 – 66 ft), 7% of time in 21 – 35 m (69 – 115 ft), 4% of time in 36 – 50 m (118 – 164 ft), 6% of time in 51 – 100 m (167 – 328 ft), 7% of time in 101 – 150 m (331 – 492 ft), 8% of time in 151 – 200 m (495 – 656 ft), 6% of time in 201 – 300 m (659 – 984 ft), and <1% in >300 m (984 ft)	Dietz et al (2002)
North Atlantic right whale	*Eubalaena glacialis*	32% at <5 m (16 ft); 15% at 5 – 79 m (16 – 259 ft); and 53% at >79 m (259 ft)	Baumgartner and Mate (2003)
ODONTOCETES - Toothed whales			
Sperm whale	*Physeter catodon*	31% in <10 m (33 ft), 8% in 10 – 200 m (33 – 656 ft), 9% in 201 – 400 m (659 – 1,312 ft), 9% in 401 – 600 m (1,316 – 1,969 ft), 9% in 601 – 800 m (1,972 – 2,625 ft) and 34% in >800 m (2,625 ft)	Amano and Yoshioka (2003)
Pygmy and dwarf sperm whales	*Kogia breviceps and K. sima*	26% in <2 m (7 ft) (surface); 41% in 2 – 71 m (7 – 233 ft); 2% in 72 – 200 m (236 – 656 ft); 4% in 201 – 400 m (659 – 1,312 ft); 4% in 401 – 600 m (1,316 – 1,969 ft); 4% in 601 – 835 m (1,972 – 2,740 ft); 19% in >835 m (2,740 ft)	Extrapolated from Blainville's beaked whale
Beaked whales	Family Ziphiidae	27% in <2 m (7 ft) (surface); 29% in 2 – 220 m (7 – 722 ft); 4% in 221 – 400 m (725 – 1,312 ft); 4% in 401 – 600 m (1,316 – 1,969 ft); 4% in 601 – 800 m (1,972 – 2,625 ft); 5% in 801 – 1,070m (2,628 – 3,510 ft); 27% in >1,070 m (3,510 ft)	Extrapolated from Cuvier's beaked whale

Table M-11. Summary of Depth Information for Marine Mammal Species with Densities in the NSWC PCD Study Area Cont'd

Common Name	Scientific Name	Depth Distribution	Reference
Killer whale	*Orcinus orca*	96% at 0 – 30 m (0 – 98 ft); 4% at >30 m (98 ft)	Baird et al (2003a)
False killer whale	*Pseudorca crassidens*	96% at 0 – 30 m (0 – 98 ft); 4% at >30 m (98 ft)	Extrapolated from killer whales
Pygmy killer whale	*Feresa attenuata*	96% at 0 – 30 m (0 – 98 ft); 4% at >30 m (98 ft)	Extrapolated from killer whales
Pilot whales	*Globicephala sp*	60% at <7 m (23 ft); 36% at 7 – 17 m (23 – 56 ft); 4% at 18 – 828 m (59 – 2,717 ft)	Heide-Jorgensen et al (2002)
Melon-headed whale	*Peponocephala electra*	Daytime, 100% at 0 – 50 m (0 – 164 ft); Nighttime, 100% at 0 – 700 m (0 – 2,297 ft)	Extrapolated from Frasier's dolphin
Risso's dolphin	*Grampus griseus*	50% at <50 m (164 ft); 15% at 51 – 200 m (167 – 656 ft); 15% at 201 – 400 m (659 – 1,312 ft); 10% at 401 – 600 m (1,316 – 1,969 ft) and 10% at >600 m (1,969 ft)	Ozturk et al (2007)
Bottlenose dolphin	*Tursiops truncatus*	Daytime: 96% at <0 – 50 m (0 – 164 ft), 4% at >50 m (164 ft); Nighttime: 51% at <50 m (164 ft), 8% at 50 – 100 m (164 – 328 ft), 19% at 101 – 250 m (331 – 820 ft), 13% at 251 – 450 m (823 – 1,476 ft) and 9% at >450 m (1,476 ft)	Klatsky et al (2007)
Rough-toothed dolphin	*Steno bredanensis*	100% at 0 – 70 m (0 – 230 ft)	Jefferson (2000b)
Pantropical spotted dolphin	*Stenella attenuata*	Daytime, 89% at 0 – 10 m (0 – 33 ft), 10% at 11 – 50 m (36 – 164 ft), 1% at 51 – 122 m (167 – 400 ft); Nighttime, 80% at 0 – 10 m (0 – 33 ft), 8% at 11 – 20 m (36 – 66 ft), 2% at 21 – 30 m (69 – 98 ft), 2% at 31 – 40 m (102 – 131 ft), 2% at 41 – 50 m (135 – 164 ft), and 6% at 51 – 213 m (167 – 699 ft)	Baird et al (2001)
Atlantic spotted dolphin	*S. frontalis*	76% in <10 m (33 ft); 20% in 10 – 20 m (33 – 66 ft); 4% in 21 – 60 m (69 – 197 ft)	Davis et al (1996); Santos and Haimovici (2001)
Striped dolphin	*S. coeruleoalba*	Daytime, 89% at 0 – 10 m (0 – 33 ft), 10% at 11 – 50 m (36 – 164 ft), 1% at 51 – 122 m (167 – 400 ft); Nighttime, 80% at 0 – 10 m (0 – 33 ft), 8% at 11 – 20 m (36 – 66 ft), 2% at 21 – 30 m (69 – 98 ft), 2% at 31 – 40 m (102 – 131 ft), 2% at 41 – 50 m (135 – 164 ft), and 6% at 51 – 213 m (167 – 699 ft)	Extrapolated from pantropical spotted dolphin

Table M-11. Summary of Depth Information for Marine Mammal Species with Densities in the NSWC PCD Study Area Cont'd

Common Name	Scientific Name	Depth Distribution	Reference
Spinner dolphin	*S. longirostris*	Daytime: 100% at 0 – 50 m (0 – 164 ft); nighttime: 100% at 0 – 400 m (0 - 1,312 ft)	Benoit-Bird and Au (2003)
Clymene dolphin	*S. clymene*	Daytime: 100% at 0 – 50 m (0 – 164 ft); nighttime: 100% at 0 – 400 m (0 – 1,312 ft)	extrapolated from spinner dolphin
Fraser's dolphin	*Lagenodelphis hosei*	Daytime, 100% at 0 – 50 m (0 – 164 ft); Nighttime, 100% at 0 – 700 m (0 – 2,297 ft)	Dolar et al (2003)

M.5.2 Sea Turtle Density and Depth Distribution for NSWC PCD Study Area, Eastern Gulf of Mexico

Sea turtles of the order Testudines include both hard-shelled (Family Cheloniidae) and leathery-shelled (Family Dermochelyidae) species. Sea turtles spend nearly their entire lives at sea, coming ashore only to nest and, in rare circumstances and locations, to bask. When at the surface, sea turtle bodies are almost entirely below the water's surface, with only the head above water. This makes sea turtles difficult to locate visually and also exposes them to effects from explosions 100 percent of the time.

Similar to marine mammals, there are limited depth distribution data for most sea turtles. Sea turtles are generally tagged while on the beach during nesting activities, although some researchers capture turtles at-sea for tag emplacement. There are a few different methodologies/techniques that can be used to determine depth distribution percentages, but TDR by far is the most widely used technique. These instruments are attached to the animal for a fairly short period of time (several hours to a few days) via a suction cup or glue, and then retrieved immediately when the animal returns to the beach. Depth information is also collected via satellite tags, sonic tags, and digital tags.

Somewhat suitable depth distribution data exists for some sea turtle species. Sample sizes are usually extremely small, nearly always fewer than ten animals total and often only one or two animals. Depth distribution information can also be interpreted from other dive and/or preferred prey characteristics, and from methods including behavioral observations, stomach content analysis and habitat preference analysis. Depth distributions for species for which no data are available are extrapolated from similar species. Table M-12 provides a summary of depth distribution information. Detailed depth information for sea turtle species in the NSWC PCD Study Area is given in the following subsections.

M.5.2.1 Density

Leatherback sea turtle, *Dermochelys coriacea*

Distribution and habitat preferences

- Leatherback turtles are the most oceanic and wide-ranging of all sea turtle species. Posthatchlings and early juveniles are entirely oceanic and restricted to waters warmer than 26°C (79°F). Late juveniles and adults range from deep, mid-ocean habitats to the continental shelf and nearshore waters.
- Juvenile and adult foraging habitats include both coastal feeding areas in temperate waters and offshore feeding areas in tropical waters.
- Leatherbacks occur year-round in the deep, offshore waters of the GOMEX (in particular, waters in the vicinity of DeSoto Canyon) for feeding, resting, and as migratory corridors.
- Leatherbacks also occur in shallow waters over the continental shelf. Individuals have been observed feeding on dense aggregations of jellyfish in nearshore waters off the Florida Panhandle, the Mississippi River Delta, and the Texas coast.
- This species often undertakes extensive migrations following depth contours for thousands of kilometers. Tagging studies in the North Atlantic Ocean have indicated

many variations in overwintering and onshore-offshore occurrence patterns. The migratory cycles of adult leatherbacks often include movements between temperate and tropical waters.

- In recent years, low levels of nesting activity have been documented on both Florida Panhandle and south Florida beaches

Loggerhead sea turtle, *Caretta caretta*

Distribution and habitat preferences:

- The loggerhead turtle occurs worldwide in habitats ranging from coastal estuaries to waters far beyond the continental shelf.
- Loggerheads are primarily oceanic as post-hatchlings and early juveniles, often occurring in *Sargassum* driftlines where they are transported throughout the ocean by dominant currents.
- Late juveniles and adults routinely occur in shallow, continental shelf habitats such as bays, sounds, and lagoons. The shallow bays and sounds of the eastern GOMEX (e.g., Chandeleur Sound; Mobile, Escambia, and Tampa bays) likely serve as important developmental habitats for late juvenile loggerheads.
- In the GOMEX, loggerhead turtles can be found throughout the year in both continental shelf and slope waters from southeastern Florida to southern Texas. Loggerhead abundance in continental slope waters of the eastern GOMEX is known to increase during the winter, as the temperatures of inshore and nearshore waters approach the lower thermal limits of this species.
- Juvenile loggerheads are known to inhabit offshore waters in the GOMEX where they are often associated with artificial reefs and oil platforms. These offshore habitats provide juveniles with an abundance of prey as well as sheltered locations where they can rest. Adult loggerhead turtles reside in similar habitats, although their feeding behavior is more benthic-oriented; thus, they are more likely to be found in nearshore rather than offshore waters.
- Based on sighting and nesting surveys, the density and abundance of loggerhead turtles is much higher in the northeastern GOMEX than in the northwestern. This trend is likely due to the fact that adult loggerheads seldom use the beaches of Texas and Louisiana as nesting habitats and juveniles do not use the northwestern GOMEX as a development habitat as extensively as they use the northeastern GOMEX.

Kemp's ridley sea turtle, *Lepidochelys kempii*

Distribution and habitat preferences:

- Kemp's ridley turtles occur in open-ocean and Sargassum habitats as post-hatchlings and early juveniles. They move as large juveniles and adults to benthic, nearshore feeding grounds along the U.S. Atlantic and Gulf coasts. Adults appear to remain in the GOMEX, with occasional occurrences in the Atlantic Ocean.
- Kemp's ridley turtles primarily occur in shallow (bottom depth <50 m [164 ft]) continental shelf waters of the northern GOMEX year-round.

- Primary feeding habitats include warm-temperate to subtropical sounds, bays, estuaries, tidal passes, shipping channels, and beachfront waters where preferred food, including the blue crab (*Callinectes sapidus*), occurs.
- In the GOMEX, the western coast of Florida (particularly the Cedar Keys area), the eastern coast of Alabama, the mouth of the Mississippi River, and the coastal waters off western Louisiana and eastern Texas have been identified as important developmental regions for the Kemp's ridley.
- Results of habitat suitability modeling revealed that the most optimal habitats for Kemp's ridleys are those with a bottom depth of less than 10 m (33 ft) and a SST between 22° and 32°C (72° and 90°F). Postnesting Kemp's ridleys travel along coastal corridors generally shallower than 50 m (164 ft) in bottom depth.
- Nesting primarily occurs on a single beach at Rancho Nuevo, Tamaulipas, México, although additional activity is documented in South TX.

M.5.2.2 Depth Distribution

Leatherback sea turtle, *Dermochelys coriacea*

Leatherbacks feed primarily on jellyfish and tunicates; their weak jaws favor soft-bodied prey (Mortimer, 1995; Ernst and Barbour, 1989). They also are known to feed on crustaceans and fish associated with jellyfish. There have been several studies on leatherback swimming and diving habits, in part because they seem to defy patterns expected of marine reptiles and observed in other sea turtles. Dive patterns are generally U or V-shaped (Myers et al., 2006), vary greatly depending on time of year and geographic area, and have been measured to exceed 1,000 m (3,280 ft) to possibly as deep as 1,300 m (4,265 ft) (Eckert et al., 1989). Leatherbacks have been observed feeding and diving in near-freezing conditions in the north Atlantic (James et al., 2006a) and distribution may be linked to the position of the 15°C (59°F) isotherm (McMahon and Hays, 2006). Several studies have revealed changes in dive patterns within a single year, whereby turtles that have just left tropical nesting areas tend to initially dive quite deep, then dive shallower and shorter as they migrate northwards (James et al., 2005b; Eckert, 2006). Although they are capable of diving in excess of 1,000 m (3,280 ft) (Eckert et al., 1989), dives of <200 m (656 ft) are more typical (e.g., James et al., 2005b, 2005c). Eckert (2006) tracked nine migrating female leathbacks from nesting grounds in Trinidad and found the following depth distributions at low latitudes: 28 percent at <6 m (20 ft), 36 percent at 6 – 12 m (20 – 39 ft), 24 percent at 13 – 51 m (43 – 167 ft), seven percent at 52 – 102 m (171 – 335 ft), three percent at 103 – 150 m (338 – 492 ft) and two percent at >150 m (492 ft). Depth distributions at higher latitudes (north Atlantic feeding areas) had higher percentages of time at the surface. Depth distributions are likely highly dependent on prey availability.

Loggerhead sea turtle, *Caretta caretta*

Loggerheads feed on different foods at different life stages (Dodd, 1988). Post-hatchlings feed on zooplankton, jellyfish, larval shrimp, craps and gastropods; juvenile and immature turtles are omnivorous and feed on crabs, mollusks and vegetation. Adult loggerheads are largely carnivorous and feed on near shore benthic invertebrates, which they crush before swallowing (Mortimer, 1995). There have been a few studies on depth distribution of loggerheads. Dellinger and Freitas (2001) placed satellite-linked TDRs on juvenile turtles and found that most

of the time was spent just below the surface with the next largest component of time spent between 10 and 25 m (33 – 82 ft). Luschi et al. (2006) observed that migrating females had relatively short submergences (12 min), which increased in time (24 min) when they arrived at foraging grounds. Polovina et al. (2004) tagged 26 migrating loggerheads in the Pacific, and their data indicated that loggerheads spent 40 percent of their time at the surface and 90 percent of their time at depths <40 m (131 ft). Another study of migrating loggerheads in the open ocean indicated that turtles spent 40 percent of total time at <1 m (3 ft) and the majority of time at <100 m (328 ft) (Polovina et al. (2003). Few studies have been carried out on loggerheads at foraging grounds, so depth distribution information was adopted from Dellinger and Freitas (2001). The following are estimates of time at depth: 33 percent at <1 m (3 ft), 15 percent at 1 – 3 m (3 – 10 ft), 12 percent at 4 – 6 m (13 – 20 ft), eight percent at 7 – 10 m (23 – 33 ft), 25 percent at 11 – 25 m (36 – 82 ft) and seven percent at >25 m (82 ft).

Kemp's ridley sea turtle, *Lepidochelys kempii*

Kemp's ridleys feed on crabs, mollusks, shrimp, fish and some plant material, and they are generally considered to be a bottom feeder (Mortimer, 1995). They arrive at northern GOM coastal feeding areas in spring and breeding adults migrate south to breeding/nesting areas in the fall (Renaud and Williams, 2005). From April to September, they are generally found in depths <20 m (66 ft), and during the rest of the year they are still generally found in depths <50 m (164 ft). Kemp's ridleys tend to spend most of the time (>90 percent) submerged (Gitschlag, 1996; Renaud and Williams, 2005; Sasso and Witzell, 2006). Studies of depth distribution of this species have not been published, so the following is a rough estimate based on information from the above referenced studies: five percent at <1 m (3 ft); 95 percent at 1 – 50 m (3 – 164 ft).

Hardshell sea turtle, Family Cheloniidae

The depth distribution for loggerhead turtles will be extrapolated to this group. The following are estimates of time at depth: 33 percent at <1 m (3 ft), 15 percent at 1 – 3 m (3 – 10 ft), 12 percent at 4 – 6 m (13 – 20 ft), eight percent at 7 – 10 m (23 – 33 ft), 25 percent at 11 – 25 m (36 – 82 ft) and seven percent at >25 m (82 ft).

Table M-12. Summary of Depth Information for Marine Mammal Species with Densities in the NSWC PCD Study Area

Common Name	Scientific Name	Depth Distribution	Reference
Leatherback sea turtle	*Dermochelys coriacea*	28% at <6 m (20 ft), 36% at 6 – 12 m (20 – 39 ft), 24% at 13 – 51 m (43 – 167 ft), 7% at 52 – 102 m (171 – 335 ft), 3% at 103 – 150 m (338 – 492 ft) and 2% at >150 m (492 ft)	Eckert (2006)
Loggerhead sea turtle	*Caretta caretta*	33% at <1 m (3 ft), 15% at 1 – 3 m (3 – 10 ft), 12% at 4 – 6 m (13 – 20 ft), 8% at 7 – 10 m (23 – 33 ft), 25% at 11 – 25 m (36 – 82 ft), 7% at >25 m (82 ft)	Dellinger and Freitas (2001)
Kemp's ridley sea turtle	*Lepidochelys kempii*	5% at <1 m (3 ft); 95% at 1 – 50 m (3 – 164 ft)	Gitschlag (1996); Sasso and Witzell, 2006)
Hardshell sea turtle	Family Chelonidae	33% at <1 m (3 ft), 15% at 1 – 3 m (3 – 10 ft), 12% at 4 – 6 m (13 – 20 ft), 8% at 7 – 10 m (23 – 33 ft), 25% at 11 – 25 m (36 – 82 ft), 7% at >25 m (82 ft)	Extrapolated from loggerhead sea turtle

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APPENDIX N
PUBLIC INVOLVEMENT MATERIALS AND COMMENT LETTERS RECEIVED ON DRAFT EIS/OEIS

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare an Environmental Impact Statement (EIS) for Naval Surface Warfare Center Panama City (NSWCPC) Mission Activities and Announcement of Public Scoping Meetings

AGENCY: Department of the Navy, DOD.

ACTION: Notice.

SUMMARY: Pursuant to Section (102)(2)(c) of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality Regulations (40 CFR parts 1500–1508), the Department of the Navy (Navy) announces its intent to prepare an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences associated with new and increased Naval Surface Warfare Center Panama City (NSWCPC) mission activities in three military operating areas in the northern Gulf of Mexico and in St. Andrews Bay. Existing and evolving activities include research, development, testing and evaluation, and in-service engineering for mine warfare, special warfare, amphibious warfare, diving, and other naval missions that take place primarily in the coastal region. These activities generally include air, surface, and subsurface operations that require the use of sonar, lasers, live ordnance, and electromagnetic fields.

DATES: Public scoping meetings will be held in Panama City, FL; Port St. Joe, FL; and Pensacola, FL, to receive oral and written comments on environmental concerns that should be addressed in the EIS. The public meeting dates are as follows:

1. Tuesday, September 14, 2004, 6 p.m. to 9 p.m., Panama City, FL.
2. Wednesday, September 15, 2004, from 6 p.m. to 9 p.m., Port St. Joe, FL.
3. Thursday, September 16, 2004, 6 p.m. to 9 p.m., Pensacola, FL.

ADDRESSES: The public meeting locations are as follows:

1. Panama City, FL—Florida State University, Panama City Campus, 4750 Collegiate Drive, Panama City, FL 32405.
2. Port St. Joe, FL—Port St. Joe High School, 100 Shark Drive, Port St. Joe, FL 32456.
3. Pensacola, FL—Pensacola Junior College, Warrington Campus, 5555 West Highway 98, Pensacola, FL 32507.

FOR FURTHER INFORMATION CONTACT: Naval Surface Warfare Center Panama City, Attn: Mrs. Carmen Ferrer, 110 Vernon Avenue, Panama City, FL 32407; telephone (850) 234–4146; E–Mail: *carmen.ferrer@navy.mil.*

SUPPLEMENTARY INFORMATION: The NSWCPC currently utilizes the adjacent coastal and marine environments to provide naval research, development, test and evaluation (RDT&E) and in-service support for acquisition of various systems. The northern Gulf of Mexico military operating areas currently utilized encompasses portions of the Eglin Gulf Test and Training Range (EGTTR). The adjacent littoral and coastal environments are also currently used to test and evaluate systems. These sites include St. Andrews Bay, East Bay, West Bay and beaches along the Gulf of Mexico up to the mean high water line. The environmental consequences associated with such support have historically been addressed on a test-by-test or program-by-program basis. This method frequently creates time constraints and schedule limitations, including delays.

The proposed action is to improve NSWCPC's capabilities to conduct new and increased mission operations for DOD and other users within three military operating areas in the northern Gulf of Mexico, and in the St. Andrews Bay area.

The proposed action would enable the Navy to successfully meet current and future national and global defense challenges by developing a robust capability to meet littoral and expeditionary warfare requirements and by providing RDT&E, and in-service engineering for mine warfare, special warfare, amphibious warfare, diving, and other naval missions that take place primarily in the coastal region. This allows the Navy to meet its statutory mission to deploy world wide naval forces equipped and trained to meet existing and emergent threats, and to enhance its ability to operate jointly with other components of the armed forces.

Alternatives to be considered in the EIS include two action alternatives that address variations in the level and tempo of mission operations plus a no action alternative. Additionally, the EIS may also consider other alternatives defined during the public scoping process, if the options meet established operational criteria.

Alternative 1 involves an increase in NSWCPC capabilities over baseline mission activities, using foreseeable (*e.g.* over a five year period) test and training requirements to project needed capabilities. Alternative 1 would enhance NSWCPC's ability to meet future needs by incorporating new test capabilities and increases in tempo and intensity of RDT&E activities.

Alternative 2 also involves an increase in NSWCPC capabilities over baseline mission activities. Alternative 2 also uses foreseeable test and training requirements to project needed capabilities. The principal difference between Alternatives 1 and 2 is that Alternative 2 proposes an increase in testing and training tempo 15% greater than that proposed in Alternative 1.

The no action alternative addresses historic and current mission activities (*e.g.* baseline mission activities or the status quo) at the NSWCPC operating areas.

The EIS will evaluate the potential environmental effects associated with the identified alternatives. The EIS will focus on the following areas: air quality; water resources; coastal zone management; noise; wildlife, including threatened and endangered species, marine mammals, and migratory birds; fisheries including an analysis of essential fish habitat, coastal/marine/benthic communities, and special biological resource areas; socioeconomic resources; and cultural resources. The analysis will include an evaluation of the direct, indirect, and cumulative impacts. Environmental effects that occur outside of U.S. territorial waters will be evaluated under Executive Order 12114. No decision will be made to implement any alternative until the NEPA process is completed.

The Navy is initiating the scoping process to identify community concerns and local issues that should be addressed in the EIS. Federal, state, and local agencies and interested persons are encouraged to provide oral and/or written comments to NSWCPC to identify specific issues or topics of environmental concern. The Navy will consider these comments in determining the scope of the EIS.

Written comments on the scope of the EIS must be postmarked by October 16, 2004, and should be mailed to: Commanding Officer, Naval Surface Warfare Center Panama City, Attn: Environmental Team Lead, Mrs. Carmen Ferrer, 110 Vernon Avenue, Panama City, FL 32407–7001; telephone (850) 234–4146; E-Mail: *carmen.ferrer@navy.mil.*

Dated: August 16, 2004.

S.K. Melancon,

Paralegal Specialist, Office of the Judge Advocate General, Alternate Federal Register Liaison Officer.

[FR Doc. 04–19045 Filed 8–18–04; 8:45 am]

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NAVY ANNOUNCES PUBLIC SCOPING MEETINGS FOR ENVIRONMENTAL IMPACT STATEDMENT

NAVSEA
WARFARE CENTERS
PANAMA CITY

PUBLIC SCOPING MEETINGS WILL BE HELD AT THE FOLLOWING LOCATIONS

Panama City
September 14, 2004 – 6:00 p.m.
Florida State University, Panama City Campus
4750 Collegiate Drive

Port St. Joe
September 15, 2004 – 6:00 p.m.
Port St. Joe High School
100 Shark Drive

Pensacola/Warrington
September 16, 2004 – 6:00 p.m.
Pensacola Junior College, Warrington Campus
5555 Highway 98 W

Public Scoping Meeting Agenda

From 6:00 to 7:00 p.m., you are invited to view information displays. At 7:00 p.m., the Navy will make a brief presentation. After the presentation, members of the public will be given the opportunity to make oral comments on the scope of the EIS and their concerns. Each speaker will have up to four minutes to make a comment and may speak only once. Written and oral comments receive the same consideration.

FOR MORE INFORMATION

For more information, please visit the Naval Surface Warfare Center Panama City EIS website at **http://www.ncsc.navy.mil/environmentinfo/default.htm** or call our information line at (850) 609-3457.

Legal No. 67021 1T Sept. 6, 2004

ΓH

Notary Public

EVELYN A. MITCHELL
Notary Public-State of FL
Comm. Exp. Aug. 1, 2008
Comm. No. DD 342640

PENSACOLA News Journal
Informed. In Tune. In Touch.

ed Daily-Pensacola, Escambia County, FL

E OF FLORIDA
/ of Escambia

the undersigned authority, personally appeared **KAY CHASTAIN** personally known to me and who on oath says that he/she is a ntative of The Pensacola News Journal, a daily newspaper ied in Pensacola in Escambia County, Florida; that the attached copy ertisement, being a legal in the matter of **NAVY ANNOUNCES C INPUT PROCESS** was published in said newspaper in the issues **PTEMBER 30, 2004.** Affidavit further states that the said Pensacola Journal is a newspaper published in Pensacola, in said Escambia y, Florida, and that the said newspaper has heretofore been uously published in said Escambia County, Florida each day and has ntered as second class mail matter at the post office in Pensacola, in Escambia County, Florida, for a period of one year next preceding the publication of the attached copy of advertisement; and Affidavit r says that he/she has neither paid nor promised any person, firm, or ration any discount, rebate, commission or refund for the purpose of ing this advertisement for publication in the said newspaper.

n to and subscribed before me this **30TH DAY OF SEPTEMBER , 2004.**

Notary Public

NIKKI G. WINDHAM
Notary Public-State of FL
Comm. Exp. Aug. 1, 2008
Comm. No. DD 342647

NAVY ANNOUNCES PUBLIC INPUT PROCESS FOR ENVIRONMENTAL IMPACT STATEMENT

NAVSEA

The Navy will host two public scoping meetings to solicit input on the proposed Environmental Impact Statement (EIS) for Naval Surface Warfare Center Panama City (NSWCPC) mission activities. The Navy extends an invitation to the residents of Pensacola, Fort Walton Beach, and the surrounding areas to attend the public meetings scheduled for Panama City and/or Port St. Joe. We regret that we are unable to hold a public scoping meeting in your immediate area at this time.
We realize that it is a difficult time for the majority of our panhandle citizens and we therefore, encourage you to provide written comments about your concerns. Please realize that written comments will be addressed with the same level of priority as publicly offered comments.

PUBLIC SCOPING MEETINGS WILL BE HELD AT THE FOLLOWING LOCATIONS

Panama City
October 5, 2004 – 6:00 p.m.
Florida State University, Panama City Campus Auditorium
4750 Collegiate Drive

Port St. Joe
October 6, 2004 – 6:00 p.m.
Port St. Joe Elementary School Auditorium
2201 Long Avenue

Public Scoping Meeting Agenda
From 6:00 to 7:00 p.m., you are invited to view information displays. At 7:00 p.m., the Navy will make a brief presentation. After the presentation, members of the public will be given the opportunity to make oral comments on the scope of the EIS and their concerns. Each speaker will have up to four minutes to make a comment and may speak only once. Again, written and oral comments receive the same consideration.

FOR MORE INFORMATION AND TO SUBMIT COMMENTS
For more information, please visit the Naval Surface Warfare Center Panama City EIS website at **http://www.ncsc.navy.mil/environmentinfo/default.htm** or call our information line at (850) 609-3457.

Please send your comments to:
Commanding Officer
Naval Surface Warfare Center Panama City
Attn: Environmental Team Lead, Mrs. Carmen Ferrer
110 Vernon Avenue, Panama City, FL 32407-7001
E-Mail: carmen.ferrer@navy.mil

Legal No. 67087 1T Sept. 30, 2004

1T Sept. 30, 2004

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER - PANAMA CITY
110 VERNON AVENUE
PANAMA CITY, FL 32407

IN REPLY REFER TO:

5200
Ser E20/006
September 9, 2004

Dear Sir or Madam:

The purpose of this letter is to inform you that Naval Surface Warfare Center Panama City (NSWCPC) is preparing an Environmental Impact Statement (EIS) to analyze and evaluate potential impacts of its mission activities in our community. Enclosures (1) and (2) contain additional information. Please feel free to call one of the contact numbers listed if you have any comments. If interested, you may also want to participate in the public scoping meeting.

Sincerely,

John Auzins
Head, Test & Evaluation Division
By direction

Encl: (1) NSWCPC EIS FACT Sheet
(2) Information for Local Organizations

Supporting Our Navy War-fighters

Mine Warfare



Expeditionary Maneuver Warfare



Operations in Extreme Environments



Maritime Special Operations



Other Navy Missions That Take Place in Coastal Regions

Naval Surface Warfare Center Panama City

Supporting Military Readiness for Nearly 60 Years

The Naval Surface Warfare Center Panama City (NSWCPC) is the premier Naval Systems Laboratory in the Department of Defense, delivering superior technology and joint warfighter capability through research, development, test and evaluation (RDT&E) efforts. The work of the NSWCPC provides key support in the areas of:

- Mine Warfare
- Expeditionary Maneuver Warfare
- Operations In Extreme Environments
- Maritime Special Operations
- Coastal Operations

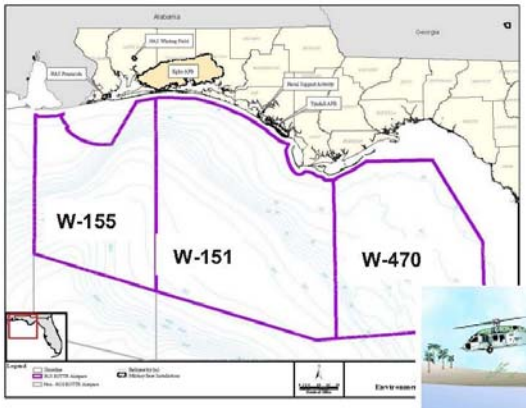


An Unparalleled Location for Testing and Training

Located on St. Andrew Bay, NSWCPC is not only renowned for its technical expertise, but also for the ready access to the shoreline and coastal waters of the Gulf of Mexico -- providing a unique and irreplaceable location for essential Navy test and evaluation activities.

NSWCPC Operations

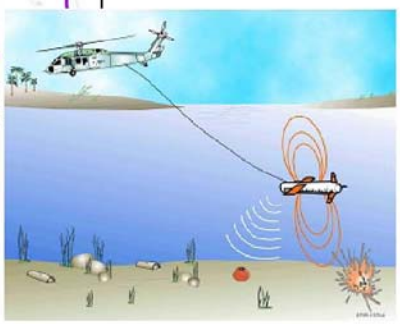
Today, the NSWCPC performs a range of RDT&E operations in its Military Operating Areas (MOAs) that includes adjacent bays and coastal areas as well as the wider Gulf of Mexico. Activities involve support surface ships and aircraft used for the RDT&E of underwater systems in a combination of operations that support seven primary areas:



- Laser
- Electromagnetics
- Detonations
- Air Operations
- Surface Operations
- Subsurface Operations
- Sonar

NSWCPC activities are conducted in the Military Operating Areas of W-155, W-151, W-470 and in the St. Andrew Bay area.

The figure on the right depicts a towed-body deployed by a helicopter, one example of the tests conducted in the NSWCPC military operating areas.



At A Glance



Naval Surface Warfare Center Panama City

The premier Naval Systems Laboratory in the Department of Defense, delivering superior technology and joint warfighter capability in littoral warfare. Mission areas include:

- Mine Warfare
- Expeditionary Maneuver Warfare
- Maritime Special Operations
- Operations in Extreme Environments
- Other Navy missions that take place in coastal regions

For More Information:

www.ncsc.navy.mil

or

www.ncsc.navy.mil/environmentinfo/default.htm
for information about an NSWCPC Environmental Impact Statement underway

Part of the Gulf Community for Decades

Formed during World War II, the NSWCPC laboratory has evolved from a Mine Warfare Test Station and Naval Amphibious Training Base to a present day, state-of-the-art facility for support of the Navy warfighter. Through the decades, NSWCPC has established itself not only as a pinnacle of technical leadership, but also as a strong member of the community, actively participating in civic and community issues, and supporting a thriving economy through job creation, contracting and more.

A Vital Member Of The Community



Employing:	
Civilian	1,319
Military	57
Non-Appropriated	84
Contractors (On Base)	143
TOTAL	1,603
Annual Payroll:	
Civilian	$ 84,801,100
Military	2,858,300
Non-Appropriated	2,477,800
Contractors (On Base)	10,467,100
Subtotal	$ 100,604,300
NSWCPC Annual Contracts & Purchases:	
Contracts & Other Purchases	$ 190,360,000
Military Construction	3,174,800
Subtotal	$ 193,534,800
Indirect Jobs Created:	23,099,240
GRAND TOTAL	$317,238,340

A Vital Community Partner

As active members of the regional community, NSWCPC and the hundreds who work there, undertake a variety of activities and programs to support community activities and needs. NSWCPC is particularly active through its School Enrichment Program to support science studies. Activities include:

- **KidsFest** -- An annual community event to promote science.
- **Dr. Science** -- A stage show geared to elementary students to bring the "magic of science" to the classroom.
- **Three Rivers Science and Engineering Fair** -- An event hosted by NSWCPC since 1986, the program includes mentoring, supporting and judging this junior and senior level science science competitions, with winners advancing to the Florida State Fair and beyond.
- **Shadowmakers** -- Providing a way to help students and teachers link their classroom learning to the "real world," NSWC Panama City employees volunteer to have guests "shadow" them for a day or more.
- **Summer Student Program** -- The Gould Award, established in 1974, is presented to one graduating student at each of the three area high schools who has made great achievements in science. The award includes the offer of employment at NSWCPC for eight weeks during the summer before they attend college.



Annual KidsFest brings the fun and excitement of science to area youth.



NSWCPC hosts the annual Three Rivers Science and Engineering Fair and mentors students throughout the year.

NSWCPC Commitment To Environmental Stewardship

Protecting Marine Life



The Navy conducts surveys of sea turtles and marine mammals before, during and after testing and training exercises.

Working With Those Who Share Our Dedication to the Environment



The base's Natural Resources Manager continually works with youth groups such as the Boy Scouts of America (BSA), providing challenges and opportunities for development of leadership skills. BSA Troops have helped to plant 250 Bald Cypress trees - important wetland trees - on the base.

Actively Protecting Wildlife



Effort to enhance and protect beach nesting areas and habitats have resulted in a marked increase in the number of Least Tern nesting pairs on the base.

Examining Environmental Resources

Naval Surface Warfare Center Panama City

Working to Preserve and Protect Our Natural Resources

The NSWCPC is situated in the magnificent Gulf Coast region noted for rich environmental, marine and cultural resources. A long-time member of the gulf community, NSWCPC is committed to environmental stewardship and devotes numerous programs and staff resources to conserving and protecting natural resources.

Environmental Impact Statement

To fully assess the potential environmental impacts of its operations and proposed future actions, and to ensure that interested officials and members of the public are fully informed and involved, NSWCPC has begun a process to develop an Environmental Impact Statement (EIS). The purpose of this EIS is to objectively analyze and evaluate the potential for significant impacts to any environmental resource that could be affected by NSWCPC operations in the EIS Study Area (see map below), looking at a broad spectrum of potential environmental impacts including:

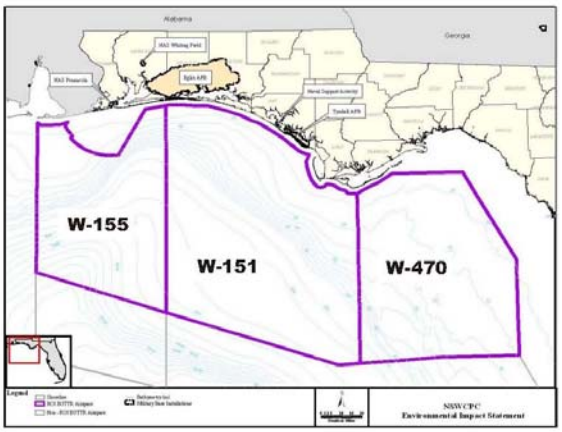


- Air quality
- Water resources
- Coastal zone management
- Threatened/endangered and protected species
- Fisheries
- Coastal/marine resources
- Sound
- Recreational and commercial/industrial activities
- Safety and occupational health and hazardous materials
- Air space
- Artificial reefs
- Cultural resources
- Environmental justice and risks to children



What Is Proposed?

In addition to the current RDT&E operations conducted in the EIS Study Area, the Navy proposes to improve NSWCPC capabilities to conduct new and increased mission operations for the Department of Defense and other users within the three military operating areas (W-155, W-151 and W-470) in the northern Gulf of Mexico, and in the St. Andrew Bay area.



NSWCPC Wants Your Input

NSWCPC understands the keen interest of agencies, officials, communities and other parties in the environmental protection of our Gulf Coast area and in the activities of the Navy in the region. We encourage all interested parties to take advantage of the information resources available as well as the opportunities to discuss and comment on this important topic.

Where to Find Additional Information

www.ncsc.navy.mil/ environmentinfo/default.htm

Information Repository Sites:

Bay County Public Library
25 West Government Street
Panama City, FL 32401

Gulf County Public Library
Highway 71 North
Port St. Joe, FL 32456

Fort Walton Beach Public Library
185 Miracle Strip Pkwy SE
Fort Walton Beach, FL 32548

Pensacola Public Library
200 West Gregory Street
Pensacola, FL 32501

Scoping Meeting Dates and Locations:

Panama City, FSU-PC
September 14, 2005
6-9 p.m.

Port St. Joe, Port St. Joe High School
September 15, 2004
6-9 p.m.

Pensacola, PJC Warrington
September 16, 2004
6-9 p.m.

Contact:
Commanding Officer,
Naval Surface Warfare Center
Attn: Environmental Lead
Code XP01FE
110 Vernon Ave
Panama City, FL 32407-700

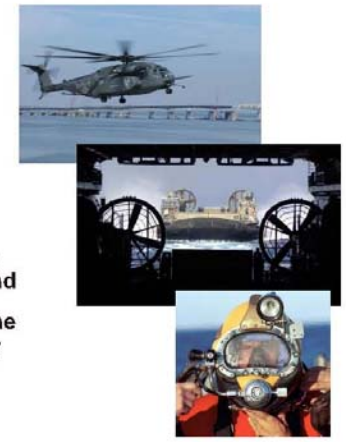
850-234-4146
nswcpcpaowebmanager@ navy.mil

Research Development Test Evaluation

Purpose of Proposed Action

A critical Navy mission is to successfully deploy worldwide naval forces equipped and trained to meet existing and emerging threats. To support this overriding need, NSWCPC must:

- **Enhance the capacity to meet littoral (shallow water) and expeditionary warfare requirements,**
- **Enhance the ability to operate jointly with other components of the armed forces, and**
- **Conduct more seamless testing, versus the segmented testing that often is necessary now.**



Alternatives Being Considered

Alternatives Being Considered

	No Action Alternative	Alternative 1	Alternative 2
Sonar	410 hrs/yr	625 hrs/yr	719 hrs/yr
Laser	244 hrs/yr	351 hrs/yr	405 hrs/yr
Electromagnetic	155 hrs/yr	245 hrs/yr	281 hrs/yr
Detonations	3 dets/yr	23 dets/yr	26 dets/yr
Projectiles	50 rnds/yr	3,674 rnds/yr	4,226 rnds/yr
Line Charges	1 line/yr	2 lines/yr	3 lines/yr
Air Operations	416 hrs/yr	444 hrs/yr	511 hrs/yr
Surface Operations	2,279 hrs/yr	2,408 hrs/yr	2,769 hrs/yr
Subsurface Operations	266 MLOs/yr	322 MLOs/yr	370 MLOs/yr

No Action Alternative: *This addresses historic and current mission activities ("Baseline mission activities" or "Status Quo") at the NSWCPC operating areas.*

Alternative 1: *This addresses baseline mission activities, as well as known future (five year) NSWCPC users' activities, in order to increase NSWCPC operational capability. Alternative 1 enhances capabilities to meet future needs by incorporating new test capabilities as well as projected increases to the baseline tempo and intensity of RDT&E activities.*

Alternative 2: *This addresses baseline mission activities, as well as known future (five year) NSWCPC users' activities at an increased tempo, in order to maximize NSWCPC operational capability. Alternative 2 includes the test capabilities of Alternative 1 and increases the overall tempo of RDT&E activities at a notional 15% over Alternative 1.*

Your Input Is Appreciated

A critical component of the Navy's review of alternatives is input from interested agencies and the public. That's why the EIS process includes opportunities for public review and comment. The first opportunity is the scoping period during which agencies and the public can provide input to the Navy on environ-mental issues and alternatives for evaluation in the Draft EIS. After publication of a Draft EIS, the public and agencies are given the opportunity to review and comment on the findings and conclusions included in the document. The final two steps in the process include issuance of the Final EIS and release of a Record of Decision. For details on each of these stages, please visit www.ncsc.navy.mil/ environmentinfo/default.htm, or see the contact information listed on this page.

INFORMATION FOR LOCAL ORGANIZATIONS

Pursuant to the requirements of the National Environmental Policy Act (NEPA) of 1969 and subsequent implementing regulations issued by the Council on Environmental Quality (CEQ) (40 *Code of Federal Regulations* Part 1500), the Department of the Navy announces its intent to prepare an EIS. The Proposed Action to be considered in the Naval Surface Warfare Center Panama City (NSWCPC) EIS is to improve NSWCPC's capabilities to conduct new and increased mission operations for the Department of Defense and other users within three military operating areas of the Eglin Gulf Test and Training Range (EGTTR) – W-151, W-155, and W-470 – in the northern Gulf of Mexico and in St. Andrews Bay. This action allows the Navy to meet its statutory mission to deploy worldwide naval forces equipped and trained to meet existing and emergent threats, and to enhance its ability to operate jointly with other components of the armed forces.

Current NSWCPC practices satisfy legal compliance for projects and programs on an individual, case-by-case basis. The time and resource limitations induced by handling crisis or surge activities do not support all of the requirements for long term planning of mission activities at NSWCPC. Environmental compliance for the marine activities of concern is governed by several laws that have a variety of associated legal requirements; including (but not limited to) the NEPA, the Endangered Species Act, the Marine Mammal Protection Act, the Magnuson-Stevens Fishery Conservation & Management Act, and the Clean Water Act.

Proposed Action, Alternatives and Environmental Issues

Alternatives have been proposed and include:

- No Action Alternative: Baseline level of operation (Historic + Current actions)
- Alternative 1: Baseline + Future activities
- Alternative 2: Baseline + Future + Notional 15% increase in activities

Table 1. Comparison of the Level of Activities for NSWCPC Testing

	No Action Alternative	Alternative 1	Alternative 2
Sonar	**410** hrs/yr	**625** hrs/yr	**719** hrs/yr
Laser	**244** hrs/yr	**351** hrs/yr	**405** hrs/yr
Electromagnetic	**155** hrs/yr	**245** hrs/yr	**281** hrs/yr
Detonations	**3** dets/yr	**23** dets/yr	**26** dets/yr
Projectiles	**50** rnds/yr	**3,674** rnds/yr	**4,226** rnds/yr
Line Charges	**1** line/yr	**2** lines/yr	**3** lines/yr
Air Operations	**416** hrs/yr	**444** hrs/yr	**511** hrs/yr
Surface Operations	**2,279** hrs/yr	**2,408** hrs/yr	**2,769** hrs/yr
Subsurface Operations	**266** MLOs/yr	**322** MLOs/yr	**370** MLOs/yr

Additional alternatives may be defined during the public scoping process if the options meet established operational criteria. The EIS will evaluate the potential environmental effects associated with the alternatives and may include but not be limited to:

- Air quality
- Water resources
- Coastal zone management
- Sound
- Wildlife, including threatened and endangered species, marine mammals and migratory birds
- Fisheries, including essential fish habitat, coastal/marine/benthic communities and special biological resource areas
- Socioeconomic resources
- Artificial Reefs
- Safety and occupational health
- Environmental justice and special risks to children
- Cultural resources

Opportunities for Public Comment

Public scoping meetings will be held:

1. Tuesday, September 14, 2004, 6 p.m. to 9 p.m., Panama City, FL – Florida State University, Panama City Campus, 4750 Collegiate Drive, Panama City, FL 32405 Room Location: Auditorium

2. Wednesday, September 15, 2004, 6 p.m. to 9 p.m., Port St. Joe, FL – Port St. Joe High School, 100 Shark Drive, Port St. Joe, FL 32456 Room Location: Lunch Room

3. Thursday, September 16, 2004, 6 p.m. to 9 p.m., Pensacola, FL – Pensacola Junior College, Warrington Campus, 5555 West Highway 98, Pensacola, FL 32507 Room Location: McMillian Auditorium

A Web site has been developed to provide further information about the environmental process for the NSWCPC EIS. Please visit the site at: www.ncsc.navy.mil/environmentinfo/default.htm. The Web site gives the schedule and locations of public meetings and hearings, an overview of the NEPA process, and the associated documents as they are released. For further information contact Mrs. Carmen Ferrer, NSWCPC, 110 Vernon Avenue, Panama City, Florida 32407; Email: carmen.ferrer@navy.mil; or call the information line at 850-609-3457. Comments may be emailed or mailed to Mrs. Ferrer and must be postmarked by October 16, 2004.

Information repositories will also contain EIS documents and will be located at the following locations.

Bay County Public Library
25 West Government Street
Panama City, FL 32401

Gulf County Public Library
Highway 71 North
Port St. Joe, FL 32456

Fort Walton Beach Public Library
185 Miracle Strip Parkway SE
Fort Walton Beach, FL 32548

Pensacola Public Library
200 West Gregory Street
Pensacola, FL 32501

Mobile Public Library
701 Government Street
Mobile, AL 36602

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER - PANAMA CITY
110 VERNON AVENUE
PANAMA CITY, FL 32407

IN REPLY REFER TO:

5200
Ser E20/006
September 9, 2004

Dear Sir or Madam:

The purpose of this letter is to inform you that Naval Surface Warfare Center Panama City (NSWCPC) is preparing an Environmental Impact Statement (EIS) to analyze and evaluate potential impacts of its mission activities in our community. Enclosures (1) and (2) contain additional information. Please feel free to call one of the contact numbers listed if you have any comments. If interested, you may also want to participate in the public scoping meeting.

Sincerely,

John Auzins
Head, Test & Evaluation Division
By direction

Encl: (1) NSWCPC EIS FACT Sheet
(2) Agency Scoping Package

AGENCY SCOPING PACKAGE

A. Introduction

This Agency Scoping Package has been prepared for the Environmental Impact Statement (EIS) Naval Surface Warfare Center Panama City (NSWCPC). It is being submitted to agencies for their review with the intent of obtaining input prior to preparation of a Draft EIS. Specifically the Navy would like to receive a list of critical issues and concerns from each key agency. This will allow the Department of the Navy to identify important issues early in the EIS process. In addition, the Navy would like to receive a description of pertinent permit requirements, if applicable, and information on recent changes to permitting and/or consultation requirements. This document is organized into the following sections:

- ***Section A - Introduction:*** background of the EIS, including agency scoping, purpose and need for the Proposed Action, and a general description of current activities at NSWCPC.
- ***Section B - Proposed Action and Alternatives:*** summary of the proposed action and alternatives that will be analyzed in the EIS.
- ***Section C - Potential Environmental Issues:*** summary of key environmental issues anticipated for the EIS.

A-1. Background

Environmental Impact Statement

The Draft EIS is currently being prepared by the Department of the Navy pursuant to the National Environmental Policy Act (NEPA) of 1969; the Council of Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Regulations [CFR] Parts 1500-1508); 32 CFR 775, Department of the Navy Procedures for Implementing the National Environmental Policy Act.

This Draft EIS will address the environmental impacts of actions proposed by the Department of the Navy to continue current and implement new Naval Surface Warfare Center Panama City (NSWCPC) mission activities in three military operating areas in the northern Gulf of Mexico and in St. Andrew Bay. The EIS study encompasses three military operating areas of in the Gulf of Mexico, W-151, W-155, and W-470 (Figure 1). The geographic scope of this EIS includes the St. Andrew Bay, East Bay, West Bay, and the Gulf of Mexico.

Agency Scoping

As part of our partnering process, the Navy is coordinating with several federal and state agencies regarding their concerns and issues for the proposed action to prepare a Draft EIS. This Agency Scoping Package is intended to inform agencies of the Navy's proposed action and to solicit comments on project-related issues. The Draft EIS is currently scheduled to be distributed to the public in December of 2004. A list of the agencies currently identified for pre-scoping coordination is presented below (addresses are listed on Attachment 1):

- U.S. Army Corps of Engineers
- NOAA Fisheries
- US. Fish and Wildlife Service
- Minerals Management Service
- National Park Service
- Federal Aviation Administration
- U.S. Coast Guard
- Air Traffic Control Center
- U.S. Environmental Protection Agency, Region 4
- Federal Emergency Management Agency
- U.S. Department of the Air Force
- Eglin Air Force Base Environmental Management Directorate
- Eglin Air Force Base Environmental Planning Office
- Pensacola Naval Air Station
- Tyndall Air Force Base Environmental Office
- Florida Emergency Management Division
- Florida State Clearinghouse
- Florida Department of Environmental Protection (DEP)
- Florida Fish and Wildlife Conservation Commission (FWC)
- Florida Department of Transportation
- Florida Department of State, Division of Historical Resources
- West Florida Regional Planning Council
- Executive Office of the Governor, Office of Policy and Budget, Environmental Policy Unit
- Office of the Governor, Office of Tourism, Trade, and Economic Development
- Florida Department of Health
- Bureau of Beaches and Wetlands Resources
- Bureau of Submerged Lands Management
- State Historic Preservation Office (SHPO)
- Alabama Department of Conservation and Natural Resources
- Alabama Department of Economic and Community Affairs
- Alabama Department of Environmental Management
- Alabama Emergency Management Agency
- Alabama Bureau of Tourism and Travel

A-2. Purpose and Need for the Proposed Action

Located on the St. Andrew Bay, the Naval Surface Warfare Center Panama City has been operated by the Department of the Navy since World War II. The NSWCPC and its adjacent military operating areas are used by U.S. military services for testing of systems to support the Navy warfighter in mine warfare, special warfare, expeditionary maneuver warfare, operations in extreme environments, and coastal operations.

Current NSWCPC practices satisfy legal compliance for projects and programs on an individual, case-by-case basis. The time and resource limitations induced by handling crisis or surge activities do not support all of the requirements for long term planning of mission activities at NSWCPC. Environmental compliance for the marine activities of concern is governed by several laws that have a variety of associated legal requirements; including (but not limited to) the NEPA, the Endangered Species Act, the Marine Mammal Protection Act, the Magnuson-Stevens Fishery Conservation & Management Act, and the Clean Water Act.

A-3. Current Activities

NSWCPC Operations

Existing and evolving activities at the Naval Surface Warfare Center in Panama City include research, development, test, and evaluation, and in-service engineering for mine warfare, special warfare, expeditionary maneuver warfare, operations in extreme environments, and coastal operations. These operations generally include air, surface, and subsurface operations that require the use of sonar, lasers, electromagnetic fields, and live ordnance.

Environmental Resource Management

The NSWCPC currently manages its natural resources in accordance with applicable environmental regulations. Environmental projects are typically compliance-based, i.e. they are performed to bring NSWCPC into compliance or to maintain compliance. Environmental analysis for individual training and test and evaluation programs proposed for the NSWCPC occurs on a case-by-case basis. The current level of resource management practices includes continuation of various protection programs for archaeological sites and wildlife, including protected species such as marine mammals and sea turtles. In addition, educational programs focused on the environment are conducted by the NSWCPC. Examples of these activities includes KidFest designed to expose children to science; the Three Rivers Science Fair for mentoring, supporting, and judging science fairs at the high school level; and Summer Student Programs implemented to provide entering college freshmen with real-world experience.

B. Proposed Action

The Proposed Action is to improve NSWCPC's capabilities to conduct new and increased mission operations for the Department of Defense and other users within three military operating areas in the northern Gulf of Mexico, and in the St. Andrew Bay area. This would enable the Navy to successfully meet current and future national and global defense challenges by developing a robust capability to meet littoral and expeditionary warfare requirements and by providing RDT&E and in-service engineering for the various areas previously outlined. This allows the Navy to meet its statutory mission to deploy worldwide naval forces equipped and trained to meet existing and emergent threats, and to enhance its ability to operate jointly with other components of the armed forces.

B-1. Alternatives

In addition to the proposed action, alternatives will be considered in the EIS. Alternative 1 involves an increase in NSWCPC capabilities over baseline mission activities, using foreseeable (five year period) test and training requirements to project needed capabilities. Alternative 1 would enhance NSWCPC's ability to meet future needs by incorporating new test capabilities and increases in tempo and intensity of RDT&E activities. Alternative 2 also encompasses an increase in NSWCPC capabilities over baseline mission activities. The principal difference between Alternatives 1 and 2 is that Alternative 2 proposes an increase in testing tempo at a notional 15 percent greater than that proposed in Alternative 1. The no action alternative addresses historic and current mission activities (baseline or status quo) at the NSWCPC operating areas. Table 1 provides a comparison among the alternatives.

Table 1. Comparison of the Level of Activities Among Three Alternatives Currently Being Considered Under the NSWCPC EIS

	No Action Alternative	Alternative 1	Alternative 2
Sonar	**410** hrs/yr	**625** hrs/yr	**719** hrs/yr
Laser	**244** hrs/yr	**351** hrs/yr	**405** hrs/yr
Electromagnetic	**155** hrs/yr	**245** hrs/yr	**281** hrs/yr
Detonations	**3** dets/yr	**23** dets/yr	**26** dets/yr
Projectiles	**50** rnds/yr	**3,674** rnds/yr	**4,226** rnds/yr
Line Charges	**1** line/yr	**2** lines/yr	**3** lines/yr
Air Operations	**416** hrs/yr	**444** hrs/yr	**511** hrs/yr
Surface Operations	**2,279** hrs/yr	**2,408** hrs/yr	**2,769** hrs/yr
Subsurface Operations	**266** MLOs/yr	**322** MLOs/yr	**370** MLOs/yr

C. Potential Environmental Issues

An EIS ensures that the programs and actions of the federal government meet the policies and goals set forth in NEPA. In compliance with 32 CFR 775 (Department of Navy Procedures for Implementing the National Environmental Policy Act), the NSWCPC EIS will provide full and unbiased discussion of significant environmental impacts and inform decision makers and the public of reasonable alternatives that would avoid or

minimize adverse impacts or enhance the quality of the human or natural environment. Federal officials are required by law to use the EIS in conjunction with other relevant materials to plan actions and make decisions.

The NSWCPC EIS will address environmental impacts resulting from implementation of the proposed action and alternatives. All potentially affected environmental resources will be analyzed including: air quality; water resources; coastal zone management; sound (airborne and underwater), wildlife, including threatened and endangered species, marine mammals, and migratory birds; fisheries including essential fish habitat, coastal/marine/benthic communities, and special biological resource areas; artificial reefs; socioeconomics, including recreational and commercial/industrial activities; airspace; safety and occupational health; environmental justice and special risks to children; and cultural resources.

The intent of this Agency Scoping Package is to solicit input on these as well as additional areas of agency concern. The Navy would like to encourage agencies to participate in the environmental review process for the Naval Surface Warfare Center Panama City EIS by providing key input and information on environmental resources. The Navy welcomes the opportunity to meet with appropriate staff to answer questions and discuss key issues. After reviewing this package, please feel free to call and discuss any potential concerns. Future meetings may be coordinated to meet with agency representatives. Thank you in advance for your participation in the NEPA process for this important Navy program.

To schedule a meeting or to obtain additional information on the NSWCPC EIS, please contact:

Commanding Officer
Naval Surface Warfare Center Panama City
Attn: Environmental Team Lead, Mrs. Carmen Ferrer
110 Vernon Avenue, Panama City, FL 32407-7001
Telephone (850) 234-4146
E-Mail: carmen.ferrer@navy.mil

ATTACHMENT 1
AGENCY SCOPING PACKAGE
DISTRIBUTION LIST

U.S. Army Corps of Engineers Jacksonville
District Office Prudential Building
701 San Marco Blvd.
Jacksonville, FL 32207

Mr. Sam Hamilton, Regional Director
U.S. Fish and Wildlife Service
Southeast Region
1875 Century Blvd, Suite 400
Atlanta, GA 30345

U.S. Department of Transportation
400 7th Street, S.W.
Washington, D.C. 20590

Mr. J.I. Palmer, Jr.
Regional Administrator
U.S. Environmental Protection Agency Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth St, SW
Atlanta, GA 30303

U.S. Department of Commerce
NOAA Fisheries
Ken Hollingshead
1315 East-West Highway
Silver Spring, MD 20910

U.S. Department of Interior
Minerals Management Service
Gulf of Mexico OCS Region
New Orleans, Louisiana

U.S. Coast Guard, 8th District
Hale Boggs Federal Building
500 Poydras Street Room
New Orleans, LA 70130

Mr. Kenneth O. Burris, Jr.
Regional Director
Federal Emergency Management Agency
Region IV3003 Chamblee-Tucker Rd
Atlanta, GA 30341

Ms. Gail Carmody
Project Leader
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, FL 32405

U.S. Department of Interior
National Park Service, Southeast Region
Regional Director
National Park Service
100 Alabama St. SW1924 Building
Atlanta, GA 30303

Federal Aviation Administration
Southern Regional Office
1701 Columbia Avenue
College Park, Georgia 30337

Eglin Air Force Base Environmental
Management Directorate
ATTN: Ms. Vickie Preacher
501 De Leon, Suite 101, Building 696
Eglin AFB, FL 32542-5133

46th Test Wing Range Planning Office
ATTN: Mr. Thomas Heffernan
101 West D Avenue Building 1, Suite 222
Eglin AFB, FL 32542

Pensacola Naval Air Station
Environmental Office 00600
Naval Air Station Pensacola
90 Radford Boulevard
Pensacola, FL 32507

325th Civil Engineer Squadron
Environmental Flight
Tyndall Air Force Base, FL 32403

Florida Division Of Emergency Management
2555 Shumard Oak Boulevard
Tallahassee, Florida 32399-2100

Ms. Lauren Milligan
Florida State Clearinghouse
3900 Commonwealth Boulevard MS-47
Tallahassee, FL 32399-3000

Department of Community Affairs
2555 Shumand Oak Blvd
Tallahassee, FL 32399-2100

Florida Department of Environmental Protection
2600 Blair Stone Road M.S. 3500
Tallahassee, Florida 32399

Florida Fish and Wildlife Conservation Commission
620 South Meridian Street
Tallahassee, FL 32399-1600

Mr. Edward Prescott
District 3 Secretary
Florida Department of Transportation
Highway 90 East
Chipley, FL 32428-0607

Florida Division of Historical Resources
500 S. Bronough Street
Tallahassee, FL 32399-0250

Mr. Lel Czeck
Executive Director
West Florida Regional Planning Council
P.O. Box 9759
Pensacola, FL 32513-9759

Executive Office of the Governor, Office of Policy and Budget, Environmental Policy Unit
400 S. Monroe Street
The Capitol
Tallahassee, Florida 32399-0001

Executive Office of the Governor
Office of Tourism, Trade, and Economic Development
The Capitol, Suite 2001
Tallahassee, Florida 32399-0001

Florida Department of Health
Office of the Secretary
4052 Bald Cypress Way, Bin# A00
Tallahassee, FL 32399-1701

Bureau of Beaches and Wetlands Resources
3900 Commonwealth Boulevard
Mail Station 300
Tallahassee, FL 32399-3000

Bureau of Public Land Administration
Submerged Lands Section
Attn: Dale Adams
3900 Commonwealth Boulevard
Carr Building - M.S. 130
Tallahassee, Florida 32399-3000

Offshore Projects and Gulf of Mexico Program
Attn: Debby Tucker
The Department of Environmental Protection
3900 Commonwealth Blvd. MS 47
Tallahassee, Florida 32399-3000

Scott Brown, Chief
Coastal Section
Alabama Department of Environmental Management
4171 Commanders Drive
Mobile, AL. 36615

Alabama Department of Conservation and Natural Resources
64 N. Union Street
Montgomery, Alabama 36130
Alabama Department of Economic and Community Affairs
P.O. Box 5690
Montgomery, AL 36103-5690

Alabama Department of Environmental Management (ADEM)
Montgomery Office
P.O. Box 301463
Montgomery, AL 36130-1463

Alabama Emergency Management Agency
5898 County Road 41P.O. Drawer 2160
Clanton, Alabama 35046-2160

Alabama Bureau of Tourism and Travel
401 Adams Avenue, Suite 126
P.O. Box 4927
Montgomery, AL 36103-4927

Phillip Hinesley
Chief, Coastal Section
Alabama Department of Conservation and Natural Resources
Stonebrook Executive Complex
23210 U.S. Highway 98, Suite B-1
Fairhope, AL 36532

Sgt. Joseph C. Kelley
Alabama Marine Police
P.O. Box 1653
Orange Beach, AL 36561

Dear Sir or Madam:

The purpose of this package is to provide the public with information about the Environmental Impact Statement (EIS) for Naval Surface Warfare Center Panama City (NSWCPC) mission activities. We ask that you please keep this information on file and accessible by the public in your library for one year.

Included to date with this package are: fact sheets and agency scoping information as well as information sent to local agencies, public officials and interested organizations. Detailed information on the EIS process, the base, and NSWCPC environmental stewardship as well as notifications are also available on our website at www.ncsc.navy.mil/environmentinfo/default.htm. We encourage the public to access this site and to submit comments consistent with methods listed there. Comments may be submitted to:

Commanding Officer
Naval Surface Warfare Center Panama City
Attn: Environmental Lead, Mrs. Carmen Ferrer
Code XP01FE
110 Vernon Ave
Panama City, FL 32407-7001
Carmen.Ferrer@navy.mil

In the future, we will send the Draft EIS and the Final EIS as well as other information as pertinent to the NSWCPC EIS process. Thank you for your assistance in providing access to this information by the public.

Sincerely,

Encl: (1) NSWCPC EIS Fact Sheets
(2) NSWPC Agency Scoping Information
(3) NSWPC Information for Local Agencies, Public Officials, and Interested Organizations

and that have significant ecological value. Conservation projects should advance the goals, objectives or implementation of federal, regional, state or local coastal management plans.

The CELCP was created by Public Law 107–77 and codified at 16 U.S.C. 1456d. NOAA issued final guidelines for the program in June 2003. Since the program's creation, CELCP has administered more than 150 grants for land conservation projects in 26 out of 34 eligible coastal states and territories and has run two national funding competitions under the guidelines.

Based on its experience implementing this program, NOAA plans to update the CELCP program guidelines to clarify certain provisions and consider other changes. The revisions will not change the CELCP process, but will clarify certain provisions and consider other improvements. The current Final Guidelines for the CELCP can be found on the Internet at *http://www.coastalmanagement.noaa.gov/land/media/CELCPfinalo2Guidelines.pdf* or can be requested either by phone at 301–713–3155 ext. 119, or by e-mail to *Roxanne.Thomas@noaa.gov*. Any proposed changes to the CELCP guidelines would be published in the **Federal Register**, with an opportunity for public comment, following compliance with any relevant statutes and executive orders.

Dated: April 2, 2008.

John H. Dunnigan,

Assistant Administrator, Ocean Services and Coastal Zone Management, National Oceanic and Atmospheric Administration.

[FR Doc. E8–7399 Filed 4–8–08; 8:45 am]

BILLING CODE 3510–22–M

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XH01

Marine Mammals; File No. 10014–01

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; receipt of application for amendment.

SUMMARY: Notice is hereby given that the New Jersey Department of Environmental Protection (NJDEP), Division of Science, Research and Technology, P.O. Box 409, Trenton, NJ 08625–0409, has applied in due form for an amendment to their Permit No. 10014 to allow them to take additional marine mammals during surveys for purposes of scientific research.

DATES: Written, telefaxed, or e-mail comments must be received on or before May 9, 2008.

ADDRESSES: The application and related documents are available for review upon written request or by appointment in the following office(s):

Permits, Conservation and Education Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Room 13705, Silver Spring, MD 20910; phone (301)713–2289; fax (301)427–2521; and

Northeast Region, NMFS, One Blackburn Drive, Gloucester, MA 01930–2298; phone (978)281–9300; fax (978)281–9394.

Written comments or requests for a public hearing on this application should be mailed to the Chief, Permits, Conservation and Education Division, F/PR1, Office of Protected Resources, NMFS, 1315 East-West Highway, Room 13705, Silver Spring, MD 20910. Those individuals requesting a hearing should set forth the specific reasons why a hearing on this particular request would be appropriate.

Comments may also be submitted by facsimile at (301)427–2521, provided the facsimile is confirmed by hard copy submitted by mail and postmarked no later than the closing date of the comment period.

Comments may also be submitted by e-mail. The mailbox address for providing e-mail comments is *NMFS.Pr1Comments@noaa.gov*. Include in the subject line of the e-mail comment the following document identifier: File No. 10014–01.

FOR FURTHER INFORMATION CONTACT: Patrick Opay or Kate Swails, (301)713–2289.

SUPPLEMENTARY INFORMATION: The subject permit amendment is requested under the authority of the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1361 *et seq.*), and the regulations governing the taking and importing of marine mammals (50 CFR part 216).

The NJDEP seeks permission to increase the number of marine mammals taken during research conducted to elucidate the distribution and abundance of baleen whales, odontocete whales, pinnipeds, and sea turtles. Research would include take by survey approach during shipboard and aircraft transect surveys. Researchers request authorization to take up to 2,500 common dolphins (*Delphinus delphis*), 3,200 bottlenose dolphins (*Tursiops truncatus*), and 1,280 harbor porpoises (*Phocoena phocoena*) annually. The study area would continue to include U.S. waters offshore of southern New Jersey out to a distance of 20 nautical miles.

In compliance with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*), an initial determination has been made that the activity proposed will require a supplemental environmental assessment.

Concurrent with the publication of this notice in the **Federal Register**, NMFS is forwarding copies of this application to the Marine Mammal Commission and its Committee of Scientific Advisors.

Dated: April 3, 2008.

P. Michael Payne,

Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. E8–7480 Filed 4–8–08; 8:45 am]

BILLING CODE 3510–22–S

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Public Hearings for the Naval Surface Warfare Center Panama City Division (NSWC PCD) Mission Activities Draft Environmental Impact Statement/Overseas Environmental Impact Statement

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 and regulations implemented by the Council on Environmental Quality (40 CFR parts 1500–1508), and Presidential Executive Order 12114, the Department of the Navy (Navy) has prepared and filed with the U.S. Environmental Protection Agency a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) on March 27, 2008, to evaluate the potential environmental effects associated with the Naval Surface Warfare Center, Panama City Division (NSWC PCD) mission activities within the NSWC PCD Study Area, which includes St. Andrew Bay (SAB), and military warning areas W–151 (includes Panama City Operating Area), W–155 (includes Pensacola Operating Area), and W–470.

The Proposed Action is to improve NSWC PCD's capabilities to conduct new and increased mission operations for the Department of Defense (DoD) and its customers within the NSWC PCD Study Area. The research, development, test, and evaluation (RDT&E) activities occurring in these areas include air

operations, surface operations, subsurface operations, sonar operations, electromagnetic operations, laser operations, ordnance operations, and projectile firing. A Notice of Intent for this Draft EIS/OEIS was published in the **Federal Register** on August 19, 2004 (69 FR 51453).

The Navy will conduct three public hearings to receive oral and written comments on the Draft EIS/OEIS. Federal agencies, state agencies, and local agencies and interested individuals are invited to be present or represented at the public hearings. This notice announces the dates and locations of the public hearings for this Draft EIS/OEIS.

Dates and Addresses: An open house session will precede the scheduled public hearing at each of the locations listed below and will allow individuals to review the information presented in the Draft EIS/OEIS. Navy representatives will be available during the open house sessions to clarify information related to the Draft EIS/OEIS.

In addition, the National Marine Fisheries Service (NMFS), which is participating as a cooperating agency in the development of the EIS, will be represented at the open houses and public hearings. All meetings will start with an open house from 6 p.m. to 7 p.m. Presentations and public comment will be held from 7 p.m. to 9 p.m. Public hearings will be held on the following dates and at the following locations:

1. May 5, 2008, Gulf Coast Community College, Student Union Conference Center, 5230 West Hwy 98, Panama City, Florida.

2. May 6, 2008, Pensacola Junior College—Warrington Campus, McMillian Auditorium, 5555 Highway 98 West, Pensacola, Florida.

3. May 7, 2008, Port St. Joe Elementary School Auditorium, 2201 Long Avenue, Port St. Joe, Florida.

FOR FURTHER INFORMATION CONTACT: Mrs. Carmen Ferrer, Naval Surface Warfare Center Panama City Division, 110 Vernon Avenue, Panama City, Florida 32407; telephone: 850–234–4146; E-mail *carmen.ferrer@navy.mil.*

SUPPLEMENTARY INFORMATION: NSWC PCD is the United States (U.S.) Navy's premier research and development organization focused on littoral (coastal region) warfare and expeditionary (designed for military operations abroad) warfare. NSWC PCD provides in-water research, development, test, and evaluation (RDT&E) in support of expeditionary maneuver warfare, operations in extreme environments, mine warfare, maritime operations, and coastal operations.

NSWC PCD is the nation's principal repository of this expertise supported by a diverse technical workforce in these areas that are critical to the future of U.S. Navy and U.S. Marine Corps operations. In accordance with Department of Defense (DoD) Directive 5000.1, test and evaluation support is to be integrated throughout the defense acquisition process (the process that encompasses every aspect of identifying, developing, and procuring defense systems) and is structured to provide essential information to decision makers. Such testing is used to validate the technical performance parameters (whether a given system performs as expected) and to determine whether systems are operationally effective, suitable, survivable, and safe for their intended use.

It is the mission of NSWC PCD to provide RDT&E, as well as in-service support for amphibious warfare, diving, maritime special operations, mine warfare (mines and mine countermeasures), and other naval missions that take place in the coastal region. The infrastructure has been established at NSWC PCD to support this mission. A unique feature of NSWC PCD that is unduplicated in the U.S. is the natural operating environment provided by the ready access to the Gulf of Mexico (GOM) and its associated littoral and coastal regions. The GOM provides a surrogate environment for most of the littoral areas of the world in which the Navy will find itself operating for the foreseeable future.

The NSWC PCD Draft EIS/OEIS addresses all of the identified RDT&E operations that occur within the NSWC PCD Study Area. The NSWC PCD RDT&E activities may be conducted anywhere within the existing military operating areas and St. Andrews Bay from the mean high water line (average high tide mark) out to 222 kilometer (120 nautical miles) offshore.

The Draft EIS/OEIS evaluates the potential environmental impacts of three alternatives, including two action alternatives (Alternatives 1 and 2) and the No Action Alternative. The No Action Alternative addresses historical and current mission activities (referred to cumulatively as "baseline mission activities") for the NSWC PCD Study Area. Alternatives 1 and 2 analyze baseline activities, as well as future growth requirements for missions and activity levels. The development process incorporated the need to support future test capabilities, expand required mission capabilities, and increase the baseline tempo and intensity of activities. Alternative 2 is the Navy's preferred alternative.

No significant adverse impacts are identified for any resource area in any geographic location within the NSWC PCD Study Area that cannot be mitigated, with the exception of exposure of marine mammals and sea turtles to underwater sound. The Navy will apply to NMFS for a Marine Mammal Protection Act Letter of Authorization (LOA) and governing regulations to authorize incidental takes of marine mammals that may result from the implementation of the activities analyzed in the Draft EIS/OEIS. NMFS is participating as a cooperating agency in the development of this Draft EIS/OEIS. NMFS staff will be present at the scheduled open houses and public hearings and available to discuss both the MMPA incidental take authorization process and NMFS's participation in the development of the EIS/OEIS.

The Draft EIS/OEIS is being mailed to Federal, State, and local agencies, elected officials, and other interested individuals and organizations. The public comment period will end May 19, 2008.

Copies of the Draft EIS/OEIS are available for public review at the following libraries: Bay County Public Library, 25 West Government Street, Panama City, FL 32401; Gulf County Public Library, 110 Library Drive, Port St. Joe, FL 32456; Fort Walton Beach Public Library, 185 Miracle Strip Pkwy SE, Fort Walton Beach, FL 32548; and Pensacola Public Library, 200 West Gregory Street Pensacola, FL 32501.

The Draft EIS/OEIS is also available for electronic public viewing at *http://nswcpc.navsea.navy.mil/Environment.htm.* A paper copy of the Executive Summary or a single CD of the Draft EIS/OEIS will be made available upon request by contacting Mrs. Carmen Ferrer, Naval Surface Warfare Center Panama City Division, 110 Vernon Avenue, Panama City, Florida 32407; E-mail: *carmen.ferrer@navy.mil.*

Federal, State, and local agencies and interested parties are invited to be present or represented at the public hearing. Written comments can also be submitted during the open house sessions preceding the public hearings. Oral statements will be heard and transcribed by a stenographer; however, to ensure the accuracy of the record, all statements should be submitted in writing. All statements, both oral and written, will become part of the public record on the Draft EIS/OEIS and will be responded to in the Final EIS/OEIS. Equal weight will be given to both oral and written statements.

In the interest of available time, and to ensure all who wish to give an oral statement have the opportunity to do so, each speaker's comments will be limited to three (3) minutes. If a long statement is to be presented, it should be summarized at the public hearing and the full text submitted in writing at the hearing, mailed to Mrs. Carmen Ferrer, Naval Surface Warfare Center Panama City Division, 110 Vernon Avenue, Panama City, Florida 32407 or submitted via e-mail to *nswcpcpaowebmanager@navy.mil.*

All written comments must be postmarked or received by May 19, 2008, to ensure they become part of the official record. All comments will be responded to in the Final EIS/OEIS.

Dated: April 3, 2008.

T. M. Cruz,

Lieutenant, Judge Advocate General's Corps, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. E8–7461 Filed 4–8–08; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Terminate the Draft Supplemental Environmental Impact Statement for the Introduction of F/A–18E/F (Super Hornet) Aircraft to the East Coast of the United States (Construction and Operation of an Outlying Landing Field); To Prepare an Environmental Impact Statement for Construction and Operation of an Outlying Landing Field To Support Carrier Air Wing Aircraft at Naval Air Station Oceana and Naval Station Norfolk, VA; and To Announce Public Scoping Meetings

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: In a Notice of Intent published on June 24, 2005 (70 **Federal Register** [FR] 36566), the Department of the Navy announced its intent to prepare a Supplemental Environmental Impact Statement (SEIS) to provide additional analysis of the environmental consequences associated with the construction and operation of an Outlying Landing Field (OLF) needed to support operations of Super Hornet squadrons stationed at Naval Air Station (NAS) Oceana, Virginia, and Marine Corps Air Station (MCAS) Cherry Point, North Carolina. The U.S. Environmental Protection Agency (EPA) published a Notice of Availability (NOA) of the Draft SEIS on February 23, 2007 (72 FR 8155). Pursuant to section (102)(2)(c) of the National Environmental Policy Act (NEPA) of 1969 and the regulations implemented by the Council on Environmental Quality (40 CFR Parts 1500–1508), the Navy announces its intent to terminate the Draft SEIS for the Introduction of F/A–18E/F (Super Hornet) Aircraft to the East Coast of the United States (Construction and Operation of an Outlying Landing Field) and prepare an EIS to evaluate potential environmental consequences of the construction and operation of an OLF at new alternative sites to support Field Carrier Landing Practice (FCLP) training requirements for carrier-based fixed-wing aircraft stationed at and transient to NAS Oceana and Naval Station (NS) Norfolk Chambers Field, Virginia. The five new alternative OLF sites identified to date are: (1) Cabin Point Site, located in Surry, Prince George, and Sussex counties, Virginia; (2) Dory Site, located in Southampton and Sussex counties, Virginia; (3) Mason Site, located in Sussex and Southampton counties, Virginia; (4) Sandbanks Site, located in Gates and Hertford counties, North Carolina; and (5) Hale's Lake Site, located in Camden and Currituck counties, North Carolina. These five site alternatives were identified by applying operational, environmental and population criteria to a list of 13 new sites provided by the State of North Carolina and the Commonwealth of Virginia, as well as on the five sites examined in the Draft SEIS.

Dates and Addresses: The Navy is initiating a scoping process to identify community concerns and local issues that will be addressed in the EIS. Federal, state, and local elected officials and agencies and interested persons are encouraged to provide comments to the Navy to identify environmental concerns that should be addressed in the EIS. To be most helpful, scoping comments should clearly describe the specific issues or topics the EIS should address.

Public scoping meetings, using an Open House format, will be held to receive written comments or concerns that should be addressed in the EIS. Public scoping meetings will be as follows:

1. Currituck County, North Carolina. North Carolina Cooperative Extension, Currituck County Center, 120 Community Way, Barco, NC 27917 on April 28, 2008, 4 p.m. to 9 p.m.;

2. Prince George County, Virginia. J.E.J Moore Middle School, 11455 Prince George Drive, Disputanta, VA 23842 on April 29, 2008, 4 p.m. to 9 p.m.;

3. Sussex County, Virginia. Sussex Central High School, 21394 Sussex Drive, Sussex, VA 23884 on April 30, 2008, 4 p.m. to 9 p.m.;

4. Southampton County, Virginia. Southampton High School, 23350 Southampton Parkway, Courtland, VA 23837 on May 1, 2008, 4 p.m. to 9 p.m.;

5. Gates County, North Carolina. Gates County High School, 088 U.S. Highway 158 West, Gatesville, NC 27938 on May 2, 2008, 4 p.m. to 9 p.m.;

6. Camden County, North Carolina. Camden County High School, 103 U.S. Highway 158 West, Camden, NC 27921 on May 5, 2008, 4 p.m. to 9 p.m.; and

7. Surry County, Virginia. Surry Central High School. 1675 Hollybush Road, Dendron, VA 23839 on May 7, 2008, 4 p.m. to 9 p.m.

The dates, times, and locations of public scoping meetings are also available at (*http://www.olfeis.com*), and will be provided to local and regional media serving localities in the vicinity of proposed OLF sites.

Comments can be made in the following ways: (1) Written statements submitted to Navy representatives at the public scoping open houses; (2) written statements mailed to Commander, Naval Facilities Engineering Command Atlantic, 6506 Hampton Boulevard, Norfolk, Virginia 23508, Attn: Code EV OLF Project Manager; and (3) written statements submitted via the Web site at *http://www.OLFEIS.com.* All written comments must be postmarked by June 7, 2008.

SUPPLEMENTARY INFORMATION: The Navy proposes to construct an OLF that will support the FCLP operations of carrier-based fixed-wing aircraft squadrons stationed at and transient to NAS Oceana, Virginia Beach, Virginia (F/A–18C Hornet and F/A–18E/F Super Hornet squadrons and Fleet Replacement Squadrons (FRS)), and NS Norfolk Chambers Field, Norfolk, Virginia (E–2C Hawkeye, C–2A Greyhound, and E–2C/C–2A FRS). While NALF Fentress will continue providing necessary support for FCLP and other training requirements, this landing field alone cannot fully support training requirements of home-based and transient aircraft from NAS Oceana and NS Norfolk Chambers Field. Training requirements for aircraft based at these airfields can exceed NALF Fentress capacity up to 63% of the time during summertime when hours of darkness are limited. Capacity problems are further exacerbated when operational demands require surging additional carrier strike groups. A new OLF is required to provide year-round capacity to support FCLP training requirements under the Fleet Response Plan, provide operational flexibility needed to respond to emergent national defense requirements, and FCLP

Local & State

Man charged with threatening Virginia Tech style massacre

MIAMI (AP) — A 20-year-old with a weapons cache that included four AK-47s was arrested after threatening to re-enact a Virginia-Tech style massacre over the Internet, authorities said Thursday.

Oregon authorities learned of a March 25 Internet message allegedly posted by Calin Chi Wong in which he threatened to re-enact the Virginia Tech killings. Two days later, Homestead Police searched the home Wong shares with his parents and found the weapons in stacked on shelves in plain view, Detective Antonio Aquino said.

Wong had 13 firearms in all, including two snipers, more than 5,000 rounds of ammunition, some that could pierce armor, and 100 rounds in a feeding clip with bullets meant to take down aircraft or military machines. He'd hidden two AK-47s in his parents closet and his parents said the guns did not belong to them, Aquino said.

Wong was charged with making written threats to kill or do bodily injury via the computer and bonded out for $7,500. Additional charges are pending, he said. A message left at a phone number listed for Wong was not immediately returned Thursday evening. The phone at his employer, China King, rang unanswered. It was not known if he had a lawyer.

Homestead Police first noticed Wong when he went to the department in February to complain he had been ripped off for $800 over the Internet after he ordered a gun online using his father's Paypal account.

He told authorities he'd called the FBI, ATF and other agencies about the issue and had finally reached a boiling point when he posted the message saying he would re-enact the Virginia Tech massacre, Aquino said.

"After speaking to him and seeing his frustration, I believe that he had the potential to carry out some kind of threat," Aquino said.

Wong felt isolated and cut off, authorities said. He'd been buying and selling guns for about two years and now word was getting around about Wong's age. Dealers stopped selling to him and he was being banned from certain gun-sale web sites.

"I'm soon to the point to re-enact the whole event," Wong wrote under the name "thehumanabc" referring to the shootings last April at Virginia Tech.

"This may not seem like a threat to you, but I'm sure others don't want to see it occur again. It should be a wake up call for All haters out there," according to an arrest report.

Wong told police making the threat made him feel good because after "he had thousands of people on the Internet paying attention to him," Aquino said.

Wong also said he was just upset and frustrated and never actually planned a killing spree.

HOT TAMALE



NICK TOMECEK | Daily News

Driver Troy Rose (left) and Marshall Steele struggle to put a 1,000-pound tire on "Hot Tamale" on Thursday at Restylers Aftermarket Specialist in Fort Walton Beach to promote a monster truck show this weekend at the Northwest Florida Fairgrounds. Gates open at 6 p.m. Friday and Saturday for the 8 p.m. shows. Gates open at noon Sunday for the 2 p.m. show. Tickets are $20 and $10 for children ages 3 to 13.

Jury finds man guilty in samurai sword killing

TAMPA (AP) — A Tampa jury has found a man guilty of second-degree murder in a samurai sword attack on his estranged wife's boyfriend.

Prosecutors said 47-year-old Willie Tarpley Jr. fatally stabbed Lee Alexander because he was enraged his family had fallen apart.

Tarpley's attorneys argued their client simply wanted to protect his young daughters from the boyfriend, who was a registered sex offender. They say he didn't mean to kill him.

The attack took place May 12 and authorities say the sword had a 42-inch blade.

Sentencing in the case is set for April 23.

Today in local HISTORY

25 years ago:

● Staff's Restaurant in Fort Walton Beach was offering stuffed scamp with salad bar and potato for $8.95.

● Nightown was hosting The Members, Modern English, Berlin, the Nitty Gritty Dirt Band and B.B. King in April.

10 years ago:

● Timber-cutting by Eglin Air Force Base across from Okaloosa Regional Airport was part of an effort to restore the long-leaf pine forests that dominated the area before it was settled.

● Two local legislators were sponsoring a bill that would require the state to sell land to Walton County for a town center at cost plus interest.

5 years ago:

● At a time when most schools had sliced art budgets, Elliott Point Elementary was scraping together extra dollars for weekly classes at a downtown art studio.

● Senators from Florida were challenging the wording of a bill that could threaten the offshore oil drilling ban.

LOTTERY

Winning numbers are:

CASH 3 6-5-3

Play 4 8-7-9-4

FANTASY 5 9-14-19-28-30

No ticket wins Lotto; prize hits to $10 million

TALLAHASSEE (AP) — No ticket matched all six Florida Lotto numbers, producing an estimated $10 million jackpot for the next drawing, lottery officials said Thursday.

A total of 61 tickets matched five numbers to win $5,044.50 each; 4,016 tickets matched four numbers for $62 each; and 78,826tickets matched three numbers for $4.50 each.

The winning Florida Lotto numbers selected Wednesday: 1-4-11-24-42-53.

4 Fantasy 5 players share $254,876 prize

TALLAHASSEE (AP) — Four winners of the Fantasy 5 game will collect $63,719.10 each, the Florida Lottery said Thursday.

The winning tickets were bought in Ocala, Miami and Melbourne, lottery officials reported.

The 690 tickets matching four numbers won $59.50 each. Another 16,612 tickets matching three numbers won $6.50 each, and 127,741 tickets won a Quick Pick ticket for picking two numbers.

The numbers drawn Wednesday night were 3-6-7-9-23.

RAUEL from page C1

Shuman, who added that he was constantly impressed by the team's professionalism.

Robison said she's not really sure how well the team will do, but just getting to Atlanta makes all the hard work worth it.

She said the group has formed some kind of unnatural attachment to Rauel, which has given up smoking.

"It's so pathetic," she joked, "but it's so fun."

Daily News Staff Writer Rachel Kyler can be reached at 863-1111, Ext. 1440.

HOUSE FINCHES from page C1

"She started flying around, started pooping. I screamed and ran away."

She used her cell phone to ask her mom to open the garage door.

Now, the Onianwas are just waiting until the young birds fledge so they can reclaim their door.

Phillips has some advice for them. They might want to move the wreath to avoid having the same problem again later in the season.

"Birds will come back to the same place," she said.

Daily News Staff Writer Wendy Victora can be reached at 863-1111, Ext. 1478.

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NORTHWEST FLORIDA Daily News

Calendar

●Walking Club: Walking to music, Destin Community Center gymnasium, 8 a.m. 654-5184.

● Coastal Wood Carvers: Meets 9 a.m.-noon, Destin Community Center. $3 charge per class includes instruction, ideas from other carvers and your first block of wood. 654-5184.

● Audubon Eventure's: Night walk at Oak Tree Nature Park, Mary Esther, 6:30 p.m. Families encouraged to join in, but the focus will be on ages 4-10. Bring a flashlight and wear bug repellent. RSVP to 862-9588.

● one + ONE Singles: Dinner at Sons of Italy, 6 p.m., followed by games at Becky's house. 218-0762.

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NAVSEA WARFARE CENTERS PANAMA CITY

Provide Your Comments on the NSWC PCD Draft EIS/OEIS

The U.S. Navy has completed the Naval Surface Warfare Center Panama City Division (NSWCPCD) Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental consequences associated with testing activities involving air, surface, and subsurface operations that require the use of sonar, lasers, electromagnetic fields, and live ordnance. The proposed activities would take place in St. Andrews Bay and the Gulf of Mexico.

The Navy is announcing the public hearings and public comment period on the draft EIS/OEIS.

City	Date	Time	Location
Panama City	May 5	6-9 p.m.	Gulf Coast Community College; Student Union Conference Center; 5230 West Highway 98.
Pensacola	May 6	6-9 p.m.	McMillian Auditorium; Pensacola Junior College – Warrington Campus; 5555 Highway 98 West.
Port St. Joe	May 7	6-9 p.m.	Port St. Joe Elementary School; Elementary School Auditorium; 2201 Long Avenue.

The Navy will hold an informative open house from 6-7 p.m. At 7 p.m., Navy officials will make a brief presentation and members of the public will be given the opportunity to make oral comments about the Draft EIS/OEIS.

A copy of the draft EIS/OEIS is available for public viewing on the project Website at: http://nswcpc.navsea.navy.mil/environmental/eis.asp and at the following local libraries: Bay and Gulf County, Fort Walton Beach, Pensacola and Mobile public libraries.

You may also mail in comments to:

Commanding Officer
Naval Surface Warfare Center
Panama City Division
Attn: Environmental Team Lead, Mrs. Carmen Ferrer
110 Vernon Avenue, Panama City, FL 32407-7001
E-Mail: nswcpcpaowebmanager@navy.mil/

Please submit all comments by June 1, 2008 to ensure that the U.S. Navy addresses them in the Final EIS/OEIS.

Local & State

Philharmonic board votes to dissolve organization

By TOM McLAUGHLIN
tomm@nwfdailynews.com

In the wake of founder and music director David Ott's retirement announcement, the membership of the Philharmonic Society of Northwest Florida has voted to disband.

Ursel Behnken, a member of the organization's board of directors, termed the action "a dissolution."

The organization will cease to exist at the end of this concert season June 30, when Ott conducts his final show.

"It's been a wonderful experience," board member Peggy Rice said of the orchestra.

Ott moved to the Emerald Coast in 1996 and took over as conductor of the Northwest Florida Symphony Orchestra at Okaloosa-Walton Community College in 1999.

He left that position in 2001 to serve as music director for the Philharmonic Society.

He announced his retirement in February through Susan Kneller, chairwoman of the Philharmonic Society's board. Kneller said Ott was leaving to put more time into music composition.

Kneller confirmed that the vote to disband came Wednesday at a membership meeting. She declined further comment and said a press release would be issued today.

Debra Miller, the Philharmonic Society's executive director, also had no comment.

The organization's dissolution leaves the region with two symphonies, the Northwest Florida Symphony Orchestra and Sinfonia, under conductor Demetrius Fuller.

That one of the three eventually would go out of business was not a complete surprise to Steve Czonstka, a member of the Northwest Florida Symphony Guild.

"There's not room in this small town for three separate orchestra organizations," he said. "I hope some of those who belong to the Philharmonic will join the guild."

Fuller said the Philharmonic Society contributed to the community.

"It is unfortunate that the board of Philharmonic had to make the decision to cease operations," Fuller said in an e-mail. "The Philharmonic was an asset to our community. The impact will surely be felt by the many patrons that Maestro Ott has touched over the years with his passion for music."

Public RECORD

FELONY ARRESTS

- April 23 – Julia A. Grant, 24, of Lloyd Street, Fort Walton Beach, charged with driving while license suspended or revoked.
- April 23 – Adolfo Roura III, 23, of Pensacola, charged with fraud, theft and dealing in stolen property.
- April 23 – Alyxzander R. Schank, 19, of John Sims Parkway, Valparaiso, charged with criminal mischief.
- April 22 – Ray A. Adams Jr., 33, of Pine Ridge Street, Destin, charged with possession of a controlled substance without a prescription.
- April 22 – Christa G. Knox, 42, of Laurie Drive, Fort Walton Beach, charged with sale of cocaine.
- April 22 – Kenneth Holt Jr., 23, of Lowery Drive, Fort Walton Beach, charged with tampering with evidence.
- April 22 – Christopher D. Matekovich, 38, of Forest Street, Destin, charged with tampering with evidence and being an accessory after the fact.
- April 22 – Carl L. Washburn, 34, of Tarrytown Road, Milton, charged with unlicensed contracting during a state of emergency.
- April 21 – A 16-year-old Crestview girl, charged with grand theft and burglary to a dwelling.
- April 21 – Timothy N. Shoffner, 30, of U.S. Highway 90, Crestview, charged with grand theft auto.
- April 21 – Monica J. Pride, 30, of Poplar Avenue, Fort Walton Beach, charged with trafficking in Hydrocodone, possession of a controlled substance with intent to distribute and retail theft.
- April 21 – Darius J. Coward, 17, address unknown, charged with robbery.
- April 20 – Lakiesha L. Patterson, 27, of Carlos Street, Navarre, charged with failure to return a hired or leased vehicle.
- April 20 – Marcus C. Waldrop, 32, address unknown, charged with grand theft.
- April 18 – Robert E. Jackson, 41, of Highway Avenue, Fort Walton Beach, charged with aggravated assault on a law enforcement officer and driving while license suspended or revoked.
- April 18 – Edwin R. Tallent, 42, of Fourth Street, Shalimar, charged with possession of cocaine.

MARRIAGE LICENSES

- Okaloosa County – Richard Timothy Fogleman, 45, of Panama City, and Lisa Anne Hodge, 49, of Fort Walton Beach; Clyde Newbold, 55, and Patricia Ann Lemon, 45, both of Fort Walton Beach; Jose Luis Aponte Jr., 28, and Brandi Marie Wilson, 26, both of Fort Walton Beach; Steven Douglas Van Keuren, 32, and Monica Nicole Odom, 26, both of Destin; Paul Philip Reynolds, 22, and Krista Rhianne Spence, 22, both of Fort Walton Beach; Thomas Jefferson Dykes, 71, and Agnes Jeanell Webb, 64, both of Fort Walton Beach; Michael Jay Johnson Jr., 25, and Tamiekian Tiesha Monec Hill, 26, both of Fort Walton Beach; Jonathan Daniel Stewart, 28, of Niceville, and Morningstar Davis Potts, 26, of Joshua Tree, Calif.; Nicholas Bradley Williams, 23, and Donna Marie Finch, 23, both of Niceville; Mark Christopher Nucci, 39, and Nenita Laput Redoble, 26, both of Navarre; Kevin Owen Younghanse, 37, and Lisa Faye Younghanse, 34, both of Fort Walton Beach; Michael Scott Queen, 25, and Meghann Michele Wesley, 24, both of Fort Walton Beach; Brandon Hughes Stricklin, 25, and Leslie Elizabeth Gray, 24, both of Destin; Dipency Jeffrey Georges, 21, and Anna Alekseevna Generalova, 23, both of Destin; Christopher Michael Tallent, 30, and Sara Catherine Gibson, 28, both of Destin; Kevin Michael Holloway, 31, of Warner Robins, Ga., and Tiffani Alisha Prieto, 29, of Fort Walton Beach.

DIVORCES GRANTED

- Okaloosa County – Diane M. Thomason and Dean R. Thomason; Leo Joseph Hagan III and Diana T. Romanska; Danny Javier Sanchez and Magalys Emma Alvarez; Judith E. Coelho and Daniel J. Coelho.

SATISFACTIONS OF JUDGMENT

- Okaloosa County – Melinda L. Parrott has satisfied debt with North Okaloosa Medical Center; Sharon J. Martin and Grant Martin have satisfied judgment with North Okaloosa Medical Center; John Gary Threadgill, et. al., has satisfied debt with Suntrust Bank; Christopher Ricketts has satisfied debt with First National Bank & Trust.

DEATH

- James Marschko, age 51, of Caryville, Fla., passed away April 23, 2008, at his residence. Arrangements under the direction of Davis-Watkins Funeral Home and Crematory of DeFuniak Springs.

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Florida Lotto multimillionaire dies broke

TAMPA (AP) — A former Florida Lotto multimillionaire has died nearly broke.

Alex Toth's attorney says he was ill and still facing federal tax fraud charges when he died at age 60. The county health department says he died April 5 but a cause was not listed.

Alex and Rhoda Toth won a $13 million jackpot in 1990.

But the Pasco County couple say most of the money ran out years ago, spent on gambling, gifts and luxuries.

They were charged in 2006 with filing false tax returns.

Alex Toth was scheduled to stand trial in June. His wife has already accepted a plea agreement from prosecutors.

The couple split up last year when Alex Toth went to a medical facility to be treated for mental problems that had left him incompetent to stand trial.

Calendar

- **Walking Club:** Walking to music, Destin Community Center gymnasium, 8 a.m. 654-5184.
- **Coastal Wood Carvers:** Meets 9 a.m.-noon, Destin Community Center. $3 charge per class includes instruction, ideas from other carvers and your first block of wood. 654-5184.
- **Mammy and Me:** Stay-at-home Mommies and their young children meet 9 a.m., Risen Savior Lutheran Church, 9664 Navarre Parkway, Navarre. Snacks provided. 455-8217.

Today in local HISTORY

25 years ago:

- Motorcyclists from around Florida gathered at the Capitol in Tallahassee to protest the state's helmet law.
- A four-bedroom Lake Lorraine home on Choctawhatchee Bay was for lease for $1,000 a month.

10 years ago:

- Residents near the private landfill off Carmel Drive in Wright were complaining about the sight and smell after the debris reached the height of a two-story building.
- Both the Niceville boys and girls tennis teams were headed to the state tournament in Gainesville after winning their respective Class 6A North 1 Regional matches on the road.

5 years ago:

- Destin celebrated Arbor Day as Tree City USA.
- The Boys and Girls Club of the Emerald Coast celebrated the realization of a 34-year dream with the grand opening of its new Teen Center.

LOTTERY

Winning numbers are:

CASH 3 4-6-9 **Play 4** 0-8-1-1

FANTASY 5 8-14-17-35-36

Three Fantasy 5 players share $256,247 prize

TALLAHASSEE (AP) — Three winners of the Fantasy 5 game will collect $85,415.95 each, the Florida Lottery said Thursday.

The winning tickets were bought in Middleburg, Pensacola and Brandon, lottery officials reported.

The 392 tickets matching four numbers won $105 each. Another 11,057 tickets matching three numbers won $10 each, and 109,099 tickets won a Quick Pick ticket for picking two numbers.

The numbers drawn Wednesday night were 9-18-22-25-31.

Florida Lotto jackpot rises to $38 million

TALLAHASSEE (AP) — The jackpot in the Florida Lotto game has grown to $38 million after no one matched the six winning numbers in the latest drawing, lottery officials said Thursday.

A total of 112 tickets matched five numbers to win $5,090 each; 6,794 tickets matched four numbers for $68 each; and 134,505 tickets matched three numbers for $4.50 each.

The winning Florida Lotto numbers selected Wednesday: 4-10-19-34-38-45.

NAVSEA WARFARE CENTERS PANAMA CITY

Provide Your Comments on the NSWC PCD Draft EIS/OEIS

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The Navy is announcing the public hearings and public comment period on the draft EIS/OEIS.

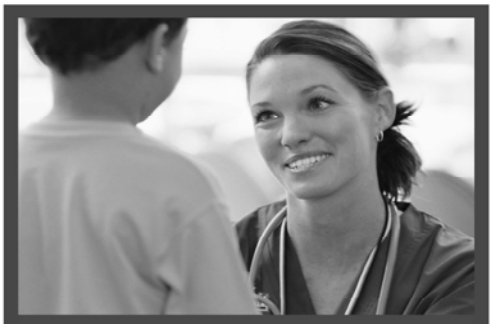
City	Date	Time	Location
Panama City	May 5	6-9 p.m.	Gulf Coast Community College; Student Union Conference Center; 5230 West Highway 98.
Pensacola	May 6	6-9 p.m.	McMillian Auditorium; Pensacola Junior College – Warrington Campus; 5555 Highway 98 West.
Port St. Joe	May 7	6-9 p.m.	Port St. Joe Elementary School, Elementary School Auditorium; 2201 Long Avenue.

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You may also mail in comments to:

Commanding Officer
Naval Surface Warfare Center
Panama City Division
Attn: Environmental Team Lead, Mrs. Carmen Ferer
110 Vernon Avenue, Panama City, FL 32407-7001
E-Mail: nswcpcpaowebmanager@navy.mil/

Please submit all comments by May 19, 2008 to ensure that the U.S. Navy addresses them in the Final EIS/OEIS.



Maybe you didn't choose your nurse.

But you can choose to honor one.

PATIENT CHOICE AWARD

All of our nurses strive to provide compassionate care and we take pride in our team's dedication. As with any group, however, there are always a few individuals who really stand out from the crowd. And this is where we need your help – in identifying these exceptional caregivers. If you or a family member have come to us for inpatient or outpatient care in the last year and have a nurse you'd like to thank for going the extra mile, let us know about your experience.

Nominate your favorite nurse for the 2008 Patient Choice Award. All you have to do is email, mail or fax your nomination to us by April 30. Be sure to include your name, address, phone number, nurse's name and the reason for nominating your choice. We'll be announcing and publicizing the winner of this award in conjunction with **National Nurses Week, May 6 through May 12.**

Submit Nominations by April 30
Email: *lynn_yort@chs.net*
Mail: Lynn Yort
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151 East Redstone Avenue
Crestview, FL 32539
Fax: 850-689-8487

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www.northokaloosa.com

CHULA'S: Agency says report just 'snapshot'

From page 1B

animal food" being stored with ready-to-eat food. But Taylor explained she had made up some hamburger patties, which she individually wrapped and put in a plastic container. She put the container on a shelf beside a wrapped loaf of bread.

The state Department of Business and Professional Regulation's, or DBPR's, 183 inspectors conduct inspections twice a year at hotels and restaurants throughout the state, but more often if there are complaints. It conducted 140,000 inspections last year and found 750,000 violations at restaurants and hotels, said Sam Farkas, the department's press secretary.

Farkas said Florida has one of the best inspection systems in the country.

"Unlike some states, we don't use the grading system," Farkas said. "Our ratings are risk-based. We cumulatively look at elements. ... Given the resources that we have, we're doing the best that we can."

The agency's Web site describes each inspection report as a "snapshot of conditions present at the time of the inspection. ... Inspections conducted on any given day may not be representative of the overall, long-term conditions at the establishment. Because conditions can change rapidly, establishments are not graded or rated."

Taylor does not deny the state inspector found 20 violations on the last visit; she just wants people to know the majority of the violations were minor and that a simple reading of the inspector's report, which is posted online, can be misleading.

A DBPR official said that cannot be helped.

"There aren't detailed notes," said Jenn Meale, the department's communication director. "The inspectors use hand-helds (devices to record information) with a drop-down menu."

Taylor also was angry the inspector reported seeing 100 dead roaches and 15 to 20 live roaches when she maintains there were only a few dead ones and eight small, live ones.

"We have regular pest control," said manager Kim Byrd. "I've been in the restaurant business for 24 years, and I've never been in a restaurant that is completely free of roaches in Florida."

Chula's was closed over this violation for several reasons. The staff wanted to get the problem corrected and didn't want the roach spray fumes to affect diners, Taylor said.

"The presence of roaches is a critical violation that requires emergency closure," Meale said. "But the owners can correct the problem and be back open in 24 hours."

Byrd said 20 violations does not equate to a bad inspection, when compared to the numbers other area restaurants have racked up. She and Taylor went online and pulled inspection reports on four other popular local eateries. The number of violations at those restaurants ranged from 27 to 48. Many of the citations on those reports also were minor: out-of-date tags and improper mounting of fire extinguishers, open Dumpsters and restaurant license not properly displayed.

Taylor, who is from Costa Rica and opened Chula's in 2006, has a degree in nursing, which she worked at for five years before graduating from the culinary program at Gulf Coast Community College.

"As a former nurse, I know what a food-borne illness can do to you," Taylor said. "Whatever I will not eat, I will not serve. I enjoy seeing my customers enjoying something I prepared."

Taylor said a party of 80 people canceled their reservations and business dropped off dramatically after news of the report.

GCCC: Kerley reaching out to community

From page 1B

center to address work force needs. For example, with the new airport coming to Bay County, training will be needed for a security force and other airport specific jobs.

"We've already talked to the Chamber of Commerce and they feel we are taking the right direction," Kerley said.

The college also will begin trying to recruit nontraditional students, those who never finished getting their degree, or those seeking certification in a vocational program.

Some of the community-oriented goals include expanding cooperative education opportunities, improving minority outreach, cultivating relationships with public officials and chambers of commerce, joining with military partners, and utilizing the services of talented retired college faculty and staff, GCCC alumni and other retirees, including military veterans.

THE SUSTAINABLE EMERALD COAST MEETINGS

for Bay, Washington, and Holmes Counties will focus on a visioning effort that will involve government officials, the general public, the business community, agricultural and environmental interests, and the development community. These stakeholders will be tasked with creating a vision for the future that enables growth while preserving natural areas and protecting wildlife and agricultural production, provides affordable housing, addresses health care, and supports healthy small towns and communities, while enabling a vibrant economic and social life. There are two more meeting dates scheduled.

WASHINGTON COUNTY VISIONING

April 29	9:00-11:00 AM	Washington County BOCC Chambers- Chipley
May 13	9:00-11:00 AM	Washington County BOCC Chambers- Chipley

HOLMES COUNTY VISIONING

April 29	2:00-4:00 PM	BCC Chambers- Bonifay
May 13	2:00-4:00 PM	BCC Chambers- Bonifay

BAY COUNTY VISIONING

April 30	9:00-11:00 AM	Panama City- City Hall, 2nd floor
May 14	9:00-11:00 AM	Panama City- City Hall, 2nd floor

All visioning meetings are public workshops.
For more information call the West Florida Regional Planning Council at 1-800-226-8914.

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Provide Your Comments on the NSWC PCD Draft EIS/OEIS

NAVSEA WARFARE CENTERS PANAMA CITY

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You may also mail in comments to:

Commanding Officer
Naval Surface Warfare Center
Panama City Division
Attn: Environmental Team Lead, Mrs. Carmen Ferrer
110 Vernon Avenue, Panama City, FL 32407-7001
E-Mail: carmen.ferrer@navy.mil

Please submit all comments by May 19, 2008 to ensure that the U.S. Navy addresses them in the Final EIS/OEIS.

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PALETTE COASTAL DESIGN

THUNDER: Organizers expecting 60,000 bikers this year

From page 1B

They joined an already large crowd that began pouring in Wednesday.

By mid-morning Friday, Front Beach Road was nearly at a standstill as motorcycles outnumbered automobiles as far as the eye could see. The seven rally sites, including Frank Brown Park, filled quickly with revelers, transformed into a metallic carpet of choppers, Harleys and other heavy iron.

Because Thunder Beach is a free event and does not record ticket sales or a crowd count, organizers said they could not provide a specific count of attendance. However, one senior official predicted this year easily could see as many as 60,000 bikers.

"We've been checking with our hotel partners, and so far, everyone reports they are way up (in attendance) compared with last year," when about 50,000 to 55,000 people were estimated to have come, said Thunder Beach executive producer Corky McCollum. "Frank Brown Park is also the biggest I've seen in the last three years."

Most attendees come from a six-hour "drive market" spanning the states of Louisiana, Mississippi, Alabama, Georgia, Tennessee and elsewhere in Florida, McCollum said.

McCollum said the rally, like ones in previous years, brings in a diverse array of people from all areas and careers into a community of shared fun.

"It's all around the motorcycle, the love of the motorcycle," McCollum said. "It's moms and dads, your mailman and your pediatrician and the regular working man."

Gina Andrews, 38, drove in from Little Rock, Ark., for Thunder Beach, leaving behind her daytime job in hotel accounting. "It's fun to be here," she said.

Not far away on the exhibition grounds, 73-year-old Ted Hess, an explosives manufacturing technician from Brooksville, said he toured in on his Yamaha roadster.

"This is my third Thunder Beach," said Angie Neal, a nurse from Wood River, Ill., who was enjoying the sun perched on her Harley-Davidson Night Train.

Other happy rally-goers ranged from Southport resident Jeff Woodward, 43, a civilian air defense system program manager at Tyndall Air Force Base, to retired airline pilot Blaine Lyter, 67, who also belongs to a Christian motorcycle organization.

Many rally participants took advantage of the array of service and maintenance facilities stationed at the fairgrounds.

As Wanda Waits stood by, her husband, Sherman, eased their burgundy Harley-Davidson Ultra Classic into a detailing booth, where he negotiated a new decorative paint trim scheme for the motorcycle.

While the Albertville, Ala., couple has come to previous Thunder Beach rallies, she said, "This is the first time we've actually brought our bike."

Thunder Beach will continue today with a major event, the second annual Sgt. Kevin Kight Memorial Bike Parade. Thunder Beach organizers renamed the highlight parade in honor of the Panama City Beach Police Department sergeant who was shot and killed while conducting a traffic stop during Spring Break 2005. Participants provide either cash or canned food donations received by the Middle Beach Road Publix supermarket, with the proceeds going to the local Cops & Kids charity.

Lineup for the parade starts at 10 a.m. on Middle Beach Road at the southwest corner of the intersection with Beckrich Road. The parade starts at 11 a.m.

Man in critical condition after cycles collide

The News Herald

PANAMA CITY BEACH

An Alabama man was in critical condition Friday night after being thrown from his motorcycle a few hours earlier, officials said.

Robbie Green, of Weaver, Ala., was operating a motorcycle on North Pier Park near Frank Brown Park on Friday afternoon when the bike struck the rear of another motorcycle that had slowed to make a left turn, police said. The crash ejected Green, who was not wearing a helmet, according to a Panama City Beach police news release.

The man and woman on the other motorcycle were not identified, but police said the woman sustained only minor injuries and the man was not injured. Green was in critical condition Friday night at Gulf Coast Medical Center.

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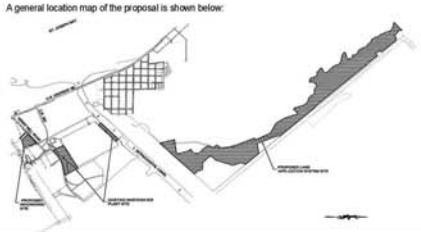
Notice of the Availability of an Environmental Assessment

The USDA, Rural Utilities Service has received an application for financial assistance from *The City of Port St. Joe*. As required by the National Environmental Policy Act, the Rural Utilities Service has prepared an Environmental Assessment that evaluated the potential environmental effects and consequences of the proposed project. This notice announces the availability of the Environmental Assessment for pubic review and comment.

The proposed project consists of upgrades to the existing wastewater treatment plant as well as the construction of a new headworks facility and land application system (LAS). This project serves the City of Port St. Joe, Gulf County, Florida. The construction plans and specifications for this project will be submitted to the Florida Department of Environmental Protection and the Northwest Florida Water Management District to assure that all construction meets current environmental standards. To prevent stormwater runoff and erosion at the construction sites, Best Management Practices will be utilized. The proposed alternative includes the following: Constructing a new Headworks and LAS at a new Location. The land surrounding these sites are industrial and agricultural with no soils that are common for prime farmland. No formally classified lands exist at the sites. The sites are not a floodway and no wetlands will be impacted. There are no cultural resources on site. Since the sites are surrounded by agricultural and industrial lands this work will not produce air quality, transportation, and noise issues. The other alternative considered included the construction of a new headworks at the existing headworks location and a new LAS at a new site. The land surrounding the existing headworks site is zoned residential and commercial and is the site of the previously demolished paper mill. The property has already been disturbed and no formally classified lands exist at this site. The existing headworks site is not in a floodway and no wetlands would be impacted. There are no cultural resources at the site. The implementation of the second alternative would have a greater impact on the cost of living for this rural community than the selected alternative.

Copies of the Environmental Assessment are available for review at USDA *Rural Development, 2741 Pennsylvania Avenue, Suite 5, Marianna, FL 32448-4014*. For further information contact Mary Gavin @ 850-526-2610 Ext. 118. Any person interested in commenting on this proposed project should submit comments to the address above by May 25, 2008.

A general location map of the proposal is shown below:



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Bystanders extinguished the blaze with a water hose before it caused much damage.

Foster was treated and released from Fort Walton Beach Medical Center after a witness said he saw smoke coming from the bathroom vent and went to knock on

CRESTVIEW — The New Jin Jin Chinese restaurant at 2258 S. Ferdon Blvd. has been temporarily closed after a routine food inspection, according to the Florida Department of Business & Professional Regulation.

a report of a man down at Neil's Storage at the corner of Gibson Road and Oakridge Road.

When the officer arrived, a witness told him a girl was inside a car, according to the report.

The officer saw the girl sitting in the passenger seat. When he opened the door, the girl's shirt was pulled up and she looked like she had been dragged through mud, according to the report.

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Prayer to the Blessed Virgin

(Never known to fail). Oh, most beautiful flower of Mt. Carmel, fruitful vine splendor of Heaven, Blessed Mother of the Son of God. Immaculate Virgin, assist me in my necessity. Oh, Star of the Sea, help me and show me, herein you are my mother. Oh Mary, conceived without sin, pray for us who have recourse to thee (3x). Holy Spirit, you who solve all problems, light all roads so that I can attain my goal. You who gave me the divine gift to forgive and forget all evil against me and that in all instances in my life you are with me. I want in this short prayer to thank you for all things and to confirm once again that I never want to be separated from you in eternal glory. Thank you for your mercy toward me and mine. The person must say this prayer 3 consecutive days. After 3 days, the request will be granted. This prayer must be published after the favor is granted. Try it.

Thank You C.C.

the section of rough pav
ment west of the Turk
Creek Bridge.

Old Spanish Trail treasure found

CRESTVIEW — Dwa
Skidmore has found the pri
in the Old Spanish Trail Fe
tival Treasure Hunt.

Skidmore said he fou
the treasure attached to
strap in a shed behind t
Crestview Community Ce
ter at 8:13 a.m. Friday.

Skidmore and a frie
Dean Matthews, had pair
up to hunt for the treasu
They will split the $1,000
cash and prizes.

"I was like, 'yeah!' I
cause we spent almost
day Thursday looking
it," Skidmore said. "Whe
found it, I was elated. N
that I found out what i
worth, it feels even better

Skidmore said he re
ized the likely location wh
he went home Thursd
He and Matthews resum
their hunt at daybreak F
day. They found the treas
— a laminated card with
structions on how to cla
the prize — soon after.

"As soon as I touched
strap, I knew what it wa
Skidmore said.

The Old Spanish Tr
Festival is today.

What Does The Bible Say About Being A Fundamentalist? Part 2

Last week I gave a simple introduction to the subject, making the point that there are many "kinds" of fundamentalist. Frankly, there are extremes in any form of "fundamentalism" including Christian fundamentalism. That does not mean that all Christian fundamentalist are extreme. The same is true of some of the other groups being referred to as "Fundamentalist." When the vast majority of a group is extreme, their kind of fundamentalism should be given as well. Actually, the word *"fundamental"* means, pertaining to the foundation or basis; Hence, essential; important and obviously necessary to the system of belief. In other words, Christians are fundamentalist when they believe certain tenants of the faith cannot be omitted. One of the major reasons we refer to ourselves as *"fundamentalist"* is to make a distinction between ourselves and *"modernist."* The most glaring mistake of the modernist is to put a question (?) where God puts a period (.) Fundamentalist do not question or correct the Word of God. We believe God's Word is *"Forever settled in Heaven,"* and *"every Word of God is pure."* By the way, this is a necessary point of belief for anyone who is to be called "a Christian Fundamentalist." You are not a fundamentalist if you do not believe in the inerrancy of the Bible. In fact, you are not a Christian fundamentalist if you do not believe in the Virgin Birth, Blood Atonement, Bodily resurrection or the necessity of being Born Again by Grace through Faith in the Death, Burial and resurrection of Christ. A fundamentalist believes in the sanctity of life. A person who commits murder in the name of Christ is not a Christian fundamentalist. For example, a true Christian fundamentalist would never advocate, approve of, or participate in the killing an abortionist.

A Christian fundamentalist stands for what he or she believes within the boundaries of the Law of God and the Law of the land. When there is a conflict between those two, we always bow to the Law of God without apology. Acts 5:29 *"We ought to obey God rather than men."*

To call me a Christian Fundamentalist is a compliment. It defines what I believe based on the Word of God, and it does not mean that I am a nut case radical. I am not ashamed to be called that, but to compare us to nut case, radical, extreme Muslims or Mormons is beyond comprehension.

TO BE CONTINUED...

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Clerk Don Howard to speak to GOP cl

BLUEWATER BAY — O
loosa County Clerk of Cou
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the Silver Sands Republi
Women on Monday.

Howard, who is runn
for his second term,
speak on the duties of
clerk's office.

The dinner meeting
gins at 5:30 p.m. at the Bl
water Bay clubhouse
Bluewater Boulevard. Th
will be a special menu
the event ranging from
to $15.

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now and forever. Most Sac
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for us. St. Jude, helper
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(Say this prayer nine time
day.) By the 8th day y
prayers will be answered. It
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for 9 days. Publication mus
promised. Thank you, St. Jud

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ida, will speak at noon Thursday.

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Really Really Free Market goes to Destin today

DESTIN — The open-air Really Really Free Market is scheduled for noon until dusk today in Clement Taylor Park.

Organizers say the market is for the sharing of goods, services and ideas.

In case of rain, the market will be next Sunday at the same time and place.

For more information, visit myspace.com/destinfreemarket.

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Charges were filed against

But they say the items in the trunk could have been combined with other ingredients to make a destructive device.



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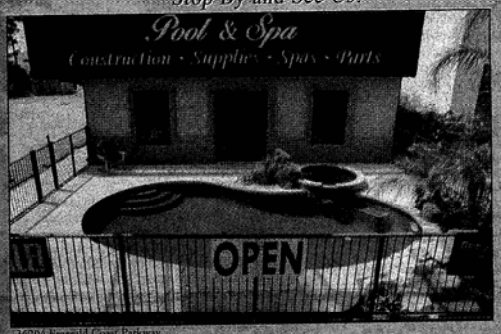
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Provide Your Comments on the NSWC PCD Draft EIS/OEIS

NAVSEA WARFARE CENTERS PANAMA CITY

The U.S. Navy has completed the Naval Surface Warfare Center Panama City Division (NSWCPCD) Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental consequences associated with testing activities involving air, surface, and subsurface operations that require the use of sonar, lasers, electromagnetic fields, and live ordnance. The proposed activities would take place in St. Andrews Bay and the Gulf of Mexico.

The Navy is announcing the public hearings and public comment period on the draft EIS/OEIS.

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Port St. Joe	May 7	6-9 p.m.	Port St. Joe Elementary School; Elementary School Auditorium; 2201 Long Avenue.

The Navy will hold an informative open house from 6-7 p.m. At 7 p.m., Navy officials will make a brief presentation and members of the public will be given the opportunity to make oral comments about the Draft EIS/OEIS.

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You may also mail in comments to:

Commanding Officer
Naval Surface Warfare Center
Panama City Division
Attn: Environmental Team Lead, Mrs. Carmen Ferrer
110 Vernon Avenue, Panama City, FL 32407-7001
E-Mail: nswcpcpaowebmanager@navy.mil/

Please submit all comments by June 1, 2008 to ensure that the U.S. Navy addresses them in the Final EIS/OEIS.

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From staff reports

Law Day to feature guest speaker

The Okaloosa-Walton Bar Association is hosting its 50th annual Law Day activities Thursday and Friday at the Emerald Coast Conference Center.

Guest speaker Seth Miller, executive director of the Innocence Project of Florida, will speak at noon Thursday.

For more information, call 609-0940.

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For more information, visit myspace.com/destinfreemarket.

Ruling to throw out videos in explosives trial appealed

TAMPA (AP) — A judge's decision to throw out key evidence against an Egyptian college student facing federal explosives charges is being appealed, a move that could delay his trial.

U.S. District Judge Steven Merryday ruled Friday that various videos of armed rockets found on Youssef Samir Megahed's home computer were presented too late by prosecutors to be used at his trial, which is scheduled for Monday. Prosecutors said the videos depicted rockets being used in Middle East conflicts.

Late Friday, prosecutors filed a notice of appeal, meaning the trial will likely be put on hold. Merryday has said he may consider releasing Megahed on bail if his trial is postponed.

Charges were filed against Megahed and co-defendant Ahmed Abdellatif Sherif Mohamed after an August traffic stop in South Carolina. Authorities say they found explosive materials in the trunk of the car the men were riding in.

The men, both University of South Florida students at the time, say those items — PVC pipe containing a mixture of sugar, potassium nitrate and cat litter, plus fuses — were for homemade fireworks, not bombs. They say they were on an innocent road trip to see the Carolina beaches.

Prosecutors have yet to present any evidence linking the men to a specific plan to carry out any terrorist act. But they say the items in the trunk could have been combined with other ingredients to make a destructive device.



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Take the time to honor our military

In honor of Memorial Day, the Eglin Dispatch and Hurlburt Warrior will publish free tributes to war veterans in our May 23 editions.

To submit a tribute, please send the member's name, rank, branch of service, conflicts he/she served in, date of passing and if possible a non-returnable photograph to:

Northwest Florida Daily
Attn: Noel Getlin – Tribute
P.O. Box 2949
Fort Walton Beach, FL
32549

Or, you can e-mail your tribute to noelg@eglindispatch.com

Or, drop your tribute off at the main reception desk at the Northwest Florida Daily News office at 200 Racetrack Road.

Submissions are due by noon on Friday, May 16.

Thanks in advance for your tributes from the staffs of the Dispatch, Warrior and Daily News.



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Provide Your Comments on the NSWC PCD Draft EIS/OEIS

NAVSEA NAVAL SEA SYSTEMS COMMAND

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Port St. Joe	May 7	6-9 p.m.	Port St. Joe Elementary School; Elementary School Auditorium; 2201 Long Avenue.

The Navy will hold an informative open house from 6-7 p.m. At 7 p.m., Navy officials will make a brief presentation and members of the public will be given the opportunity to make oral comments about the Draft EIS/OEIS.

A copy of the draft EIS/OEIS is available for public viewing on the project Website at: http://nswcpc.navsea.navy.mil/environmental/eis.asp and at the following local libraries: Bay and Gulf County, Fort Walton Beach, Pensacola and Mobile public libraries.

You may also mail in comments to:

Commanding Officer
Naval Surface Warfare Center
Panama City Division
Attn: Environmental Team Lead, Mrs. Carmen Perez
110 Vernon Avenue, Panama City, FL 32407-7001
E-Mail: nswcpcpaowebmanager@navy.mil

Please submit all comments by June 1, 2008 to ensure that the U.S. Navy addresses them in the Final EIS/OEIS.

NOT FORGOTTEN

These obituaries appeared in *The News Herald* over the past seven days:

Linda Gail Adcock, 60, of Bridgeport, died May 1.
Rufus Tyler Blue, 22, of Pensacola, died April 29.
Steadman Carroll, 71, of Cottondale, died April 26.
Alberta Irene Carter, 68, of Lynn Haven, died May 1.
Darrell W. Casteel, 42, died April 21.
Edison Causey, 53, of Dalkeith, died May 2.
Dolores May Clark, 74, of Panama City, died April 28.
William Donnelly, 78, of Panama City, died April 25.
Michelle Lynn (Burgess) Dozier, formerly of Salem, Mo., died April 29.
Earline Coffin Dufour, 79, of Panama City, died April 27.
Juanita Aileen Durham, 78, of Mexico Beach, died April 24.
Robert George Fritz, 87, of Vernon, died April 27.
Elizabeth Quick Ferguson, 76, died April 29.
Mary Nell Gainer, 77, of Panama City, died April 28.
James Ulys Gilbert, 80, of Marianna, died May 1.
Xuripha Belyeu Harper, 87, formerly of Panama City, died April 30.
John Edward King, 52, died April 27.
James Marschka, 51, of Caryville, died April 23.
Dorothy Mason, 88, died April 20.
Aden Steven McFatter died April 27.
Vincent Gene Morgan, 75, of Youngstown, died April 30.
Chance Morris, 20, of Wausau, died May 1.
Chap Thi Nguyen, 78, of Panama City, died April 24.
Jacque Alline Fabel Price, 87, of Port St. Joe, died April 26.
Ruby Lee Richardson, 76, of Panama City, died May 2.
James Francis Rodgers, 87, of Parker, died April 25.
Gene Richard Rupe, 73, of Panama City, died April 13.
David Jackson Weakes Jr., 82, died April 25.
Rosie Lee Vandergrift, 94, of Panama City, died April 27.

Other deaths received from the Bay County Health Department from April 24 to April 30:

Albert Watson, 61, Lynn Haven
Galita St. Einmetz, 36, Panama City Beach
Jane Agnes Waringa, 82, Valrico
Emmy Donat, 88, Port St. Joe
William Fox, 74, Wewahitchka
Geoffrey George Alepakos, 50, Panama City Beach
James Ralston, 81, city not available
Mellissa Gray Shepherd, 37, Panama City Beach
Hildegard Yessta McRae, 92, Panama City
Frances June Beaumont, 68, Panama City
Bill Glen Aday, 73, Panama City
Anna Mae Davis, 84, Panama City

Explosives video ruling appealed

The Associated Press

TAMPA

A judge's decision to throw out key evidence against an Egyptian college student facing federal explosives charges is being appealed.

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Charges were filed against Megahed and co-defendant Ahmed Abdellatif Sherif Mohamed after an August traffic stop in South Carolina. Authorities say they found explosive materials in the trunk of the car.


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Member American College of Phlebology
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Phlebology/Vein Training: American Vein Institute
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Richard Wooten, PT

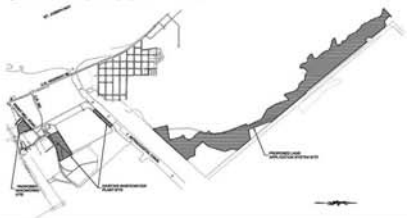
Notice of the Availability of an Environmental Assessment

The USDA, Rural Utilities Service has received an application for financial assistance from *The City of Port St. Joe*. As required by the National Environmental Policy Act, the Rural Utilities Service has prepared an Environmental Assessment that evaluated the potential environmental effects and consequences of the proposed project. This notice announces the availability of the Environmental Assessment for pubic review and comment.

The proposed project consists of upgrades to the existing wastewater treatment plant as well as the construction of a new headworks facility and land application system (LAS). This project serves the City of Port St. Joe, Gulf County, Florida. The construction plans and specifications for this project will be submitted to the Florida Department of Environmental Protection and the Northwest Florida Water Management District to assure that all construction meets current environmental standards. To prevent stormwater runoff and erosion at the construction sites, Best Management Practices will be utilized. The proposed alternative includes the following: Constructing a new Headworks and LAS at a new Location. The land surrounding these sites are industrial and agricultural with no soils that are common for prime farmland. No formally classified lands exist at the sites. The sites are not a floodway and no wetlands will be impacted. There are no cultural resources on site. Since the sites are surrounded by agricultural and industrial lands this work will not produce air quality, transportation, and noise issues. The other alternative considered included the construction of a new headworks at the existing headworks location and a new LAS at a new site. The land surrounding the existing headworks site is zoned residential and commercial and is the site of the previously demolished paper mill. The property has already been disturbed and no formally classified lands exist at this site. The existing headworks site is not in a floodway and no wetlands would be impacted. There are no cultural resources at the site. The implementation of the second alternative would have a greater impact on the cost of living for this rural community than the selected alternative.

Copies of the Environmental Assessment are available for review at USDA *Rural Development, 2741 Pennsylvania Avenue, Suite 5, Marianna, FL 32448-4014.* For further information contact Mary Gavin @ 850-526-2610 Ext. 118. Any person interested in commenting on this proposed project should submit comments to the address above by May 25, 2008.

A general location map of the proposal is shown below:



Provide Your Comments on the NSWC PCD Draft EIS/OEIS

NAVSEA WARFARE CENTERS PANAMA CITY

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You may also mail in comments to:

Commanding Officer
Naval Surface Warfare Center
Panama City Division
Attn: Environmental Team Lead, Mrs. Carmen Ferrer
110 Vernon Avenue, Panama City, FL 32407-7001
E-Mail: carmen.ferrer@navy.mil

Please submit all comments by May 19, 2008 to ensure that the U.S. Navy addresses them in the Final EIS/OEIS.

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E-Mail: nswcpcpaowebmanager@navy.mil/

Please submit all comments by June 1, 2008 to ensure that the U.S. Navy addresses them in the Final EIS/OEIS.

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Cervical cancer	Mouth or tongue cancer
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Coronary heart disease (or hardening of the arteries)	Peripheral vascular artery disease
Heart attack	Throat or voice box cancer
Esophogeal cancer	Stomach cancer
Kidney cancer	

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$50 Phone offer expires May 10, 2008, while supplies last. Phone offer requires a new 2-year agreement on a qualifying plan. $35 activation fee and a $200 early termination fee may apply. Taxes not included. Offer may not be available at all dealer locations. Additional terms may apply. See southernlinc.com/promodetails for more information. FamilyTALK 1000 Plan offer ends June 30, 2008. New 2-year agreement required on all plans. This service plan is available to new customers and to SouthernLINC Wireless customers who establish a new line of service on a new master account. Additional Anytime Cellular Minutes will be $0.40/minute. SouthernLINC Wireless Phone Roaming is $0.40/minute. Taxes not included. Anytime Cellular Minutes include calls that originate within the SouthernLINC Wireless Regional calling area. Subject to permissible usage allowances. For more information on service limitations, see southernlinc.com/promodetails. ©2008 Motorola, Inc. Motorola and the stylized M logo are registered in the U.S. Patent and Trademark Office. ©2008 Southern Communications Services, Inc. d/b/a SouthernLINC Wireless.

FLORIDA

Man critical after being struck by SUV

By Tony Bridges
News Herald Writer
522-5114 / tbridges@pcnh.com

PANAMA CITY BEACH

A man was seriously injured Sunday morning when he apparently stepped in front of an SUV on Thomas Drive.

R. Kevin Bartha, 39, of Lutz, was taken to Bay Medical Center in critical condition after being struck, according to the Florida Highway Patrol.

Troopers said 21-year-old Kyle C. Coleman was driving his 2007 Kia west on Thomas a little before 4 a.m. He was passing Hammerhead Fred's, just west of Joan Avenue, when Bartha tried to cross in front of him.

The impact knocked Bartha into the middle of the road.

Troopers are investigating, and no charges have been filed.

Injured officer

An Ohio man ran a red light Sunday morning, and his vehicle struck a Panama City Beach police officer on his way home after working a 12-hour night shift.

Officer Jason Gleason, 32, suffered a hand injury in the crash, said Maj. Dave Humphreys, spokesman for the Panama City Beach Police Departments.

Florida Highway Patrol troopers estimated damage to the officer's marked 2005 Ford police car at $10,000.

Troopers said John Harmon, 58, of Berea, Ohio, was headed south on State 77 when he went through the red light at County 388. Gleason was on his way home and was crossing 77 towards Edwards Road.

Harmon's Ford van crashed into the left side of the patrol car.

Tony Bridges

Body found

Parker police are investigating the death of a 26-year-old man whose body was found in his Hickory Street apartment Sunday.

Police Chief Richard Sweatt said the death does not appear suspicious and possibly is related to a medical condition. An autopsy is scheduled for today.

The man's name has not been released pending notification of next of kin. A friend found his body and called police, according to Sweatt.

Tony Bridges

Essay contest

OCALA

An Ocala woman is offering her $1.25 million home as a prize to the winner of a "pet lover" essay contest.

Entrants in Clementina Marie Giovannetti's contest must pay a $200 fee. They also must submit a cover letter, the essay and a photo of the pet to be considered in the competition.

Giovannetti has set a minimum number of entries at 6,250, and contest rules allow her to extend her July 23 entry deadline or to cancel the contest if she doesn't get enough entries.

Attorney Eric Gifford, who drafted the contest rules, said he has been contacted by several Florida homeowners interested in similar contests.

Gifford said Giovannetti's property, purchased in early 2006, had been on the market for more than a year.

The Associated Press

EMT lawsuit

MOUNT DORA

A Lake County firefighter-emergency medical technician has sued an 84-year-old woman whose home she responded to on a May 2005 call.

Jennifer Roland seeks unspecified damages of more than $15,000 in her lawsuit, which was filed a year ago. Roland said she hurt her back and neck when a fire engine's front wheel broke through a septic tank lid at Elizabeth Baker's home.

Messages left for attorneys on the case were not returned Saturday evening.

Roland is not the first emergency responder to pursue legal action after an emergency call.

Last year, a central Florida police officer sued a family after she slipped and fell in their home while trying to rescue a boy who nearly drowned. The officer dropped her lawsuit and was fired.

The Associated Press

Infant death

DELRAY BEACH

Authorities say a 10-month-old boy died in an apartment fire in Delray Beach.

Fire-Rescue Battalion Chief Russ Accardi said there were no adults in the apartment when firefighters arrived early Sunday.

Seven other children, the oldest of whom was 16, escaped from the burning apartment unharmed.

Firefighters recovered to the severely burned baby, who died at the scene.

The Associated Press

Bear sighting

FORT MYERS

Wildlife officials say they tranquilized and relocated a black bear that was sighted near homes in south Fort Myers.

Sheriff's deputies and residents sighted the 225-pound adult male bear, who spent part of Saturday morning resting against bushes behind a home.

Florida Fish and Wildlife Conservation Commission biologists tranquilized the bear with a dart about 5 p.m.

The bear was moved safely to a more rural area in north central Florida. He was tagged with an identification number, and some fur was taken for DNA sampling. Ice bags were used to keep the bear cool.

Commission spokesman Gary Morse said black bears typically are docile. Morse said the bear could have been forced from his regular home by construction or other "disturbance."

The Associated Press

Orlando shooting

ORLANDO

Orlando police shot a man while responding to a burglary, but the man's injuries aren't life threatening.

The man, identified as 31-year-old Tyronne Peterson, was taken to a local hospital.

Police say shots were fired during a confrontation with a man Sunday morning, and more shots were fired after a car chase.

Police say Peterson has been charged with burglary. Additional charges are pending. He was wanted on two warrants at the time of his arrest.

The four officers involved in the shooting have been placed on paid leave, pending the outcome of an investigation.

The Associated Press

Wastewater work

MARATHON

Leaders from the Keys city of Marathon are trying to persuade federal lawmakers to help pay for an $85 million advanced wastewater installation project.

Mayor Pete Worthington and two other officials spent three days last week meeting with lawkamers in Washington.

Marathon already has a financial plan in place to pay for installing sewers. But officials have been seeking grants to help ease the burden on local property owners, who will end up paying for most of the project.

The state says Marathon and the rest of Monroe County must have updated wastewater treatment facilities in place by July 2010.

The Associated Press

Mall shooting

AVENTURA

One person was fatally shot and another wounded Sunday night in a shooting at a South Florida mall parking garage, police said.

Police Department Lt. Michael Bentolila said the shooting appeared to be "domestic-related," and involved a 36-year-old man and a 45-year-old woman whose names were not released.

The man shot the woman before turning the gun on himself, Bentolila said.

"Nobody else was hurt, but we do have a couple people who were in the area," Bentolila said. "We're in the process of questioning them now for what they heard or what they saw."

Bentolila said both the man and woman were airlifted to Jackson Memorial Hospital in Miami, where the man was pronounced dead. The woman, who suffered shoulder and neck injuries, was in stable condition, he said.

Bentolila said it was unclear how the man arrived at the shopping center and if he entered the mall with a gun.

Aventura Mall is home to more than 250 stores and a movie theater, according to its Web site. It is located about 20 miles north of Miami.

The Associated Press

PUBLIC NOTICE OF A STAFF WORKSHOP ON THE FORM BASED CODE AND STAFF INTERVIEWS OF THE FORM BASED CODE CONSULTANT

The City Council of Panama City Beach, also serving as the Panama City Beach Community Redevelopment Agency, along with the Planning Board, have been invited to attend the Staff Workshop of the Form Based Code on May 6, 2008 at 1:30 P.M.

The Staff Interviews of the Form Based Code Consultants will commence at 9:00 A.M. on May 7, 2008.

Both meetings will be conducted in the Board Room of the Tourist Development Council, 17001 Panama City Beach Parkway.

The Public is invited to attend and observe the presentations.

PUBLIC NOTICE OF THE REGULAR MEETING OF THE PANAMA CITY BEACH CITY COUNCIL AND COMMUNITY REDEVELOPMENT AGENCY

The City Council of Panama City Beach, also serving as the Panama City Beach Community Redevelopment Agency, will conduct a Regular Meeting of the City Council at 6:00 P.M. on May 8, 2008. At that time, the Certification of Election and Investiture of the Council members will occur.

The meeting will be conducted in the Council Meeting Chambers of Beach City Hall, 110 South Arnold Road (Highway 79).

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315 East 15 Street, Panama City

Provide Your Comments on the NSWC PCD Draft EIS/OEIS

The U.S. Navy has completed the Naval Surface Warfare Center Panama City Division (NSWCPCD) Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental consequences associated with testing activities involving air, surface, and subsurface operations that require the use of sonar, lasers, electromagnetic fields, and live ordnance. The proposed activities would take place in St. Andrews Bay and the Gulf of Mexico.

The Navy is announcing the public hearings and public comment period on the draft EIS/OEIS.

City	Date	Time	Location
Panama City	May 5	6-9 p.m.	Gulf Coast Community College; Student Union Conference Center; 5230 West Highway 98.
Pensacola	May 6	6-9 p.m.	McMillian Auditorium; Pensacola Junior College – Warrington Campus; 5555 Highway 98 West.
Port St. Joe	May 7	6-9 p.m.	Port St. Joe Elementary School; Elementary School Auditorium; 2201 Long Avenue.

The Navy will hold an informative open house from 6-7 p.m. At 7 p.m., Navy officials will make a brief presentation and members of the public will be given the opportunity to make oral comments about the Draft EIS/OEIS.

A copy of the draft EIS/OEIS is available for public viewing on the project Website at: http://nswcpc.navsea.navy.mil/environmental/eis.asp and at the following local libraries: Bay and Gulf County, Fort Walton Beach, Pensacola and Mobile public libraries.

You may also mail in comments to:

Commanding Officer
Naval Surface Warfare Center
Panama City Division
Attn: Environmental Team Lead, Mrs. Carmen Ferrer
110 Vernon Avenue, Panama City, FL 32407-7001
E-Mail: carmen.ferrer@navy.mil

Please submit all comments by May 19, 2008 to ensure that the U.S. Navy addresses them in the Final EIS/OEIS.

PUBLIC COMMENT ON FEDERAL REGISTER ATTACHED BELOW IN FULL Page 1 of 8

Latusek, Jennifer N.

From: jean public [jeanpublic@yahoo.com]
Sent: Wednesday, April 09, 2008 11:15 AM
To: NSWCPCPAOWEBMASTER@NAVY.MIL; Ferrer, Carmen M CIV NSWC PC
Cc: AMERICANVOICES@MAIL.HOUSE.GOV; COMMENTS@WHITEHOUSE.GOV
Subject: PUBLIC COMMENT ON FEDERAL REGISTER ATTACHED BELOW IN FULL

FAR TOO OFTEN THE US NAVY HAS BEEN RESPONSIBLE FOR
CAUSING HEMORRHAGES IN WHALES BRAINS AND IN THE BRAINS
OF OTHER MARINE LIFE. FAR TOO OFTEN THE US NAVY HAS
BOMBED THE HELL OUT OF GOD'S CREATURES SIMPLY TRYING
TO EXIST IN THE OCEAN. IT IS TIME TO STOP THAT. THE US
NAVY SHOULD START PRACTICING MORE IN SIMULATION AND
STOP BOMBING THE HELL OUT OF THE US MAINLAND AND
ENVIRONS. WE ARE ALL TIRED OF THE DAMAGE DONE TO THIS
EARTH AND TO GOD'S CREATURES BY THE US NAVY. THEY
THINK NOTHING OF CAUSING DEATH. THIS IS COMPLETELY
UNACCETABLE. I WANT THE US NAVY REINED IN. B. SACHAU
15 ELM ST
FLORHAM PARK NJ 07932
>
> [Federal Register: April 9, 2008 (Volume 73, Number
> 69)]
> [Notices]
> [Page 19194-19196]
> From the Federal Register Online via GPO Access
> [wais.access.gpo.gov]
> [DOCID:fr09ap08-28]
>
>
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>

>
> DEPARTMENT OF DEFENSE
>
> Department of the Navy
>
>
> Notice of Public Hearings for the Naval Surface
> Warfare Center
> Panama City Division (NSWC PCD) Mission Activities
> Draft Environmental
> Impact Statement/Overseas Environmental Impact
> Statement
>
> AGENCY: Department of the Navy, DoD.
>
> ACTION: Notice.
>

8/7/2008

>

>
> SUMMARY: Pursuant to section 102(2)(c) of the
> National
> Environmental
> Policy Act (NEPA) of 1969 and regulations
> implemented
> by the Council on
> Environmental Quality (40 CFR parts 1500-1508), and
> Presidential
> Executive Order 12114, the Department of the Navy
> (Navy) has prepared
> and filed with the U.S. Environmental Protection
> Agency a Draft
> Environmental Impact Statement/Overseas
> Environmental
> Impact Statement
> (EIS/OEIS) on March 27, 2008, to evaluate the
> potential environmental
> effects associated with the Naval Surface Warfare
> Center, Panama City
> Division (NSWC PCD) mission activities within the
> NSWC
> PCD Study Area,
> which includes St. Andrew Bay (SAB), and military
> warning areas W-151
> (includes Panama City Operating Area), W-155
> (includes
> Pensacola
> Operating Area), and W-470.
> The Proposed Action is to improve NSWC PCD's
> capabilities to
> conduct new and increased mission operations for the
> Department of
> Defense (DoD) and its customers within the NSWC PCD
> Study Area. The
> research, development, test, and evaluation (RDT&E)
> activities
> occurring in these areas include air
>
> [[Page 19195]]
>
> operations, surface operations, subsurface
> operations,
> sonar
> operations, electromagnetic operations, laser
> operations, ordnance
> operations, and projectile firing. A Notice of
> Intent
> for this Draft
> EIS/OEIS was published in the Federal Register on
> August 19, 2004 (69
> FR 51453).
> The Navy will conduct three public hearings to

8/7/2008

> receive oral and
> written comments on the Draft EIS/OEIS. Federal
> agencies, state
> agencies, and local agencies and interested
> individuals are invited to
> be present or represented at the public hearings.
> This
> notice announces
> the dates and locations of the public hearings for
> this Draft EIS/OEIS.
> Dates and Addresses: An open house session will
> precede the
> scheduled public hearing at each of the locations
> listed below and will
> allow individuals to review the information
> presented
> in the Draft EIS/
> OEIS. Navy representatives will be available during
> the open house
> sessions to clarify information related to the Draft
> EIS/OEIS.
> In addition, the National Marine Fisheries
> Service
> (NMFS), which is
> participating as a cooperating agency in the
> development of the EIS,
> will be represented at the open houses and public
> hearings. All
> meetings will start with an open house from 6 p.m.
> to
> 7 p.m.
> Presentations and public comment will be held from 7
> p.m. to 9 p.m.
> Public hearings will be held on the following dates
> and at the
> following locations:
> 1. May 5, 2008, Gulf Coast Community College,
> Student Union
> Conference Center, 5230 West Hwy 98, Panama City,
> Florida,
> 2. May 6, 2008, Pensacola Junior
> College--Warrington Campus,
> McMillian Auditorium, 5555 Highway 98 West,
> Pensacola,
> Florida,
> 3. May 7, 2008, Port St. Joe Elementary School
> Auditorium, 2201
> Long Avenue, Port St. Joe, Florida.
>
> FOR FURTHER INFORMATION CONTACT: Mrs. Carmen Ferrer,
> Naval Surface
> Warfare Center Panama City Division, 110 Vernon
> Avenue, Panama City,
> Florida 32407; telephone: 850-234-4146; E-mail

8/7/2008

> carmen.ferrer@navy.mil.
>
> SUPPLEMENTARY INFORMATION: NSWC PCD is the United
> States (U.S.) Navy's
> premier research and development organization
> focused
> on littoral
> (coastal region) warfare and expeditionary (designed
> for military
> operations abroad) warfare. NSWC PCD provides
> in-water
> research,
> development, test, and evaluation (RDT&E) in support
> of expeditionary
> maneuver warfare, operations in extreme
> environments,
> mine warfare,
> maritime operations, and coastal operations.
> NSWC PCD is the nation's principal repository of
> this expertise
> supported by a diverse technical workforce in these
> areas that are
> critical to the future of U.S. Navy and U.S. Marine
> Corps operations.
> In accordance with Department of Defense (DoD)
> Directive 5000.1, test
> and evaluation support is to be integrated
> throughout
> the defense
> acquisition process (the process that encompasses
> every aspect of
> identifying, developing, and procuring defense
> systems) and is
> structured to provide essential information to
> decision makers. Such
> testing is used to validate the technical
> performance
> parameters
> (whether a given system performs as expected) and to
> determine whether
> systems are operationally effective, suitable,
> survivable, and safe for
> their intended use.
> It is the mission of NSWC PCD to provide RDT&E,
> as
> well as in-
> service support for amphibious warfare, diving,
> maritime special
> operations, mine warfare (mines and mine
> countermeasures), and other
> naval missions that take place in the coastal
> region.
> The
> infrastructure has been established at NSWC PCD to
> support this

> mission. A unique feature of NSWC PCD that is
> unduplicated in the U.S.
> is the natural operating environment provided by the
> ready access to
> the Gulf of Mexico (GOM) and its associated littoral
> and coastal
> regions. The GOM provides a surrogate environment
> for
> most of the
> littoral areas of the world in which the Navy will
> find itself
> operating for the foreseeable future.
> The NSWC PCD Draft EIS/OEIS addresses all of the
> identified RDT&E
> operations that occur within the NSWC PCD Study
> Area.
> The NSWC PCD
> RDT&E activities may be conducted anywhere within
> the
> existing military
> operating areas and St. Andrews Bay from the mean
> high
> water line
> (average high tide mark) out to 222 kilometer (120
> nautical miles)
> offshore.
> The Draft EIS/OEIS evaluates the potential
> environmental impacts of
> three alternatives, including two action
> alternatives
> (Alternatives 1
> and 2) and the No Action Alternative. The No Action
> Alternative
> addresses historical and current mission activities
> (referred to
> cumulatively as ``baseline mission activities'') for
> the NSWC PCD Study
> Area. Alternatives 1 and 2 analyze baseline
> activities, as well as
> future growth requirements for missions and activity
> levels. The
> development process incorporated the need to support
> future test
> capabilities, expand required mission capabilities,
> and increase the
> baseline tempo and intensity of activities.
> Alternative 2 is the Navy's
> preferred alternative.
> No significant adverse impacts are identified
> for
> any resource area
> in any geographic location within the NSWC PCD Study
> Area that cannot
> be mitigated, with the exception of exposure of
> marine

8/7/2008

> mammals and sea
> turtles to underwater sound. The Navy will apply to
> NMFS for a Marine
> Mammal Protection Act Letter of Authorization (LOA)
> and governing
> regulations to authorize incidental takes of marine
> mammals that may
> result from the implementation of the activities
> analyzed in the Draft
> EIS/OEIS. NMFS is participating as a cooperating
> agency in the
> development of this Draft EIS/OEIS. NMFS staff will
> be
> present at the
> scheduled open houses and public hearings and
> available to discuss both
> the MMPA incidental take authorization process and
> NMFS's participation
> in the development of the EIS/OEIS.
> The Draft EIS/OEIS is being mailed to Federal,
> State, and local
> agencies, elected officials, and other interested
> individuals and
> organizations. The public comment period will end
> May
> 19, 2008.
> Copies of the Draft EIS/OEIS are available for
> public review at the
> following libraries: Bay County Public Library, 25
> West Government
> Street, Panama City, FL 32401; Gulf County Public
> Library, 110 Library
> Drive, Port St. Joe, FL 32456; Fort Walton Beach
> Public Library, 185
> Miracle Strip Pkwy SE, Fort Walton Beach, FL 32548;
> and Pensacola
> Public Library, 200 West Gregory Street Pensacola,
> FL
> 32501.
> The Draft EIS/OEIS is also available for
> electronic public viewing
> at http://nswcpc.navsea.navy.mil/Environment.htm. A
> paper copy of the
> Executive Summary or a single CD of the Draft
> EIS/OEIS
> will be made
> available upon request by contacting Mrs. Carmen
> Ferrer, Naval Surface
> Warfare Center Panama City Division, 110 Vernon
> Avenue, Panama City,
> Florida 32407; E-mail: carmen.ferrer@navy.mil.
> Federal, State, and local agencies and
> interested
> parties are
> invited to be present or represented at the public

8/7/2008

> hearing. Written
> comments can also be submitted during the open house
> sessions preceding
> the public hearings. Oral statements will be heard
> and
> transcribed by a
> stenographer; however, to ensure the accuracy of the
> record, all
> statements should be submitted in writing. All
> statements, both oral
> and written, will become part of the public record
> on
> the Draft EIS/
> OEIS and will be responded to in the Final EIS/OEIS.
> Equal weight will
> be given to both oral and written statements.
>
> [[Page 19196]]
>
> In the interest of available time, and to ensure
> all who wish to
> give an oral statement have the opportunity to do
> so,
> each speaker's
> comments will be limited to three (3) minutes. If a
> long statement is
> to be presented, it should be summarized at the
> public
> hearing and the
> full text submitted in writing at the hearing,
> mailed
> to Mrs. Carmen
> Ferrer, Naval Surface Warfare Center Panama City
> Division, 110 Vernon
> Avenue, Panama City, Florida 32407 or submitted via
> e-mail to
> nswcpcpaowebmanager@navy.mil.
> All written comments must be postmarked or
> received by May 19,
> 2008, to ensure they become part of the official
> record. All comments
> will be responded to in the Final EIS/OEIS.
>
> Dated: April 3, 2008.
> T. M. Cruz,
> Lieutenant, Judge Advocate General's Corps, U.S.
> Navy,
> Federal Register
> Liaison Officer.
> [FR Doc. E8-7461 Filed 4-8-08; 8:45 am]
>
> BILLING CODE 3810-FF-P
>
>
>

8/7/2008

Latusek, Jennifer N.

From: Joe Kaskey [jkaskey@geo-marine.com]
Sent: Thursday, April 10, 2008 8:46 AM
To: Ferrer, Carmen M CIV NSWC PC
Subject: CD Request

Dear Mrs. Ferrer:

I would like to request a **CD copy** of the Draft EIS/OEIS for the Naval Surface Warfare Center Panama City Division (NSWC PCD) Mission Activities list in the April 9, 2008 Federal Register. Please send to the following address:

Joseph B. Kaskey
Geo-Marine, Inc.
2201 K Avenue
Suite A2
Plano, Texas 75074

In addition, your website for the Draft EIS/OEIS for electronic public viewing cannot currently be accessed. Thank you for your time.

Joseph

8/7/2008

Latusek, Jennifer N.

From: Rowe, Casey J [Casey.Rowe@mms.gov]
Sent: Friday, April 18, 2008 10:06 AM
To: Ferrer, Carmen M CIV NSWC PC
Cc: Goeke, Gary
Subject: RE: NSWC PCD EIS/OEIS

Carmen,

Our office will prepare a letter to provide updated information to the NSWC regarding MMS lease sales in the Gulf of Mexico. Also, please add me to the mailing list for Scoping and public notices for Navy projects as well as to receive digital or electronic copies of draft and final NEPA documents, including the GOMEX and AFAST documents. A Marine Resources Assessment was prepared for the Gulf of Mexico for the Department of the Navy. Was a Marine Resource Assessment also prepared for the Atlantic as well. If so, could you send me a link the information? Thanks.

Casey J. Rowe
Biologist
U.S. Department of the Interior
Minerals Management Service
1201 Elmwood Park Blvd.
New Orleans, LA 70123-2394
(504) 736-2781
(504) 736-2407

-----Original Message-----
From: Ferrer, Carmen M CIV NSWC PC [mailto:carmen.ferrer@navy.mil]
Sent: Wednesday, April 16, 2008 3:15 PM
To: Rowe, Casey J
Cc: Ferrer, Carmen M CIV NSWC PC
Subject: FW: NSWC PCD EIS/OEIS

Casey,

Here is the pdf of the appendices. If you have any other questions please contact me.

Carmen Ferrer
NSWC PCD Environmental Manager
110 Vernon Avenue
Panama City, FL 32407-7001
(850) 234-4146
DISN 436-4146

8/7/2008

-----Original Message-----
From: Ferrer, Carmen M CIV NSWC PC
Sent: Wednesday, April 16, 2008 15:11
To: 'Casey.Rowe@mms.gov'
Cc: Ferrer, Carmen M CIV NSWC PC
Subject: RE: NSWC PCD EIS/OEIS

Casey,

We had a problem with the website last week. That issue has been fixed. You should be able to access the website now. In any case here is the pdf of the main document. I will send a separate email with the appendices due to the size of these files.

Carmen Ferrer
NSWC PCD Environmental Manager
110 Vernon Avenue
Panama City, FL 32407-7001
(850) 234-4146
DISN 436-4146

-----Original Message-----
From: Rowe, Casey J [mailto:Casey.Rowe@mms.gov]
Sent: Wednesday, April 16, 2008 9:43
To: M_NSWCPC_PAOWebManager_UD
Cc: Goeke, Gary
Subject: NSWC PCD EIS/OEIS

The Minerals Management Service, Gulf of Mexico Region would like the opportunity to review a copy of the Draft EIS/OEIS to determine if the proposed action will affect OCS Oil and Gas Activities in the Eastern or Central Planning Areas. I have reviewed your website for the subject Draft EIS/OEIS, but was unable to find an electronic copy on your website. Is it possible to receive an electronic PDF version of the EIS/OEIS? If not, I would like to receive a hard copy to review. Thank you for your assistance.

Casey J. Rowe
Biologist
U.S. Department of the Interior
Minerals Management Service
1201 Elmwood Park Blvd.
New Orleans, LA 70123-2394
(504) 736-2781
(504) 736-2407

8/7/2008

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Richard B. Russell Federal Building
75 Spring Street, S.W.
Atlanta, Georgia 30303

ER 08/386
9043.1

May 19, 2008

Mrs. Carmen Ferrer
EIS Team Lead
Naval Surface Warfare Center Panama City Division
Code XPF1
110 Vernon Avenue
Panama City, FL 32407

RE: Draft Environmental Impact Statement for the Naval Surface Warfare Center Panama City Division Mission Activities, FL

Dear Mrs. Ferrer:

The Department of the Interior has reviewed the draft EIS for the Naval Surface Warfare Center Panama City Division, Florida. The following comments are offered for your consideration.

Chapter 10, List of References, page 10-21

The link provided for "USGS, 2006" contains a typographical error; the correct link is: http://capp.water.usgs.gov/gwa/ch_g/G-Floridan.html.

Thank you for the opportunity to review and comment on this DEIS. If you have any questions concerning these comments, please contact Lloyd Woosley, Chief of the USGS Environmental Affairs Program, at (703) 648-5028 or at lwoosley@usgs.gov.

You can reach me at 404-331-4524 if you should have any questions or comments.

Sincerely,

Gregory Hogue
Regional Environmental Officer

cc:
USGS, Reston
OEPC, Washington

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

May 20, 2008

Mr. A. BUDUO III
Captain, U.S. Navy
Commander
Naval Surface Warfare Center Panama City Division
110 Vernon Avenue
Panama City, FL 32407-7001

Attention: Mrs. Carmen Ferrer

Subject: Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for proposed new and increased mission activities within the NSWC PCD Study Area, Panama City, Florida.

Dear Mr. BUDUO:

Pursuant to both the Clean Air Act (CAA) § 309 and National Environmental Policy Act (NEPA) § 102 (2)(C), EPA has reviewed the draft EIS/OEIS proposal to improve NSWC PCD's capabilities to intensify current and add new air, surface, subsurface, sonar, electromagnetic, laser, ordnance and projectile firing–related research, development, test and evaluation (RDT&E) activities. Those activities associated with mine countermeasure systems operations in the coastal, near and offshore marine environment in the geographic area identified as of St. Andrew Bay and three military warning areas (W-155, 151, & 470) off the Florida Gulf Coast: Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, Franklin, Wakulla, Jefferson, Taylor and Dixie Counties.

To fulfill EPA's NEPA and related CAA § 309 responsibilities, EPA has enclosed its review comments of the above identified draft EIS/OEIS and is providing a rating of EC-2 (environmental concerns, additional information requested). The explanation of EPA's rating system is also enclosed.

Regarding the environmental concern aspects of EPA's rating, the EIS as written does not discuss what the background underwater noise levels are in the Study Area and how background compares with the "noise" associated with Proposed Action's sonar operations or "ops" (and other relevant operations, e.g., ordnance, surface vessel, etc.), nor what the potentially "annoying" noise levels are (e.g., marine species most affected). Additionally, the EIS states that studies indicate that **most** of the marine fish studied are hearing "generalists" and have their best hearing sensitivity at or below 0.3 kHz. The EIS does not define what "**most**" means in this context. Similarly, the EIS states that "**few**" marine hearing "specialists" can detect sounds up to 4.0 kHz and some can detect above 120 kHz and for one of these species a gap in sound "hearing" exists between 3.2 kHz – 12.5 kHz. In this regard, we have two comments: first, the EIS does not define what "**few**" means in this context and

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second, are any of these hearing specialists likely to inhabit the Study Area? Specifically, how will they likely to be affected: how intense will the sonar operations be and when are they likely to occur?

The EIS' language as the EIS states that studies indicate most marine fish are hearing generalists. The EIS should use more precise language -- it is unclear how many species have been studied, how many of the studied fish are generalists versus specialists, and of these how many inhabit the Study Area. Furthermore, the appropriateness of extrapolating from "*fewer than 100 fish species*[1]" to cover the entire 27,000 known fish species is questionable, particularly when Magnum-Stevenson Act (MSA) § 2 broadly defines "fish" to include other aquatic organisms not typically associated with the word, "fish," i.e., mollusks, crustaceans, and all other forms of marine animal & plant life, other than marine mammals and birds.

Second, the EIS provides operational-activity information in terms of hours-per-year, items-per-year and rounds-per-year but provides limited information on the intensity, timing, and location of these operations. For example, what does 7,443 hours of surface operations mean? Are the proposed 1,620 hours of laser operations to be conducted all at once or sporadically through out the year? What does 10,872 "rounds-per-year" mean? Will these rounds be fired all in one place all at one time? Are there certain months of the year when these operations are conducted or certain geographical areas where they conducted? This information is all relevant to determining environmental impacts associated with the proposed action.

Regarding the EIS adequacy rating of "2" (i.e., insufficient information), this draft EIS/OEIS does not contain sufficient information to fully assess environmental impacts that should be avoided in order to fully protect the environment. There are three issues of concern. First, the EIS should address the gaps in the environmental impacts analysis (i.e., Chapter 4) which prevent it from fully analyzing the Proposed Action's potential impacts at a sufficient level of detail to facilitate meaningful analysis.[2] For example, the environmental impacts information contained in chapter #4 should directly reflect the information regarding the proposed action (chapter #2) and the information provided on the affected environment (chapter #3).

Second, the EIS should clearly demarcate between a conclusion of no impact based on strong supporting evidence versus one based on the absence of scientific information is important.[3] Identifying the "unknown" allows for research priority setting and project design to fill in identified knowledge gaps, which is part of the NEPA's purpose in "informing the public and the decision maker." Under this issue are two sub issues: one is the identification of when science/data/ environmental information does not exist or is too limited to determine whether a significant environmental impact (or environmental harm) will occur. The second issue is that any absence of science/data/environmental information should not be portrayed to substantiate findings of no environmental significant impact (or harm).

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[1] Line #39, p. 4-45.
[2] See heading: ** ***Gaps in the Environmental Impacts Analysis*** ** for specific details.
[3] See heading: ** ***Identify the Limitations of the Best Available Scientific Information*** ** for specific details.

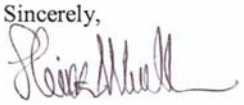
Third, the collection of relevant environmental impacts information as part of the RDT&E testing data collection used to determine operations performance is another EPA concern.[4] For example buried in Section 4.3.1.1 "Surface Operations" the EIS states, "[n]*either regulations nor scientific literature provide criteria for determining the significance of the potential effects of the NSWC PSD activities*.[5]" This statement likely applies to all of the Proposed Action's operations.

NSWC PSD has been in the mine countermeasures testing and development business in the Study Area and will likely continue in the future. Yet, this EIS/OEIS lacks the environmental studies and associated environmental impacts-type information associated with past and ongoing mine countermeasures testing and development activities. This information is relevant to this EIS'/OEIS' cumulative effects analysis and to fulfilling NEPA's EIS goals and EIS requirements.

In summary, EPA finds that the DEIS lacks specificity in several areas that should be clarified in the FEIS. These areas include better disclosure of the environmental impact information associated with its operations, e.g., sonar and fish hearing, increased detail on the specific geography and season for the implementation of the various operations, closing the gaps in the environmental impacts analysis, clear demarcation between a conclusion of no impact based on strong supporting evidence versus one based on the absence of or limited scientific information and the absence of science/data/environmental information should not be portrayed to substantiate findings of no environmental significant impact, and last, the operations performance should include an environmental impacts component.

The challenge we all face is how can the Federal Government use all practicable means, as outlined in NEPA §101, to improve and coordinate federal plans, functions, programs, and resources such that the Nation may fulfill the responsibilities of each generation as trustee of the environment for succeeding generations. Consequently, EPA's enclosed comments have been provided to assist the Department of the Navy in meeting this challenge. If you wish to discuss this matter further, Beth Walls (404-562-8309 or walls.beth@epa.gov) will serve as EPA's initial point of contact.

Sincerely,



Heinz J. Mueller, Chief
NEPA Program Office

Enclosure - 2

[4] See heading: ***Environmental Information Collection as part of RDT&E testing Operations**** for specific details.
[5] Line # 29-30, p. 4-39.

EPA Comments to the Draft Environmental Impact Statement (EIS) /Ocean Environmental Impact Statement (OEIS) for the Naval Surface Warfare Center Panama City Division (NSWC PCD) Mission Activities.

General FEIS/FOEIS Recommendations

- Strengthen the Environmental Effects/Impacts chapter (chapter # 4). This chapter is the most important part of the EIS/OEIS. It needs more scientifically-substantiated conclusions, and clear demarcations where the science/data/environmental information is lacking or so limited that making environmental-impacts related conclusions/determinations is impossible. Moreover, the NEPA analysis and findings should not be limited by or based solely on ESA or MMPA-designated species impacts as defined by the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA).

  For example, apply the information provided in both the Operations (chapter # 2) and Affected Environment Chapter (# 3) to the Environmental Consequences Chapter (# 4). The described environmental impacts are generalized without relating to the specifics of the Study Area's environment, ecosystem, and biota.

- Expand existing operations performance-related environmental-data collection to include operations' environmental-impacts information so this information can be used in this and the next EIS/OEIS.

- Be more precise in language use.

- Be more direct in language use, for example the EIS/OEIS states that the small levels of electrical current generated (roughly equivalent to two car batteries) represents no danger of electrocution.[1] The reader must assume this is associated with OASIS and is relevant to the statement that OASIS is unlikely to electrocute or be a source of lethality for biological resources (i.e., fish) near the electrode. Unclear from first paragraph[2] that the EIS/OEIS is discussing OASIS. But since OASIS is mentioned for the first time in conjunction with the electrode discussion, (i.e., OASIS is unlikely to electrocute or be a source of lethality for biological resources) the reader must then assume OASIS is the topic of discussion. EPA recommends the FEIS/FOEIS be more direct and minimize the reader's need to make assumptions and the opportunities for making inappropriate assumptions.

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[1] Section 4.3.3.3.1 on p. 4-51.
[2] See lines 3 – 19.

- The references and studies cited in the EIS/OEIS should be made available to the reviewer to allow the reviewer complete access to the materials used to support the Navy's final position, i.e., FONSI. The reviewer should not be expected to accept the Navy's interpretation of its cited studies without some degree of verification. Acceptable availability would be to provide an electronic copy of these studies via a Cd Rom or an Internet address to these studies.

- The EIS/OEIS states that NSWC PCD has developed a website: http://nswcpc.navsea.navy.mil/environmental/eis.asp to provide a forum for the dissemination of materials, data, and notices for this EIS/OEIS.[3] As of 5/14/08 this site was not accessible nor was it accessible from the link, http://www.gomexrangecomplexis.com/, from the web page located at http://nswcpc.navsea.navy.mil/Environment.htm . EPA recommends this be addressed so that this information can be accessed or remove this statement from the FEIS/FOEIS.

- Clarify the statement: actions that fall outside the scope of this document (i.e., those actions that may increase the effects or create new effects), would be addressed separately as they are proposed.[4] It is unclear from the text provided what this means in terms of the EIS/OEIS and the proposed action.

- Because of the current escalating concerns regarding the potential for human impacts toward accelerating climate change, the recommendation is being made that DON consider estimating its CO_2 emissions and investigating possibilities for incorporating measures to reduce or offset its CO_2 emissions.

- Because of the current escalating concerns over increasing demands on limited existing energy sources and the call for the development and use of alternative energies, the recommendation is being made that DON discuss its energy strategies for addressing these issues. EPA also recommends incorporating into the EIS/OEIS a direct discussion of energy efficiency measures/activities/opportunities. NEPA is the basic national charter for environmental protection and important issues of environmental protection and quality include energy and resource use, efficiency, and conservation. NEPA's regulations[5] specifically require addressing in the discussion of environmental consequences: energy requirements and conservation potential of various alternatives and mitigation measures and natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.[6]

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[3] P. 1-11.
[4] Line #26-27, p. 1-(10-11).
[5] 40 CFR 1502.16(e) & (f).
[6] More information can be found from EPA's document, *Energy Efficiency Reference for Environmental Reviewers* (1994) prepared by Science Applications International Corporation under EPA Contract 68-W2-0026, which can be found at www.nepa.gov.

Specific Issues/Concerns

Alternatives

NEPA regulations require the EIS/OEIS to describe alternatives that reflect the development a range of alternatives that could reasonably achieve the identified need of the proposed action. This range of alternatives needs to be sufficient to address issues and suggest an environmentally preferred alternative. It is to NEPA §101 that the "environmentally preferred" alternative responds.

This draft EIS'/OEIS' alternatives analysis considered three alternatives: 1) no action as in current activities, 2) increasing the level of current activities and adding new activities (i.e., Alternative #1), and 3) increasing three-fold the activities described in 2) above (i.e., Alternative #2). The above identified range of alternatives may be too narrow to sufficiently explore environmental issues and to suggest an environmentally preferred alternative.

For example, the EIS'/OEIS' alternatives do not explore the location and timing aspects to the implementation of its activities, i.e., avoiding potential impacts to spawning, juveniles, and adult marine, bird, and other affected (non ESA and MMPA designated protected) species at certain life-cycle critical times. While the EIS/OEIS attempts to address the temporal-spatial (seasonal and geographic) issue,[7] it does so on a limited basis: it is tailored to MMPA and ESA-designated species when NEPA's scope is much broader than that of the MMPA and ESA. Additionally, the protective measures appear to have caveats to their application, i.e., "other identified areas **may** be avoided due to potential effects to biological, economic, or social resources." However, consideration of potential effects to biological, economic, or social resources are the factors that should be part of the EIS'/OEIS' alternatives-development analysis.

EPA recommends the FEIS/OEIS discuss alternatives that consider the location and timing aspects to the implementation of its various operational activities. Of interest is whether there are certain locations and timing (e.g., season) in the Study Area that are the best environmental alternative(s) for conducting the ordinance, projectile firing, sonar, and/or electromagnetic field (EMF) operations. For example, the hypothetically best environmental alternative for conducting ordnance operations might be in the deepest part of the Study Area that is greatest distance from any designated marine protected area and estuaries when marine mammals are not known to be migrating, which hypothetically might be W-151's southern border outside the DeSota Canyon Closed Area.

The Affected Environment

- **Ecosystem assessment lacking:** the EIS'/OEIS' environmental impacts analysis discusses only the impacts to individual organisms, in lieu of the actual near and offshore marine

[7] Section 5.11 Avoidance Areas, p. 5-14 and Figure 5-2 p. 5-16.

ecology, e.g., trophic levels or the food chain. EPA recommends the FEIS/FOEIS discuss the near and offshore benthic and pelagic invertebrate communities.

> The organisms selected for evaluation were primarily either those deemed threatened or endangered species (e.g., ESA & MMPA). The protective measures for marine mammals and sea turtles do not ensure a functioning near and offshore ecosystem, which provides the valuable ecosystem service: nursery to the GOM's fisheries on which the ESA & MMPA designated species depend upon for their survival. NEPA §101's emphases is on using all practicable means to create and maintain conditions where man and nature can coexist in productive harmony and the attainment of the widest range of beneficial uses of the environment without degradation.
>
> For example, the EIS/OEIS speaks to "any "***small level***" of mortality caused by the NSWC PSD RDT&E activities involving detonations will most likely not be significant to the population as a whole given the "***localized effects***" of a small amount of NEW used in territorial waters.[8]" While the total invertebrate populations may not be seriously affected, however the ecosystem or communities might be impacted. Because the environmental analysis lacks a community-ecosystem assessment focus, the effects of a small level of mortality to a certain level in the food chain, e.g., an entire invertebrate species serving a specific ecosystem purpose (e.g., trophic level) could have devastating effects up to the food chain, including birds and marine mammals. This issue is not discussed in the EIS/OEIS.
>
> EPA recommends the FEIS/FOEIS define "small level" and "localized effects" to invertebrate populations be defined (e.g., which species, what degree of harm or mortality, and this mortality may affect the ecosystem they exist, e.g., are they known to be a "keystone" species or serve an ecosystem function that may be disrupted.

- **Anthropogenic sources**: the anthropogenic-sources information lacks specificity. EPA recommends the FEIS/FOEIS discuss the specifics regarding what are the primary anthropogenic sources in the Study Area, e.g., commercial traffic: fisheries, industrial, retail, military? What are their corresponding noise signatures and other background conditions associated with the anthropogenic sources? How does the proposed action compare and contrast with the anthropogenic source background conditions? Additionally, this type information should be provided for the proposed sonar, ordnance, and surface vessel operations.

- **Special biological areas:** this section does not discuss the Crystal River National Wildlife Refuge (NWR) and only mentions the Big Bend Sea Grass Aquatic Preserve without describing both as foraging habitat for (and therefore attracting) manatees and sea turtle, which has implications to the proposed action.

[8] Line #4-6, p. 4-43.

The Crystal River NWR may support the largest Florida manatee populations and provides critical habit for approximately 25% of the Nation's endangered manatee population.[9] Furthermore, the Crystal River/Kings Bay area is one of two areas supporting growing Florida manatee populations.[10] In warmer months the manatees spend most of their time at sea while from October – March the colder water drives them inland to find warm water.[11]

EPA recommends the FEIS/FOEIS add the Crystal River National Wildlife Refuge (NWR) and provide more information on the Big Bend Sea Grass Aquatic Preserve to its "affected environment" and "environmental consequences" discussions.

- **Special biological areas:** this section does not discuss that St. Andrews Bay's sea grass beds contain sea grass species that constitute a large portion of mantees' diets, i.e., shoal, manatee, turtle, and widgeon grasses and that sea grass beds are important to manatee feeding sites. EPA recommends this information be added to the FEIS/FOEIS.

- **Special biological areas:** the EIS/OEIS describes the specially designated marine managed areas (i.e., De Soto Canyon Closed Area, Florida Middle Grounds, Madison-Swanson Spawning Site, Steamboat Lumps Spawning Site, and the Reef Stressed Areas) within the Study Area but does not elaborate on what the purpose of these areas and how the Proposed Action will affect these purposes and areas. EPA recommends this information be added to the FEIS/FOEIS.

  Marine Mammals: the EIS'/OEIS' statement that sightings of the endangered Florida manatee rarely occur west of the Wakulla River[12] conflicts with the position that summer sightings in Alabama are common and that during summer months they may be found as far west as Texas.[13] Furthermore, the introduction of power plants and paper mills in northern Florida, Louisiana, and Texas have given manatees an opportunity to expand their winter range to areas not previously frequented.[14] EPA recommends this information be added to or clarified in the FEIS/FOEIS.

- **Sea Turtles:** this section correctly states that the Hawksbill turtle does not nest in the Study Area but Table 3-15 is unclear as to whether it occurs in the Study Area. Section 3.4.8 generally indicates that it is one of five species that occur along the eastern GOM continental shelf.[15] EPA recommends this information be clarified in the FEIS/FOEIS.

- **Sea Turtles:** this section did not mention or provide turtle nesting data for the other Florida counties (Wakulla (St. George Island), Jefferson, Taylor, Dixie, Levy, Citrus, Hernando,

[9] http://fws.gov/crystalriver .
[10] http://www.savethemanatee.org/myths.html .
[11] http://www/scubarystalriver.com/manateefacts.html .
[12] Section 3.4.7 on p. 3-29.
[13] http://www.savethemanatee.org/manfcts.htm .
[14] http://www.saj.usace.army.mil/regulatory/assets/docs/species/manatee/manateeInfo.pdf .
[15] P. 3-31.

Pasco, & Pinellas) that border the eastern edge of the Study Area, i.e., W-470. Moreover the Big Bend Seagrass Aquatic Preserve encompasses the coast of the four western counties mentioned above and is a forging area for both turtles and manatee. EPA recommends this information be addressed in the FEIS/FOEIS.

- **Artificial Reefs:** the EIS/OEIS provides confusing information regarding the Alabama Artificial Reef Program. First, it is unclear as to why the Alabama reefs are not included in the EIS/OEIS when they appear to be included in Figure 3-8 despite text stating otherwise.[16] Second, are just the "inshore reefs in Mobile Bay, Bon Secour Bay, and Mississippi Sound close to shore and inside the barrier reef system and not a factor in the military operations? Or are all the reefs outside of and including the barrier reef system considered not to be a factor?[17]

  And last, both Figure 3-8 and the associated Artificial Reef Text[18] is unclear in explaining "Artificial Reef General Permit Area." For instance, the text[19] states that Alabama maintains five artificial-reef general permit areas, which implies that Alabama permits them as part of its artificial reef program. However, Figure 3-8 depicts five additional areas off the Florida coast. Should the uneducated reader assume (incorrectly) that Alabama permits these or the USACOE? Because the text[20] that actually speaks to the USACOE as regulating artificial reef construction is silent regarding Artificial Reef General Permit Area, it appears that is part of the Alabama Reef Program and that only those reefs outside these General areas require USACOE permits. If that is the case, how does Alabama maintain Artificial Reef General Permit Areas off the FL coast?

  EPA recommends the above information be clarified in the FEIS/FOEIS.

- **Birds:** the EIS/OEIS indicates that one of the two types of laser operations is the air-to-water mine identification but does not discuss potential impacts to birds, which fly and float on the water surface, from these laser operations. EPA recommends this issue be addressed in the FEIS/FOEIS.

- **Fisheries:** EPA recommends the FEIS/FOEIS address how the Proposed Action's operations impact the Gulf of Mexico Fishery Management Council's seven fishery management plans for coastal migratory pelagics, spiny lobster, reef fish, shrimp, stone crab, red drum, and coral/reefs and the designated marine management areas?

- **MMPA & ESA Coordination:** the EIS/OEIS states that the DON has initiated ESA § 7 and MMPA § 101 consultation with NOAA. However, the environmental information related to this process is necessary for EPA to fulfill its CAA § 309 responsibilities (e.g., reviewing and commenting on the adequacy of the environmental analysis and the proposed federal action's environmental impacts). EPA recommends this information be provided in the FEIS/FOEIS.

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[16] lines #17-18 on p. 3-44.
[17] Consistent with text in line #33-34 on p. 3-1 under heading 3.1. Affected Environment, which states that activities would not be conducted along the coastlines or in estuaries in Alabama.
[18] pp. 3-43 – 44.
[19] line # 7-8.
[20] under the 3.5.3 Artificial Reefs heading.

Environmental Impacts

- **Environmental consequences:** the EIS/OEIS states that surface, subsurface, air, laser, and electromagnetic operations would result in no effects to any one of the areas addressed including physical, biological, and anthropogenic sources.[21] Is it accurate to say "no effect" or is "no effect" presumed due to absence of relevant science, data, and environmental information. If the latter, then this should be clearly stated. EPA recommends the FEIS/FOEIS clarify this issue.

- **Sonar Operations:** the EIS/OEIS is unclear that the towed arrays are on the surface or near the surface, as opposed to the sea-floor bottom.[22] EPA recommends the FEIS/FOEIS contain a statement to that effect.

- **Sonar Operations:** EPA recommends the FEIS/FOEIS discuss how does the Proposed Action's sonar operations compare with the background sonar use associated with other anthropogenic sources, i.e., commercial and private fisheries and academic sonar use?

- **Sonar Operations:** the EIS/OEIS does not discuss what the background underwater noise levels are in the Study Area and how background compares with the "noise" associated with Proposed Action's sonar ops (and other relevant operations, e.g., ordnance, surface vessel, etc.). Nor what the potentially "annoying" noise levels are (e.g., marine species most affected). EPA recommends the FEIS/FOEIS address the above.

- **Sonar Operations - fish:** the EIS/OEIS states that studies indicate that **most** of the marine fish studied are hearing generalists and have their best hearing sensitivity at or below 0.3 kHz.[23] EPA recommends the FEIS/FOEIS define what "**most**" means in this context.

  Sonar Operations - fish: the EIS/OEIS states that "**few**" marine hearing "specialists" can detect sounds up to 4.0 kHz and some can detect above 120 kHz and for one of these species a gap in sound "hearing" exists between 3.2 kHz – 12.5 kHz.[24] Two comments: first the EIS/OEIS does not define what "**few**" means in this context. And second are any of these "hearing specialists" likely to inhabit the Study Area? How will they likely to be affected? E.g., how intense will the sonar operations be? When are they likely to occur? EPA recommends the FEIS address the above.

- **Sonar Operations - fish:** care is needed with the EIS'/OEIS' language as the EIS/OEIS states that studies indicate most marine fish are hearing generalists.[25] The EIS/OEIS should be more precise with its language, e.g., most (define this term) of the species studied, i.e., fewer (define this term) than 100 species of the 27,000 known fish species, appear to be hearing generalists. This statement is different than simply stating "most marine fish" and far less misleading.

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[21] p. 2-16.
[22] P. 2-6, line # 1-33.
[23] Section 4.3.3.2, p. 4-45.
[24] Section 4.3.3.2, p. 4-45.
[25] Line #39, p. 4-45.

Additionally, the appropriateness of extrapolating from fewer than 100 fish species to cover the entire 27,000 fish species is questionable, particularly when MSA § 2 broadly defines "fish" to include other aquatic organisms not typically associated with the word, "fish," i.e., mollusks, crustaceans, and all other forms of marine animal & plant life, other than marine mammals and birds.

Another example, "*however, **most** marine fish species are not expected to* [be] *able to detect sounds in the mid-frequency range of the sonars used in the proposed action.*"[26] The [be] indicates that "be" is missing and is necessary to complete this sentence and "most" needs defining and put in context of less than 100 fish species studied of a known 27,000 fish species.

EPA recommends the FEIS/FOEIS clarify and address the above.

- **Sonar Operations - fish:** the EIS'/OEIS discussions of the sensitive species (e.g., herring and clupeids) are unclear as to whether these species are common in the study area and if so what protective measures (e.g., the use of low-frequencies and ultrasound)[27] might be taken to clear the operational area prior to testing.

The EIS/OEIS only mentions ultrasound detecting clupeids (such as shad and menhaden) with distributions overlapping the NSWC PCD Study Area may have similar reactions to mid-frequency active sonar because of their similarities in hearing sensitivity – good information but where are these sensitive species in the Study Area and where are they in relationship to the Proposed Action's operations? Can these sensitive-species-dominated areas be avoided? What other fish known to inhabit the Study Area are known to be hearing "sensitive" or "generalists," and of the known fish to inhabit the Study area, which ones have "unstudied" hearing? EPA recommends the FEIS/FOEIS address the above identified issues.

- **Sonar Operations - fish:** the EIS/OEIS states the only experiments showing mortality in fish have been investigations on juvenile hearing when exposed to intense mid-frequency.[28] However, it does not define "mid-frequency" and does not discuss the potential environmental impacts associated with the specifics of the Proposed Action's proposed "mid frequency" sonar use as described in Tables 2-1, 2, & 3, in the Study Area. EPA recommends the FEIS/FOEIS address these issues.

- **Sonar Operations - fish:** the EIS/OEIS states that individual juvenile fish with a swim bladder resonance in the frequency range of the operational sonars, and especially hearing specialists such as some clupeid species may experience injury or mortality. But the EIS/OEIS does not describe how this is relevant to the Study Area.

In other words, the EIS/OEIS does not apply the information provided in Chapters 2 (proposed action specifics) and to the affected environment (Chapter 3) to determine the

[26] Line #10, p. 4-47.
[27] Line #16-18 on p. 4-48.
[28] Line # 12, p. 4-46.

environmental impacts (i.e., Chapter 4). This is a reoccurring problem throughout Chapter 4 for all the Proposed Action's operations. EPA recommends the FEIS/FOEIS address the above identified issues.

- **Electromagnetic Operations:** the distinction should be made that previous research focused on undersea cables and chronic, continuous, and low level EMF emissions and contrasted with the EMF specifics of the proposed action. Moreover it is unclear what the Proposed Action's EMF effects may have on (studied or unstudied) sensitive species, e.g., mating and reproduction or can EMF (and sonar) operations facilitate aggressive behaviors, i.e., shark attacks? EPA recommends the FEIS/FOEIS address the above identified issues.

- **Projectile Operations:** the EIS/OEIS speaks to using "rounds" and "projectiles" but does not describe their size, volume, and the projected surface area of the sea floor in terms of communities affected (e.g., near or offshore benthic invertebrates that should be identified in the "affected environment" chapter) that could be covered by the spent portion of these rounds.

  Additionally, the EIS/OEIS speaks to mining ammunition from the sea floor but does not discuss the potential environmental impacts of the mining or describe the mining action in any detail.[29] EPA recommends the FEIS/FOEIS address the above identified issues.

- **Operational-activity information:** the EIS/OEIS provides operational-activity information in terms of "*hours-per-year*," "*items-per-year*," and "*rounds-per-year*" but provides limited information on the intensity, time, and location of these operations.

  For example, is the 244 hours of laser operations under the No Action Alternative conducted every day of the year? Or are there certain months of the year when these operations are conducted? Another example, are the laser operations conducted through out the Study Area or are they confined to a certain geographical area? Similarly for the ordnance operations: "*rounds-per-year*," will these be fired all in one place at one time? How many hours are involved with firing 3,624 rounds? Lastly, will these rounds be collected or left on the seafloor for marine scavengers to bioaccumlate these rounds and associated pollutants and put them into the food chain, e.g., the potential aquatic version of the "condor (bird) lead" issue?

  EPA recommends the FEIS/FOEIS address the above identified issues.

The Protective Measures

- EPA applauds the inclusion of these protective measures in the draft EIS/OEIS. It notes they are primarily targeted to ESA & MMPA-designated species and does not consider communities of interest and the important food chain that supports the ESA & MMPA-designated species. The issue of concern is larger than "habitat" protection and touches upon

[29] Section 4.2.4.2, p. 4-37.

the rationale for creating EFHs and Marine Management Areas. Hence, EPA's earlier recommendations that the FEIS/FOEIS include alternatives that explore environmentally preferred alternates for each of the proposed action's operations to identify likely impacts to the near and offshore marine ecology, which might be addressed in an expanded version of this topic.

- This section speaks to using visual surveys using people located in the highest points of ships and in airplanes that focus on surface water sightings of actual marine mammals and sea turtles, or indicators for their potential presence, e.g., presence of large *Sargassum* rafts and large concentrations of jelly fish (sea turtle indicators) and large flocks of birds and schools of fish (marine mammal indicators).[30] Would the use of "fish finder" type sonar operated from small-craft operations an option to identify submerged marine life (e.g., whales and turtles and large schools of fish, or large fish schools) that may not surface and therefore not be identified in the visual surveys nor be in the vicinity of the targeted indicators but in the vicinity of potential ordnance and projectile firing operations?

- The proposed protective measures attempt to address ordnance operations effects on Gulf sturgeon migration from fresh to GOM waters during October and November, but does not (and EPA recommends that the FEIS/FOEIS) address general manatee migrations from GOM waters to inland waters for the winter months and from inland waters to GOM waters for the summer months. Moreover these seasonal-transitional manatee migrations may be affected by more than the proposed action's ordnance operations. Furthermore, watercraft strikes tend to be the largest contributing factor to manatee mortality and the preferred alternative proposes 7,433 hours per year of surface vessel operations, when a 365-day year has 8,544 hours.[31]

General Comments, Concerns, & Issues

*** Gaps in the Environmental Impacts Analysis ****

Imprecise Language

Concern exists over numerous instances of imprecise use of language, particularly in the Environmental Effects/Impacts sections to substantiate the Navy's environmental impact findings. A few examples are identified below to illustrate this concern. EPA recommends that the FEIS/FOEIS define its generalities and be clear in its word choices.

- In the sonar operations environmental effects upon fish discussion, the EIS/FOEIS states that studies indicate that "**most**" of the marine fish studied are hearing generalists[32] without defining "**most.**" Same is true for "**few**" in the statement: "**few**" marine hearing "specialists"

[30] Section 5.10 on p. 5-12.
[31] http://myfwc.com/whatsnew/08/statewide/News_08_X_07ManateeDeaths.htm
[32] Section 4.3.3.2, p. 4-45.

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can detect sounds up to 4.0 kHz, and best available fish hearing data exists for "**fewer**" than 100 of the 27,000 species of fish.[33] The use of "**most**" and "**few**" fails to convey a sufficient level of detail to facilitate meaningful analysis.

Additionally the statement, "*however, most marine fish species are not expected to* [be] *able to detect sounds in the mid-frequency range of the sonars used in the proposed action,*"[34] is misleading as written. Best available fish hearing data exists for fewer (needs to be defined) than 100 of the 27,000 species of fish and suggest that for these studied fish, the preponderance (needs to be defined) of fish hearing occurs below 1 kHz. The EIS/OEIS should be more precise with its language, e.g., what number of fish species studied is not expected to detect sounds in the mid-frequency range (will they be able to detect high-frequency sounds? Is the answer known?). Do these fish inhabit the Study Area?

EPA recommends that the FEIS/FOEIS address all similar examples to the above.

- The EIS/OEIS states that RDT&E activities "***typically***" occur "***well seaward*** of estuarine and near shore environments.[35]" The language "**typically**" and "**well seaward**" are imprecise and fail to convey a sufficient level of detail to facilitate meaningful analysis. EPA recommends that the FEIS/FOEIS define the above generalities and all similar ones that are not identified in these comments.

- The EIS/OEIS speaks to RDT&E activities conducted in the near shore environment may "***temporarily***" increase "**minor**" wave action in estuarine areas.[36] Sediment suspension will be "***temporary***" and "***local***.[37]" How are these terms defined? Seconds? Feet? The language is imprecise and fails to convey a sufficient level of detail to facilitate meaningful analysis. EPA recommends that the FEIS/FOEIS define the above generalities and all similar ones that are not identified in these comments.

- The EIS/OEIS speaks to "any "***small level"*** of mortality caused by the NSWC PSD RDT&E activities involving detonations will most likely not be significant to the population as a whole given the "***localized effects***" of a small amount of NEW used in territorial waters.[38]"

However, "***small level"*** and "***localized effects***" lack a sufficient level of detail to facilitate meaningful analysis. Because the mortality is undefined, it is difficult to ascertain impacts to the ecosystem and its food chain see heading, "**Ecosystem assessment lacking"** in the "*Affected Environment*" section below. EPA recommends that the FEIS/FOEIS define the above generalities and all similar ones that are not identified in these comments.

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[33] Section 4.3.3.2, p. 4-45.
[34] Line #10, p. 4-47.
[35] Line #19-20, page 4-39.
[36] Line #33 – 34, p. 4-39.
[37] Line #17 – 18, p. 4-40.
[38] Line #4-6, p. 4-43.

- In its discussion of water quality effects, the EIS states that "currently there are no **ecological** criteria for each constituent in non-territorial waters.[39]" The way the section is set up, the reader expects "**water quality**" criteria not ecological. EPA recommends that the FEIS/FOEIS clarify the above.

- Another example is where the EIS/OEIS states, "*Operation of the laser at eye safe levels ensure that damage from laser wavelengths within the visible spectrum (400 – 700 nm) will not occur to the scales*.[40]" EPA recommends that the FEIS clarify this confusing sentence – what does eye-safe levels have to do with scales? Furthermore, eye-safe levels for whom? Fish? Humans?

Specificity and Relevance

This concern based over the absence in the environmental effects discussion (chapter # 4) of the application of the specifics associated with the Proposed Action's various operations (chapter # 2) and the affected environment (chapter #3). Moreover, insufficient operations specifics are provided in any chapter at a sufficient level of detail to facilitate meaningful analysis of potential environmental impacts. Additionally, information provided in the form of studies cited either are not applied or incompletely applied (i.e., compared and contrasted) to the specific facts of the Study Area and the Proposed Action's operations. Consequently, the Environmental Effects discussion contains generalities to substantiate the Navy's environmental impact findings but limited as to specifics regarding the proposed action's actual environmental impacts.

EPA recommends that the FEIS/FOEIS address the issues identified above and illustrated in the following examples.

- One example is the EIS'/FOEIS' application of two generalized statements[41]: 1) approximately 96% of a laser beam projected into the ocean is absorbed, scattered, or otherwise lost and 2) the potential for damage due to exposure to a laser beam below the water's surface decreases as the depth increases into one generalized conclusion: thus the potential for effects will be greatest at the surface and since the majority of the invertebrates live on the sea floor or in the sediment where the energy from a laser bean will be unlikely to reach due to adsorption and scattering there will be no significant impact to invertebrates.

  A concern is the EIS'/OEIS' failure to define the relevant terms used in the generalized statements and omission of the Study Area's specifics. "Ocean" is undefined and it is not compared to the Study Area's specific characteristics. Numerous figures in the EIS/OEIS depict the study area's bathymetry such that it appears the predominant depth is less than 200 meters. Does the above generalized statement apply to water depths of less than 200 meters? Will the laser operations be conducted in water depths less than 200 meters? Furthermore water clarity (i.e., absence of turbidity) also significantly influences the laser beam's ability to penetrate and impact invertebrates.

[39] Line #12, p. 4-34.
[40] Section 4.3.3.4 on p. 4-53 see line #37-38.
[41] Sections 4.3.2.3.2 & 4.3.2.3.3 on p. 4-44 starting with line # 18.

Also relevant is the surface area affected by laser beams (or repeated beams), which could be compared to the overall surface area of the affected sea floor and benthic inhabitants and any repetitiveness of the laser operations (i.e., will the same area be repeatedly affected) to provide the reader better information on the degree of seafloor that may be affected.

As written the EIS/OEIS is unclear as to where and what water depths in the Study Area the laser operations will occur and therefore the EIS'/OEIS' existing discussion is not (and needs to be) relevant to the particulars of the Study Area. Consequently it is unclear how the EIS/OEIS makes the conclusion that there will be no significant impacts to invertebrates. To do this, one has to make a lot of assumptions (which have not been and should be clearly stated) to make the Navy's environmental impacts conclusions.

Another example is the EIS' discussion of electromagnetic field (EMF) studies associated with offshore wind farms.[42] There appears to be an absence in comparison between similar data metrics used in the Proposed Action (e.g., tesla and Gauss metrics) and that used in the offshore wind farm studies (e.g., volts/meter and Hz metrics[43]). Without the use of comparable metrics, it is difficult to compare and contrast between the information provided in the wind farms studies and the Proposed Action to determine potential environmental impacts. In other words, an insufficient level of detail has been provided to facilitate meaningful analysis.

Moreover, the EIS/OEIS does not make the distinction (contrast) between the chronic, continuous, and low emissions nature of the EMF studied with the offshore wind farms with that of the Proposed Action, which might be more acute, episodic, and higher in intensity?

These distinctions may be relevant, even if currently unknown/unstudied, to impacts on the marine biology. In other words, the offshore wind farms EMF generation studies are focused on the specific facts associated with wind farms and not with the Navy's surface-mine-countermeasure-testing related activities and therefore limited in relevance and applicability. The EIS/OEIS needs to inform as to how limited and relevant they are to the Proposed Action.

It is scientifically appropriate to state when impacts are unknown rather than textually leapfrogging from unrelated studies of limited relevance and applicability to an unscientific conclusion of no significant impacts. The NEPA decision maker and public needs to know what is known and unknown and what this status means to the Proposed Action.

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[42] Section 4.3.3.3.1 on p. 4-51. See line # 36 –"*the literature on the effects of EMF to marine species is limited and the majority of studies have focused on permanent infrastructure related to offshore wind farms.*"

[43] Examples include: *Memorandum Addressing Electric and Magnetic Field (EMF) Questions Draft, Cape Wind Energy Project, Nantucket Sound* (August 2005)at www.mms.gov/offshore/PDFs/cwfiles/141.pdf, and *Investigation into the Effects of EMF generated by Offshore Windfarm Cables under Various Conditions*, at http://www.offshorewind.co.uk/Rsearch/ReasarchAreas/ElectromagneticFields/EMFPhase1.aspx.

- In the EIS/OEIS discussion of ordnance operations impacts to fish,[44] it provides threshold information for physical injury to fish and invertebrates from detonations[45] and generalized information on fish impacts, e.g., shock waves associated with underwater use of explosives has the potential to rupture swim bladders and blood vessels, tear fish tissues, and rupture/hemorrhage the spleen, etc., in the proximity of the detonation source.

  The EIS/OEIS explains that the offshore-removal-of-oil-rigs related studies revealed a few generalities: at very close range, underwater explosions are lethal to most fish species regardless of size, shape, or internal anatomy leading to the generalized cause of death: internal bleeding associated with massive organ and tissue damage. At longer range, fish species with gas-filled swim bladders (e.g., snapper, cod, and striped bass) are more susceptible than those without swim bladders (e.g., flounders and eels). Additionally, larger fish may be less susceptible than smaller fish. Open water pelagic fish (e.g., mackerel) may be less affected than reef fish.

  The EIS/OEIS has not taken the above information and applied it such that it is relevant to the Study Area and the Proposed Action. Absent is the application of this information to the specifics associated with the Proposed Action's operations (chapter 2) and the fish known to inhabit the area (chapter 3)? Moreover any estimations of the number of fish killed associated with the oil rig studies, e.g., number associated with the various net explosive weigh categories proposed to be detonated in the Study Area would be useful.

  In other words, an insufficient level of detail has been provided to facilitate meaningful analysis.

Further Clarity Needed to Understand the Proposed Action

It is unclear where and how the various operations are occurring, e.g., the 3-dimension geographic territory: aerial extent, water depth, whether the same areas will be subjected to repeated laser beams, sonar operations, projectile firings, ordnance operations, etc., and whether and how nearshore and/or offshore benthic communities will be affected, birds, fisheries, etc. An exception to this observation is the depth component of the ordnance discussion regarding mine detonation and that discussion does not discuss the geographical where in relation to the different warning areas and SAB. Another example, will sonar operations primarily occur in depths exceeding 200 meters? Will ordnance operations be focused off federally-owned coastal areas and which ones? And where the information is given it is not sufficiently discussed in the environmental impacts chapter.

EPA recommends that the FEIS/FOEIS address the issues identified above.

[44] Section 4.3.3.5 on page 4-55.
[45] Table 4-21 on p. 4-55.

***** Identify the Limitations of the Best Available Scientific Information *****

Two concerns exist: one is the identification of when science/data/environmental information does not exist or is too limited to determine whether a significant environmental impact (or environmental harm) will occur. The second is that this absence of science/data/environmental information not be portrayed to substantiate findings of no environmental significant impact (or harm).

EPA recommends that the FEIS/FOEIS should clearly inform both the decision maker and the public as to what is or not and clearly indicate whether decisions are being based on unknown information. Where science/data/environmental information do not exist or are too limited to determine whether a significant environmental impact (or environmental harm) will occur, this should be so stated in lieu of making unsubstantiated findings of no significant impact (or harm). To do otherwise, is to fail to meet the NEPA obligation of informing the decision maker and the public.

If the most accurate conclusion is that the environmental impacts the use of laser (or sonar, etc.) within the study area on the invertebrate communities (or fish, turtles, etc.) in the area are unknown. This should be stated and why it is unknown. It is one thing to make a decision based on known science and quite another to make a decision based on unknown science.

To implement NEPA's purpose, a decision maker and the interested public need to know and should be informed as to whether the decision is being made based on known science, the degree of confidence in the science's outcomes/conclusions, and the degree of the science's applicability to the proposed action, or when the science has not been done or lacking or limited and whether the available information is anecdotal. Furthermore, identifying the "unknown" allows for research priority setting and project design to fill in identified knowledge gaps, which is part of the NEPA's purpose in "informing the public and the decision maker."

Limited or absent scientific information

- For example in the EIS'/OEIS' discussion on the EMF operations environmental impacts, it is unclear how the EIS/OEIS concludes that smalltooth sawfish and Gulf sturgeon will not be affected by the Navy's use of EMF.[46] The clarity issue is caused by the information in the sentence immediately preceding this conclusion which states that "*the effects of EMFs on smalltooth sawfish and Gulf sturgeons are unknown; however based on the findings for sensitive species sensitive to electromagnetic fields the Navy finds its use of EMF will not affect smalltooth sawfish and Gulf sturgeons and there will be no NEPA significant impacts*."

  Moreover the EIS/OEIS is silent as to whether smalltooth sawfish and Gulf sturgeons' EMF sensitivities been studied. The EIS/OEIS only mentions the elasmobranches and flounder studies. Furthermore the EIS/OEIS is silent as to whether the studied EMF-sensitive species have certain relevant bio-characteristics sufficiently similar to

[46] Line # 6 – 12 on p. 4-53.

smalltooth sawfish and Gulf sturgeons to support the EIS'/OEIS' conclusion of no significant impact to smalltooth sawfish and Gulf sturgeons or other marine species known to inhabit the Study Area.

Additionally those species known to be sensitive to EMF are only those limited number of species that have been studied, likely those species associated with the offshore wind farm infrastructure, not the Navy's surface-mine countermeasures-testing activities within the Study Area. The EIS/OEIS does not inform the reader how many marine species have been studied, if those studied species inhabit the study area particularly where the EMF activities are likely to occur.

EPA recommends that the FEIS/FOEIS address the issues identified above.

- Another example is the EIS/OEIS section on laser operations on fish. The EIS/OEIS states that no research has been conducted on fish[47] yet concludes there will be no significant impacts to fish. An attempt is made to rationalize this finding by noting "*the duration that any given area will be radiated will be extremely short considering the majority of the platforms will be continuously moving in the test area*." Because EPA is not and cannot be expected to be (nor the general public) familiar with Navy testing operations, it is unable to connect this statement to the determination of no significant impacts to fish, particularly since the EIS/OEIS states that fish have not been studied.[48]

  Will the platforms repeatedly traverse the same course causing repeated "radiation?" Moreover, what does the Navy mean when it says "radiated." The use of "radiated" could imply radiation harm associated with chemical degradation (nuclear), which leads to confusion since the EIS/OEIS has stated that "eye" harm is the primary concern.

  EPA recommends that the FEIS/FOEIS address the issues identified above.

- In the EIS'/OEIS' discussion on the ordnance operations impacts to fish,[49] it is unclear how the Navy has determined that fish impacts will be minor and have little effect on fish populations as a whole when no data exists on the density of fish in the Study Area and consequently it is unable to determine the quantity of fish affected. The EIS/OEIS also states that the quantity of fish affected will be small relative to the abundance of these populations in the GOM, yet provides no GOM fish population information. Furthermore in the broadest sense, all the waters of the gulf, including estuarine and freshwater areas in state waters are designated as essential fish habitat (EFH).[50] EPA defers to NOAA but has the following comments.

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[47] Section 4.3.3.4. on page 4-54 see line #1.
[48] The argument could be made that NSWC PSD has had plenty of opportunity and a NEPA responsibility to conduct these studies since its surface mine countermeasures testing operations are the lifeblood of its surface mine countermeasures program which has been in existence for a number of decades.
[49] Section 4.3.3.5 on page 4-55.
[50] See: http://galveston.ssp.nmfs.gov/research/fisheryecology/EFH/Relative/gulfwide/index.html

EFH designations reflect the need to address declining not abundant fish populations in that the purpose of designating EFHs are to protect species believed to be declining due to overfishing.

The Study Area encompasses EFH for 26 species including groupers, shrimps, cobia, corals, sargassum, mahi, amberjacks, snappers, triggerfish, mackerels, little tunny, red drum, scamp, stone crab, spiny lobster, and tile fish.[51] This information does not include all the temperate and tropical species known to the Study Area that have no EFH designation.[52] Additionally, the Gulf of Mexico Fishery Management Council has developed seven fishery management plans that affect the Study Area.

The argument in the EIS/OEIS that most species experience a large number of natural mortalities especially during early life-stages, and therefore any small level of mortality (the one remaining undefined) caused by detonations during RDT&E activities will be minor and have little effect on the population as written appears to be self-serving and not to be grounded on best available environmental science/data/information.

Furthermore, it is unclear from the EIS'/OEIS statement that test personnel have not observed any fish mortalities associated with the use of line charges or small detonations is the result of strict protocols requiring these observations be made for all testing or whether this an isolated and anecdotal piece of information. The EIS/OEIS declined to discuss this in a sufficient level of detail to facilitate meaningful analysis and to support its finding of no significant environmental impact to fish.

EPA recommends that the FEIS/FOEIS address the issues identified above.

The EIS/OEIS states "[t]*here is no information that shows there will be any effect to marine invertebrates from sonar transmissions*.[53]" This statement is unclear as to whether no studies have been done or whether studies have been done but have found no invertebrate effects. If no studies have been done, why has not NSWC PSD been studying this issue associated with their sonar operations in the Study Area during the history of their surface-mine countermeasures testing and development program?

EPA recommends that the FEIS/FOEIS address the issues identified above.

Incomplete Environmental Impacts Discussions

Concern – the EIS/OEIS fails to discuss the environmentally-relevant particulars of the various operations (e.g., the frequencies and intensities) and their potential environmental impacts. EPA recommends that the FEIS/FOEIS address this issue described above and identified in the following examples.

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[51] Section 3.4.4. on p. 3-24.
[52] P. 3-(19-20).
[53] Line #21-23, p. 4-41.

- For example, the EIS/OEIS does not discuss hours and their associated impacts of the anticipated laser operations. The EIS/OEIS states the laser-operation hours will range from 244 (no action alternative) to 1,053 hours (preferred alternative). Yet the EIS/OEIS is silent on whether the laser operations will consist of continuous 244 hour operations, or several independent and discrete operations of varying hours. Nor does the EIS/OEIS discuss where the operations will occur – nearshore or offshore habitats – the water depth ranges, etc. Will there be a seasonality component to these operations?

- Another example is the EIS section on laser operations on fish.[54] The EIS/OEIS states that none of the laser operations in any of the proposed alternatives will affect smalltooth sawfish and Gulf sturgeon because they prefer the benthic habitats on the seafloor. If the laser operations are conducted in shallow waters, perhaps the seafloor might not offer much protection to any shallow-water occupying sawfish or sturgeon.

Uncertainty

Three basic types of uncertainty exist: incomplete or imperfect mastery of available knowledge, limitations in current knowledge, and difficulties in distinguishing between the above. The environmental impacts chapter (chapter # 4) is written with more certainty and confidence than is warranted by the available science and environmental information/data it cites.

EPA recommends the FEIS/FOEIS should clearly state the limits of the available science, data, and environmental information and the limitations on the mastery of the available information regarding the environmental impacts associated with beach nourishment projects.

ESA used to Justify No Significant Impacts Findings

Findings of no significant impacts appear to based solely on whether an ESA-designated species is detrimentally impacted consistent with the ESA. NEPA is broader than the ESA, for example its scope includes non ESA-protected species and ecosystems,[55] which is outside the ESA's scope and intent. EPA recommends that the FEIS/FOEIS address this issue described above and identified in the following examples.

- For example in the EIS'/OEIS' discussion of EMF environmental impacts,[56] it essentially states the effects of EMFs on smalltooth sawfish and Gulf sturgeons are unknown; however based on the findings for sensitive species sensitive to electromagnetic fields the Navy finds its use of EMF will not affect smalltooth sawfish and Gulf sturgeon, in accordance with the ESA and there will be no NEPA significant impacts to fish associated with any of the described Alternatives.

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[54] Section 4.3.3.4. on page 4-54.
[55] One of NEPA's purposes is "to enrich the understanding of the ecological systems and natural resources important to the Nation." 42 USC § 4321.
[56] Line # 6 – 12 on p. 4-53.

Yet the body of the discussion is silent as to the impacts to the other marine species known to inhabit the Study Area, as described in the EIS'/OEIS' Chapter 3, including the known EMF-sensitive species: the elasmobranches (sharks, rays, and skates) and flounder. As written, the EIS'/OEIS' "*NEPA no finding of significant impacts*" conclusion appears to rest solely on whether the ESA-designated species, smalltooth sawfish and Gulf sturgeon, are significantly impacted as defined by the ESA.

Absence of the NMFS Biological Opinion and the LOA request

The absence of the NMFS biological opinion (BO) and request for a letter of authorization for the incidental harassment of marine animals from the EIS/OEIS is relevant the environmental impacts analysis. EPA recommends that the FEIS/FOEIS address this issue.

*****Environmental Information Collection as part of RDT&E testing Operations*****

Similar to all federal agencies, the Department of the Navy (DON) is in the business of activities that have tremendous ramifications to the state of the Nations environment, and for DON, the global environment. The concern is that due to the nature of DON's business it does not actively encourage, and understandably so, outside monitoring and assessment of environmental impacts associated with its global-scale operations. Consequently, DON has an added burden in meeting NEPA's goals and requirements. It needs to assess its own environmental impacts and cannot rely on outside studies as no one else is in the same business as DON or is in the position to know the specifics of DON's business to be able to assess associated environmental impacts.

For example buried in Section 4.3.1.1 "Surface Operations" the EIS/OEIS states, "[n]*either regulations nor scientific literature provide criteria for determining the significance of the potential effects of the NSWC PSD activities*.[57]" This statement probably applies to all of the Proposed Action's operations. Yet, NSWC PSD has been in the surface-mine countermeasures testing and development business for decades in the Study Area and will likely to continue into the future. Where in this EIS/OEIS are its environmental studies and associated environmental impacts-type information to fulfill NEPA's EIS/OEIS goals and EIS/OEIS requirements? NSWC PSD has likely been collecting a lot of environmental operational performance information since NEPA's passage, but apparently nothing on its operational environmental impacts. It is likely no one else has the access and authority to collect this environmental impacts information in a restricted area during testing operations. EPA recommends the FEIS/FOEIS provide this operational data and experience.

[57] Line # 29-30, p. 4-39.

Comment 14

Page 5-11, lines 5-6, states no detonations with bottom disturbance will occur over shipwrecks. Again, this only takes into account known shipwreck locations.

Comment 15

Page 6-40, lines 11-12, states "Effects to cultural resources in the marine environment are unlikely as the submerged resources are protected under the bottom sediment by sediment from wave action." This statement is only partially true. While archaeological resources that are buried under sufficient sediment would be protected from seafloor disturbing activities, any resources that are above the sediment, or only minimally covered by sediment, would have the potential for impact from seafloor disturbing activities. Given the limited amount of remote-sensing survey data in the project area and the fact that this area has a high potential for both prehistoric and historic archaeological resources, the potential for impacts is much greater than expressed in this Draft EIS/OEIS. Unless remote-sensing surveys are conducted and an archaeological assessment of these data completed prior to seafloor disturbing activities, the potential for impacts is possible.

Comment 16

Page 3-47, lines 18-19, states that the Abandoned Shipwreck Act of 1987 (ASA) gives the title and jurisdiction over historic shipwrecks to the Federal Government out to the EEZ. This statement is not accurate. The ASA gives title to historic ships in State waters to the Federal Government, which then cedes them back to the State. The ASA has no effect in Federal waters whatsoever.

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123-2394

In Reply Refer To: MS 5410

MAY 15 2008

Captain A. Buduo III
Department of the Navy
Naval Surface Warfare Center
110 Vernon Avenue
Panama City, Florida 32407-7001

Dear Captain Buduo:

This letter is in response to your letter (dated April 4, 2008) announcing the availability for public review and comment of the Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for the *Naval Surface Warfare Center Panama City Division Mission Activities*. We have prepared comments to the Draft EIS/OEIS and attached them as an enclosure to this letter.

We appreciate the opportunity to comment on the EIS/OEIS. The Minerals Management Service and the Department of the Navy have coordinated and worked cooperatively on OCS issues for many years and we look forward to maintaining that relationship. If you have any questions regarding this letter, please contact Mr. Dennis Chew at 504-736-2793.

Sincerely,

Joseph A. Christopher
Regional Supervisor
Office of Leasing and Environment

Enclosures

TAKE PRIDE IN AMERICA

Enclosure

Comments to the Draft EIS/OEIS for the Effects Associated with the Naval Surface Warfare Center Panama City Division Mission Activities

The Minerals Management Service reviewed the Naval Surface Warfare Center Panama City Division (NSWC PCD) draft EIS/OEIS and identified the following issues.

Comment 1

Information regarding the Gulf of Mexico Energy Security Act of 2006 (GOMESA) was included in Chapter 6.2.16, State Oil and Gas Activities, of the EIS/OEIS. Because GOMESA provides for oil and gas leasing in Outer Continental Shelf waters, this information would be more appropriately listed under Chapter 6.2.8, Minerals Management Service (MMS) Regulated Activities.

Comment 2

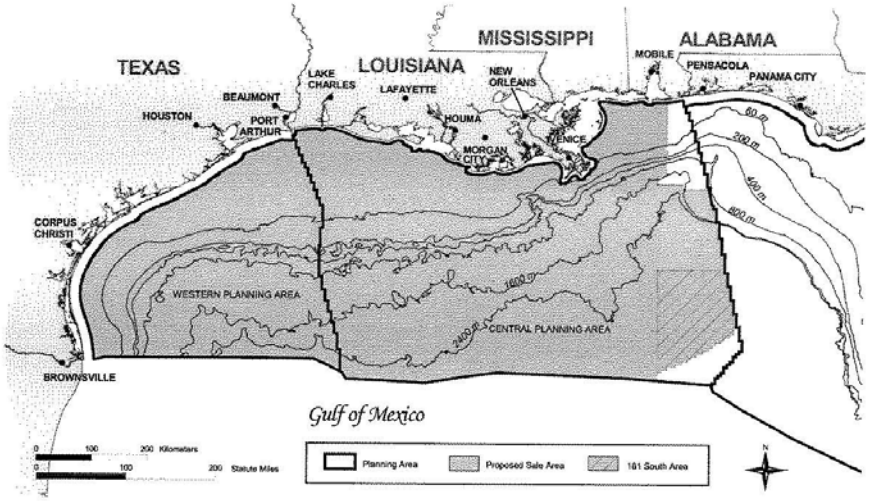
The information in Chapter 6.2.16 describing MMS actions related to GOMESA is not up to date. Below is more accurate information regarding MMS lease sales related to GOMESA:

The Gulf of Mexico Energy Security Act (GOMESA) of 2006 (P.L. 109-432, December 20, 2006) repeals the Congressional moratorium on certain areas of the Gulf of Mexico, places a moratorium on other areas in the Gulf of Mexico, and increases the distribution of offshore oil and gas revenues to coastal States. The GOMESA defines two areas in the Gulf of Mexico – the 181 Area and the 181 South Area. Approximately 2 million acres (ac) of the 181 Area are located in the Central Planning Area (CPA). Because this portion was not previously under moratorium, it was available for lease starting with CPA Lease Sale 205 held on October 3, 2007. The remaining portion of the 181 Area is approximately 500,000 ac located in the Eastern Planning Area (EPA). The MMS published a Final Supplemental EIS (SEIS) in October 2007 (copy of CD enclosed) on this eastern portion of the 181 Area, and it was offered in Lease Sale 224 on March 19, 2008.

One of the areas the GOMESA defines is referred to as the 181 South Area (Figure enclosed). This area is located in the CPA and is approximately 5.8 million acres (ac). The MMS is proposing the sale area for proposed CPA Sales 208 (2009), 213 (2010), 216 (2011), and 222 (2012) be expanded to include 4.3 million ac of the 181 South Area. The remaining acreage of the 181 South Area (1.5 million ac) is located beyond the U.S. Exclusive Economic Zone (EEZ) and, therefore, would not be offered. The MMS Multisale EIS (USDOI, MMS, 2007) did not analyze the 181 South Area. Therefore, MMS has prepared a separate National Environmental Policy Act (NEPA) review to reevaluate the expanded CPA sale area (USDOI, MMS, 2008).

As part of the environmental review process for the expanded CPA sale area, MMS held four scoping meetings in October 2007. One scoping meeting was held in Texas, two scoping meetings in Louisiana, and one scoping meeting in Alabama (USDOI, MMS, 2008). The Draft SEIS was released on April 11, 2008, and a copy of the CD is enclosed. Three public meetings

will be held in Larose and Baton Rouge, Louisiana, and Mobile, Alabama, on May 13, 14, and 15, respectively. The comment period for the Draft SEIS will close on June 10, 2008.



References:

U.S. Dept. of the Interior. Minerals Management Service. 2007. Gulf of Mexico OCS oil and gas lease sales: 2007-2012; Western Planning Area Sales 204, 207, 210, 215, and 218; Central Planning Area Sales 205, 206, 208, 213, 216, and 222—final environmental impact statement. 2 vols. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS EIS/EA MMS 2007-018.

U.S. Department of the Interior. Minerals Management Service, 2008. Proposed Gulf of Mexico OCS oil and gas lease sales: 2009-2012; Central Planning Area Sales 208, 213, 216, and 222; Western Planning Area Sales 210, 215, and 218—draft supplemental environmental impact statement. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS EIS/EA MMS 2008-011.

Comment 3

The Gulf of Mexico Energy Security Act (GOMESA) of 2006 also includes a provision allowing for credits for exchanged leases. The credits will cover 79 active leases acquired between 1984 and 1990 within 125 mi of the Florida coast in the EPA and certain leases within 100 mi from the coast in the CPA. The proposed rule was placed in the *Federal Register* February 1, 2008 with a 60-day comment period. For further information, use the following link to the *Federal Register* notice:
http://a257.g.akamaitech.net/7/257/2422/01jan20081800/edocket.access.gpo.gov/2008/pdf/E8-1860.pdf.

Comment 4

Line 31 of page 6-19 referenced *Tyson, 2007* while describing the effect of the State of Louisiana lawsuit against MMS requiring MMS to take into consideration the effects of Hurricanes Katrina and Rita cumulatively with the effects of the sale. The reference, *Tyson, 2007,* was not included in the bibliography in Chapter 10.

Comment 5

All of the leases in the area of the proposed Navy activities already have or will have a military stipulation that requires coordination with military officials responsible for activities in the relevant military warning areas. The MMS standard military stipulation coordination requirement should handle any space-use conflicts between oil and gas leases and the proposed Navy activities. Nonetheless, MMS would like to be kept abreast of any future updates or revisions related to this Navy proposal.

Comment 6

Current lease information, including the Gulf of Mexico OCS Region's lease map and lease status reports, can be accessed at http://www.gomr.mms.gov/homepg/lsesale/lsesale.html.

Comment 7

The last paragraph of Chapter 6.2.8 regarding marine mammal mitigation measures is not accurate. The Marine Mammal Protection Act (MMPA) Take-Regulations cited (NOAA, 2002c) expired on February 2, 2004. The American Petroleum Institute (API) petitioned for/received the authorization on behalf of its members (not MMS), and it did not authorize the taking of 200 bottlenose and spotted dolphins, but only a "small number" by harassment. Nowhere did they define "small number."

No removal operations have been covered by MMPA Take-Regulations since the 2002 extension's expiration. The MMS submitted a petition package under Subpart I of the MMPA for the promulgation of take-regulations for marine mammals impacted by explosive-severance operations on February 25, 2005. The National Marine Fisheries Service (NMFS) published a Notice of Receipt of MMS Petition on August 25, 2005, and a Draft Rule on April 7, 2006. The comment period on the Draft Rule expired on May 22, 2006, but MMS has yet to receive the Final Rule.

No takes of a sperm whale will be issued via the Endangered Species Act (ESA) until the MMPA Take-Regulations are published. Even then (with a amended Biological Opinion (BO)/Incidental Take Statement (ITS)), MMS will only expect take **by harassment** of around 1/year.

Comment 8

Table 6-12 contains out-dated information regarding the estimated number of sea turtle takes from MMS rig removals. On August 28, 2006, MMS received the BO/ITS from NMFS conducted under Section 7 of the ESA (on the MMPA Rulemaking exercise MMS began with its petition on February 25, 2005). The ITS allows for incidental take of

- **3** sea turtles/year (or 18 sea turtles/6-year period) **by injury or mortality** from explosive severance;
- **1** turtle may be captured in a site-clearance trawl (though they do not actually define it as an injury, mortality, or harassment); and
- **84** sea turtles/year **by harassment**;

Comment 9

Page 3-47, lines 22-23, states "There are currently no NRHP-listed properties administered by NSWC PCD within the NSWC PCD Study Area." However, there has been relatively little remote-sensing survey data collected in this area; therefore, it is not known how many potentially significant archaeological resources may be located within this area.

Comment 10

Page 4-154, lines 39-41, states operations "will not be conducted in areas that are expected to contain known cultural resources." Since the entire operations area within Federal waters are located in navigable waters, and given the fact that this area was a high-traffic area for historic vessels, cultural resources could be expected to be located **anywhere** in the proposed project area. Given the limited amount of remote-sensing survey data in this area, there is no way of determining how many potentially significant archaeological resources could be impacted in unsurveyed areas.

Comment 11

Page 4-155, lines 1-7, states there will be no significant impact to cultural resources. Again, without proper survey coverage prior to seafloor impacts and ordnance operations, it is impossible to make this determination.

Comment 12

Page 5-9, lines 14-15, identifies proposed consultation with appropriate agencies when avoidance of historic properties is not possible; however, this does not take into account potential impacts to unexpected finds.

Comment 13

Page 5-9, lines 32-33, states bottom disturbance activities will not occur over shipwreck sites. This only takes into account known locations.