Appendix A – Integrated Comprehensive Monitoring Program. 2010 Update.

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UNITED STATES NAVY

INTEGRATED COMPREHENSIVE MONITORING PROGRAM

2010 UPDATE

20 December 2010

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EXECUTIVE SUMMARY

The Navy is responsible for compliance with a suite of Federal environmental laws and regulations that apply to marine mammals and other marine protected species, including the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). As part of the regulatory compliance process associated with these Acts, the Navy is responsible for meeting specific requirements for monitoring and reporting on activities involving active sonar and/or detonations from underwater explosives.

This Integrated Comprehensive Monitoring Program (ICMP) plan provides the overarching framework for coordination of the United States Navy monitoring program. It has been developed in direct response to Navy Range permitting requirements established in the various MMPA Final Rules, ESA consultations, Biological Opinions, and applicable regulations. As a framework document, the ICMP applies by regulation to those activities on ranges and operating areas for which the Navy sought and received incidental take authorizations.

The ICMP is intended for use as a planning tool to focus Navy monitoring priorities pursuant to ESA and MMPA requirements. Top priority will always be given to satisfying the mandated legal requirements across all ranges. Once legal requirements are met, any additional monitoring-related research will be planned and prioritized using guidelines provided by the ICMP, consistent with availability of both funding and scientific resources. As a planning tool, the ICMP is a "living document" that will be routinely updated as the Program matures.

The ICMP will be evaluated annually through the adaptive management process to assess progress, provide a matrix of goals for the following year, and make recommendations for refinement and analysis of the monitoring and mitigation techniques. This process includes conducting an annual Adaptive Management Review (AMR) at which the Navy and National Marine Fisheries Service (NMFS) jointly consider the prior year's goals, monitoring results, and related science advances to determine if modifications are needed to more effectively address monitoring program goals. Modifications to the ICMP that result from AMR decisions will be incorporated by an addendum or revision to the ICMP. The ICMP updates will be provided to NMFS by 31 December annually beginning in 2010. This adaptive management process recurs annually, with some modifications to the process in 2011, when the Navy, with guidance and support from NMFS, is to host a monitoring workshop that incorporates outside experts and expanded participation.

Section 1 introduces the ICMP, including purpose, objectives, specific ranges and geographic areas included, and additional background material. Section 2 describes overall monitoring goals and prioritization guidelines. Section 3 discusses standard data collection and management procedures. Section 4 addresses the coordination of reporting requirements, including a specific timeline for coordination of the current year's reporting requirements, and the record-keeping system that documents how each Range Complex contributes to ongoing monitoring objectives. Section 5 outlines the adaptive management process, including provisions for annual reviews as well as a monitoring workshop in 2011. Section 6 discusses near-term plans for continued maturation of the Monitoring Program. Section 7 provides roles and responsibilities among the various Navy components. References are listed in Section 8.

OPNAV (N45) is responsible for maintaining and updating this ICMP, as required, to reflect the results of future regulatory agency final rulemakings, adaptive management reviews, best available science, improved assessment methodologies, or more effective protective measures. This will be done in consultation with Navy technical experts, Fleet Commanders, and Echelon II Commands, as appropriate, as part of the adaptive management process.

2010 UPDATE SUMMARY

The initial version of the ICMP was released in December 2009. This document is updated on an annual basis and modifications of substance to the 2010 version are summarized below:

In Section 1, Table 1, "Status of MMPA Final Rules for Navy Range Complexes included in the ICMP" was updated. Additionally, information derived from those Final Rules published during 2010 was used to update Appendices A and B.

In Section 2, the top-level goals for monitoring were refined through the adaptive management process and expanded to incorporate comments from the Marine Mammal Commission (MMC). The process by which these goals would be further refined through collaboration with a newly created Scientific Advisory Group (SAG) and group review was added. This section also notes that Navy awarded *HDR engineering-environmental Management (*HDR|e^{2}M*)* of Englewood, CO a contract to assist with designing, managing, and performing the overall monitoring. A description of an alternate approach to the study questions currently used to focus the range-specific monitoring plans was added. This alternate approach provides that HDR|e^{2}M and the SAG will use the top-level goals established by the ICMP to define a proposed long-term strategic plan for monitoring. The intent is to incorporate this strategic plan into the framework provided by the ICMP.

In Section 3, updates to the data management approach are provided. Navy and NMFS continue to work together to develop a data-sharing process that best supports the regulatory process in a transparent manner. Navy is working with HDR|e^{2}M to develop structured procedures to meet specific access requirements for the various Fleet, Scientific, and General Public user groups. This work will continue into 2011.

In Section 4, Table 4, "Common reporting requirements for range complexes/study areas covered by ICMP" was updated. As part of adaptive management, NMFS and the Navy are coordinating on the development of a streamlined workload plan for developing and reviewing these reports. Although the reports described will always be submitted annually at a time that allows for adequate analysis by NMFS prior to the issuance of the subsequent LOA, NMFS retains the flexibility to change those dates yearly. Each annual LOA will provide the required submittal dates.

There were no substantial changes to the adaptive management process described by Section 5.

In Section 6, progress within each of the designated "ICMP Near-Term Development Focus Areas" was listed.

In Section 7, the roles and responsibilities of Naval Facilities Engineering Command were added.

Finally, Appendix E was added to provide an initial framework for the range matrix characterization. This matrix, currently under development, will include reference information that provides the user a top-level view of attributes across the various Navy range complexes and supports comparative analysis. The work to fully develop this matrix will extend into 2011.

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1. INTRODUCTION

The Navy is responsible for compliance with a suite of Federal environmental laws and regulations that apply to marine mammals and other marine protected species, including the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). As part of the regulatory compliance process associated with these Acts, the Navy is responsible for meeting specific requirements for monitoring and reporting on military readiness activities involving active sonar and underwater detonations from explosives and explosive munitions. These military readiness activities include both Fleet training events and Navy-funded research, development, test and evaluation (RDT&E) activities.

This Integrated Comprehensive Monitoring Program (ICMP) plan provides the overarching framework for coordination of the United States Navy monitoring program. It is intended for use as a planning tool to focus Navy monitoring priorities pursuant to ESA and MMPA requirements and as an adaptive management tool to analyze and refine monitoring and mitigation techniques over time. It has been developed in direct response to Navy Range permitting requirements established in the various MMPA Final Rules, ESA consultations, Biological Opinions, and applicable regulations. As a framework document, the ICMP applies by regulation to those activities on ranges and operating areas for which the Navy sought and received incidental take authorizations.

The ICMP currently includes specific monitoring plans that have been or are being developed for the Southern California (SOCAL) Range Complex, Atlantic Fleet Active Sonar Training (AFAST) Study Area, Hawaii Range Complex (HRC), Mariana Islands Range Complex (MIRC), Northwest Training Range Complex (NWTRC), Gulf of Alaska (GOA) Temporary Maritime Activities Area (TMAA), Virginia Capes (VACAPES) Range Complex, Cherry Point Range Complex, Jacksonville (JAX) Range Complex[1], Gulf of Mexico (GOMEX) Range Complex, Naval Sea Systems Command Naval Undersea Warfare Center Keyport (NUWC Keyport) Range Complex, and Naval Sea Systems Command Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area. These range complexes and study areas are depicted in Figure 1. Note that the AFAST study area encompasses multiple smaller ranges. Additional ranges or study areas may be added to the ICMP consistent with future Navy range permitting requirements.

Table 1 provides a status listing of the MMPA Final Rules for ranges and study areas presently included in the ICMP, and the applicable dates for those Final Rules that are in effect. This table is current as of 3 December 2010. Unless otherwise specified, references to "MMPA Final Rules" throughout this document include all of the rules listed by Table 1 that have a status of "In Effect". A listing of the corresponding Letters of Authorization (LOA) and monitoring plans in effect as of the data date is provided in the reference section. While the ICMP also applies to range-specific monitoring plans that are still being developed, modifications to the ICMP may be required to appropriately reflect requirements established by future rulemakings.

[1] Note, the Jacksonville Range Complex includes operating areas for both Jacksonville, FL and Charleston, SC and is sometimes referred to as the Charleston / Jacksonville (CHASJAX) Range Complex. For purposes of this document, references to this Range Complex will simply be as Jacksonville Range Complex, which is consistent with the nomenclature used in the MMPA Final Rule.

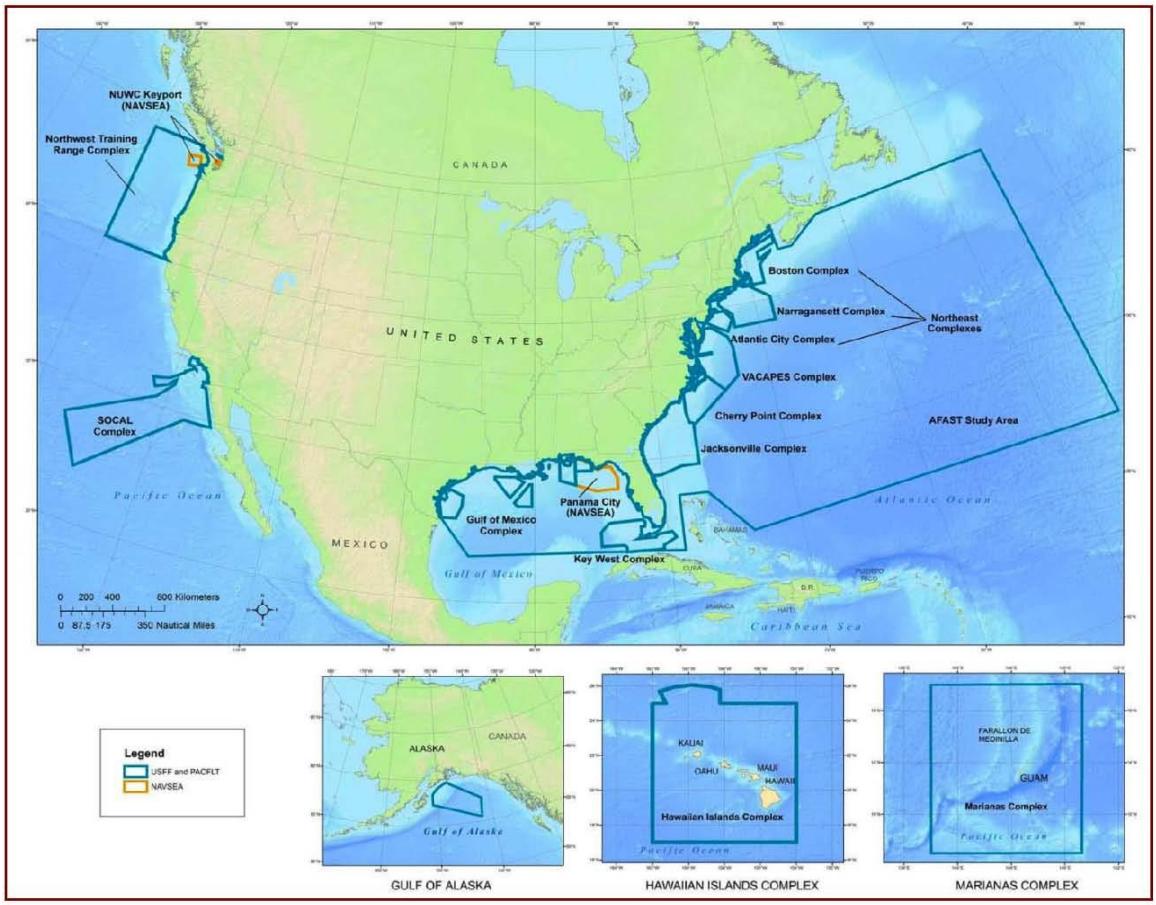

Figure 1: Navy Range Complexes and Study Areas included under the ICMP

Table 1: Status of MMPA Final Rules for Navy Range Complexes included in the ICMP
(Data date: 3 December 2010)

RANGE	MMPA Final Rule Reference (or status)	Dates Applicable
Hawaii Range Complex (HRC)	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Hawaii Range Complex; Final Rule, 74 Fed. Reg. 1456 (January 12, 2009) (to be codified at 50 C.F.R. § 216).	5 Jan 2009 – 5 Jan 2014
Southern California (SOCAL) Range Complex	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Southern California Range Complex; Final Rule, 74 Fed. Reg. 3883 (January 21, 2009) (to be codified at 50 C.F.R. § 216).	14 Jan 2009 - 14 Jan 2014
Atlantic Fleet Active Sonar Training (AFAST) Study Area	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy's Atlantic Fleet Active Sonar Training (AFAST); Final Rule, 74 Fed. Reg. 4844 (January 27, 2009) (to be codified at 50 C.F.R. § 216).	22 Jan 2009 - 22 Jan 2014
Cherry Point Range Complex	**IN EFFECT:** Taking and Importing Marine Mammals; U.S. Navy Training in the Cherry Point Range Complex; Final Rule, 74 Fed. Reg. 28370 (June 15, 2009) (to be codified at 50 C.F.R. § 218).	5 Jun 2009 – 4 Jun 2014
Jacksonville (JAX) Range Complex	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Jacksonville Range Complex; Final Rule, 74 Fed. Reg. 28349 (June 15, 2009) (to be codified at 50 C.F.R. § 218).	5 Jun 2009 – 4 Jun 2014
Virginia Capes (VACAPES) Range Complex	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Virginia Capes Range Complex; Final Rule, 74 Fed. Reg. 28328 (June 15, 2009) (to be codified at 50 C.F.R. § 218).	5 Jun 2009 – 4 Jun 2014
Naval Sea Systems Command Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area	**IN EFFECT:** Taking and Importing Marine Mammals; U.S. Naval Surface Warfare Center Panama City Division Mission Activities; Final Rule, 75 Fed. Reg. 3395 (January 21, 2010) (to be codified at 50 C.F.R. § 218).	21 Jan 2010 - 21 Jan 2015
Mariana Islands Range Complex (MIRC)	**IN EFFECT**: Taking and Importing Marine Mammals; Military Training Activities and Research, Development, Testing and Evaluation Conducted Within the Mariana Islands Range Complex; Final Rule, 75 Fed. Reg. 45527 (August 3, 2010) (to be codified at 50 C.F.R. § 218).	3 Aug 2010 – 3 Aug 2015
Northwest Training Range Complex (NWTRC)	**IN EFFECT**: Taking and Importing Marine Mammals; Navy Training Activities Conducted Within the Northwest Training Range Complex; Final Rule, 75 Fed. Reg. 69296 (November 10, 2010) (to be codified at 50 C.F.R. § 218).	9 Nov 2010 - 9 Nov 2015
Naval Sea Systems Command Naval Undersea Warfare Center Keyport (NUWC Keyport) Range Complex	**PROPOSED**: Taking and Importing of Marine Mammals; U.S. Navy's Research, Development, Test, and Evaluation Activities Within the Naval Sea Systems Command Naval Undersea Warfare Center Keyport Range Complex; Proposed Rules, 74 Fed. Reg. 32264 (July 7, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rule closed to public comments on 6 Aug 2009.
Gulf of Mexico (GOMEX) Range Complex	**PROPOSED**: Taking of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Training Operations Conducted Within the Gulf of Mexico Range Complex; Proposed Rules, 74 Fed. Reg. 33960 (July 14, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rule closed to public comments on 13 Aug 2009.
Gulf of Alaska (GOA) Temporary Maritime Activities Area (TMAA)	**PROPOSED:** Taking and Importing Marine Mammals; Military Training Activities Conducted Within the Gulf of Alaska (GoA) Temporary Maritime Activities Area (TMAA); Proposed Rules, 75 Fed. Reg. 64508 (October 19, 2010)	TBD. Proposed Rule closed to public comments on 18 Nov 2010.

There are two broad categories of authorized activities covered by the ICMP. These include:

1) Authorized Fleet activities carried out on Fleet-permitted ranges in support of military readiness, and
2) Authorized Navy Acquisition Community RDT&E activities carried out on NAVSEA-permitted ranges in support of military readiness.

There are variations in the monitoring and mitigation requirements between Fleet and Acquisition Community activities. This is in part due to the significant differences in the nature of activities conducted by these two communities relative to factors such as the types of sound sources, numbers and size of platforms (boats, ships, aircraft), as well as numbers of individuals involved. Monitoring and mitigation measures are tailored to the specific authorized activities consistent with permitting requirements. For the Fleet-permitted ranges, the associated monitoring plans are generally "range-specific" and apply across all authorized activities on that range. For the NAVSEA-permitted ranges, their monitoring plans tend to be "project-specific", that is, specifically tailored to each individual authorized activity.

Appendices A and B provide a listing by range complex/study area of specific sound sources and activities included in the associated MMPA Final Rules/Proposed Rules for the Fleet and Naval Sea Systems Command (NAVSEA) action proponents respectively. Note that for Atlantic ranges in the AFAST study area, monitoring and mitigation requirements for mid-frequency active sonar (MFAS), high-frequency active sonar (HFAS), and underwater detonations from explosive sonobuoy (specifically IEER) Fleet military readiness activities are addressed in the AFAST MMPA Final Rule. Monitoring requirements associated with Fleet military readiness activities involving other types of underwater detonations are established in the MMPA Final Rules for the individual range complexes (e.g., VACAPES, JAX, Cherry Point, and GOMEX) where these activities will be conducted.

The MMPA Final Rules detail specific requirements for this document. The following quote is from the Final Rule for the SOCAL Range Complex[2]. Similar language is found in each of the other MMPA Final Rules listed by Table 1.

> "The Navy shall complete an Integrated Comprehensive Monitoring Plan (ICMP) in 2009. This planning and adaptive management tool shall include:
> (1) A method for prioritizing monitoring projects that clearly describes the characteristics of a proposal that factor into its priority.
> (2) A method for annually reviewing, with NMFS, monitoring results, Navy R&D, and current science to use for potential modification of mitigation or monitoring methods.
> (3) A detailed description of the Monitoring Workshop to be convened in 2011 and how and when Navy/NMFS will subsequently utilize the findings of the Monitoring Workshop to potentially modify subsequent monitoring and mitigation.
> (4) An adaptive management plan.
> (5) A method for standardizing data collection across Range Complexes."

The MMPA Final Rules further provide that the primary objectives of the ICMP are to:

[2] See 74 Fed. Reg. 3882 (January 21, 2009) (50 C.F.R.§216.275(c)).

- Monitor and assess the effects of Navy activities on protected marine species;
- Ensure that data collected at multiple locations is collected in a manner that allows comparison between and among different geographic locations;
- Assess the efficacy and practicality of the monitoring and mitigation techniques; and
- Add to the overall knowledge base of protected marine species and the effects of Navy activities on these species.

The ICMP meets these requirements and objectives by:

- Identifying top-level goals for the monitoring program, as well as guidelines for use in prioritizing monitoring projects and related RDT&E activities;
- Defining standard procedures for the compilation and management of data from range/project-specific monitoring plans;
- Establishing an adaptive management process that includes annual reviews with NMFS;
- Making provisions to review relevant monitoring-related research and, where appropriate, incorporate findings as updates to the range/project-specific monitoring plans and mitigation measures through adaptive management; and
- Providing an unclassified recordkeeping system that will allow interested parties to see how each range complex is contributing to ongoing monitoring.

As the overarching framework, the ICMP focuses Navy monitoring priorities pursuant to ESA and MMPA requirements. However, the ICMP does not include or specify the actual monitoring fieldwork components, nor does it commit to fund specific monitoring-related activities. Individual Navy permit-holders and research sponsors are responsible for defining the range/project-specific fieldwork components and research activities for their respective range monitoring plans and research programs. Top priority will always be given to satisfying the mandated legal requirements across all ranges. Once legal requirements are met, any additional monitoring-related activities will be planned and prioritized using guidelines provided by the ICMP, consistent with availability of both funding and scientific resources.

The ICMP will be evaluated annually through the adaptive management process to assess progress, provide a matrix of goals for the following year, and make recommendations for refinement and analysis of the monitoring and mitigation techniques. This process includes conducting an Adaptive Management Review (AMR) at which Navy and National Marine Fisheries Service (NMFS) will jointly consider the prior year's goals, monitoring results, and related science advances to determine if modifications are needed to more effectively address monitoring program goals. Modifications to the ICMP that result from AMR decisions will be incorporated by an addendum or revision to the ICMP. These ICMP updates will be provided to NMFS by 31 December annually beginning in 2010. This adaptive management process recurs annually, with some modifications to the process in 2011, when the Navy, with guidance and support from NMFS, is to host a monitoring workshop that incorporates outside experts and expanded participation.

The ICMP is organized in the following way: Section 2 describes overall monitoring goals and prioritization guidelines; Section 3 discusses standard data collection and management procedures; Section 4 addresses the coordination of reporting requirements and the recordkeeping system that documents how each range complex contributes to ongoing monitoring objectives; Section 5 outlines the adaptive management review process,

including provisions for a monitoring workshop in 2011; Section 6 discusses near-term plans for continued maturation of the Monitoring Program; Section 7 provides roles and responsibilities among the various Navy components; and references are listed in Section 8.

2. MONITORING GOALS AND PRIORITIZATION GUIDELINES

Research relating to the effects of anthropogenic sound on marine species is an evolving science. The Navy is committed to utilizing the best available science in developing and implementing the monitoring programs required pursuant to ESA and MMPA. The Navy demonstrated this commitment by funding approximately $26 million annually in marine mammal-related research projects for fiscal years 2007-2009[3] to better understand how marine mammals hear and how they are affected by sound. Researchers at Navy laboratories and warfare centers are investigating marine mammal bioacoustics, marine mammal distribution and abundance, and passive acoustic detection of marine mammals. The Navy also collaborates with universities, institutions, conservation agencies, private industries, and independent researchers around the world to better understand what combinations of ocean conditions, bathymetry, and sonar usage patterns may lead to marine species disturbances. The Navy intends to continue this level of annual investment in protected marine species research over the next five years.[4]

As the overarching framework for coordination of the Navy's monitoring efforts, the ICMP guides the research investment by establishing top-level goals and guidelines for use in prioritizing monitoring projects and related RDT&E activities. The guidelines are not intended to supersede the specific legal requirements that each range complex must meet for monitoring and mitigation of ongoing Navy military readiness activities as detailed by its associated LOA. Top priority will continue to be given to satisfying the mandated legal requirements across all ranges.

To meet requirements in the MMPA Final Rules for Navy range complexes[5], this section provides a method for prioritizing monitoring projects and clearly describes the characteristics of a proposal that factor into its priority. However, as noted previously, the ICMP does not specify or commit to fund specific monitoring-related research; that remains the responsibility of individual research sponsors. The ICMP also makes provisions for maintaining an unclassified record of Navy-sponsored monitoring projects and research using the procedures described in Section 4.

The adaptive management process described in Section 5 will be used to review and, when appropriate, incorporate findings from relevant research as updates to the range/project-specific monitoring plans. Adaptive management will also be used to evaluate and update the goals and priorities presented here on an annual basis. ICMP updates resulting from the adaptive management process will be documented and provided to NMFS by 31 December annually beginning in 2010.

[3] Research funding level from http://www.navy.mil/oceans/environmental.html on 14 April 2009.

[4] Projected investment level from http://www.navy.mil/oceans/science.html on 15 July 2009.

[5] *E.g.*, 50 C.F.R. § 216.175(c).

2.1 MONITORING GOALS

Monitoring measures prescribed in range/project-specific monitoring plans and Navy-funded research relating to the effects of Navy training and testing activities on protected marine species should be designed to accomplish one or more of the following top-level goals:

- An increase in our understanding of the likely occurrence of marine mammals and/or ESA-listed marine species in the vicinity of the action (i.e., presence, abundance, distribution, and/or density of species);

- An increase in our understanding of the nature, scope, or context of the likely exposure of marine mammals and/or ESA-listed species to any of the potential stressor(s) associated with the action (e.g., tonal and impulsive sound), through better understanding of one or more of the following: 1) the action and the environment in which it occurs (e.g., sound source characterization, propagation, and ambient noise levels); 2) the affected species (e.g., life history or dive patterns); 3) the likely co-occurrence of marine mammals and/or ESA-listed marine species with the action (in whole or part) associated with specific adverse effects, and/or; 4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and/or ESA-listed marine species (e.g., age class of exposed animals or known pupping, calving or feeding areas);

- An increase in our understanding of how individual marine mammals or ESA-listed marine species respond (behaviorally or physiologically) to the specific stressors associated with the action (in specific contexts, where possible, e.g., at what distance or received level);

- An increase in our understanding of how anticipated individual responses, to individual stressors or anticipated combinations of stressors, may impact either: 1) the long-term fitness and survival of an individual; or 2) the population, species, or stock (e.g., through effects on annual rates of recruitment or survival);

- An increase in our understanding of the effectiveness of mitigation and monitoring measures;

- A better understanding and record of the manner in which the authorized entity complies with the Incidental Take Authorization and Incidental Take Statement;

- An increase in the probability of detecting marine mammals (through improved technology or methods), both specifically within the safety zone (thus allowing for more effective implementation of the mitigation) and in general, to better achieve the above goals; and

- A reduction in the adverse impact of activities to the least practicable level, as defined in the MMPA.

Several of the top-level goals listed above focus on understanding the short-term effects to individual animals from naval anthropogenic sound. For the purposes of the ICMP, short-term is defined as the period during which the behavioral response is empirically determined or presumed to be directly attributable to exposure to naval anthropogenic sound.

The original set of range-specific monitoring plans were designed as a collection of focused "studies" to gather data that would allow the Navy to address a series of proposed questions (not all questions apply to each range). However, during the Adaptive Management Review in 2010, discussions reported that these five "study questions" [provided below for completeness] were determined to be too general for practical application across all ranges/study areas. The original study questions were as follows:

- Are marine mammals (and sea turtles) exposed to mid-frequency active sonar (MFAS), especially at levels associated with adverse effects (i.e., based on NMFS' criteria for behavioral harassment, temporary threshold shift (TTS), or permanent threshold shift (PTS))? If so, at what levels are they exposed?

- If marine mammals (and sea turtles) are exposed to MFAS, do they redistribute geographically as a result of continued exposure? If so, how long does the redistribution last?

- If marine mammals (and sea turtles) are exposed to MFAS, what are their behavioral responses to various received levels?

- What are the behavioral responses of marine mammals and sea turtles that are exposed to explosives?

- Is the Navy's suite of mitigation measures for MFAS (e.g., measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality of marine mammals?

As an alternate approach to these five original study questions, the Navy worked with NMFS and the scientific community to further refine the top-level goals, with refined goals as listed at the beginning of this section, and continues to work on the development of a 3-5 year strategic plan for monitoring activities across the various ranges and study areas covered by authorizations and permits.

Figure 2 depicts the process that will develop this strategic plan and lead to the selection of annual range-specific monitoring projects. This process is also described below. While revisions to the existing monitoring plans are anticipated, the Navy does not expect there will be a significant change in types of monitoring activities proposed. Rather, proposed changes to the distribution of activities are more likely to focus concentrated effort on larger, more integrated monitoring efforts.

In the initial steps of the process, the Navy will complete development of a matrix that characterizes the various geographic regions of interest and provides "bounding conditions" to the Scientific Advisory Group (SAG). Appendix E provides additional information regarding this matrix.

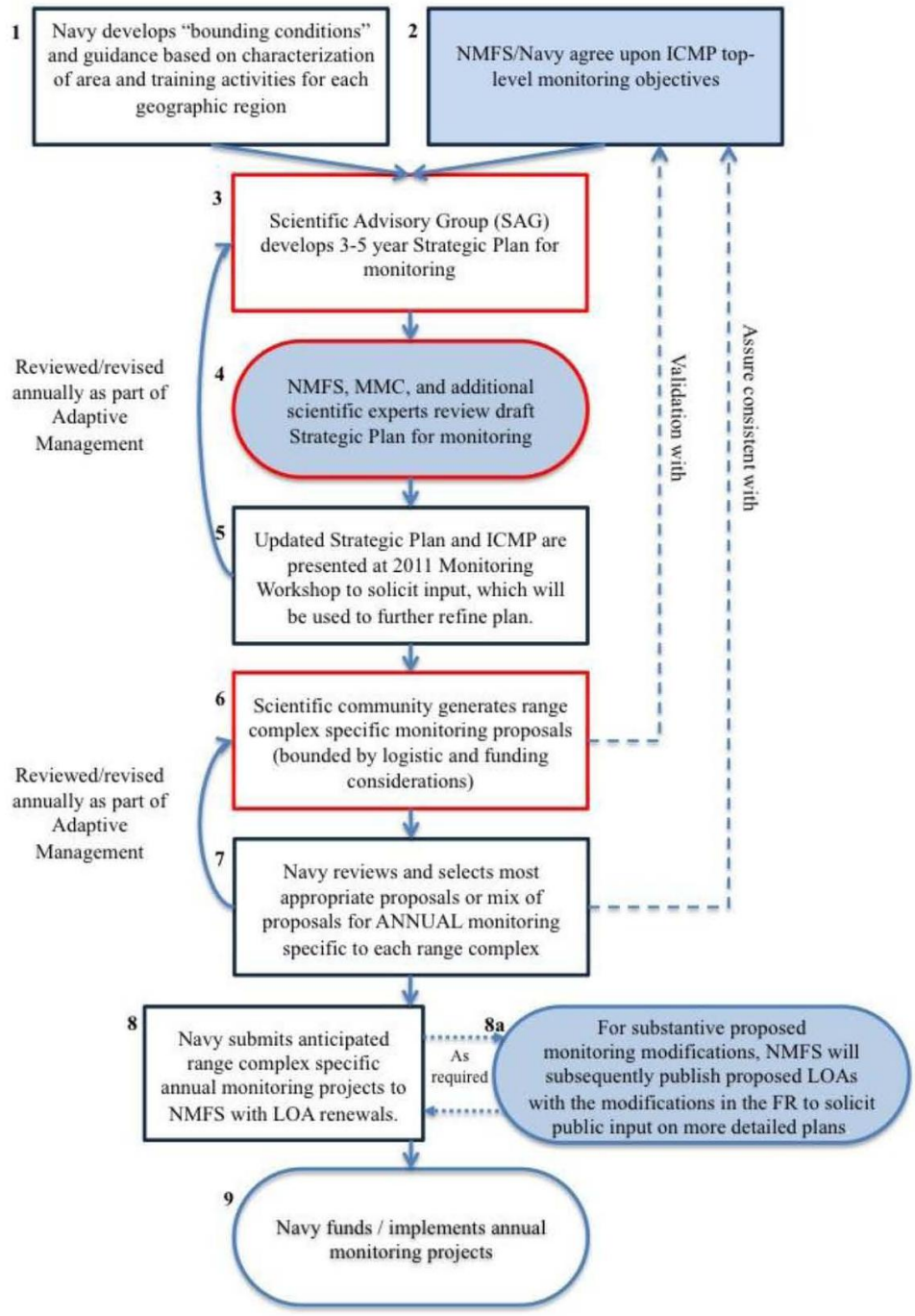

Figure 2: Strategic plan development and implementation process

Next, with support from their lead contractor[6], *HDR engineering-environmental Management (*HDR|e^{2}M*)* of Englewood, CO, the Navy will then convene the newly created SAG. The SAG will use the top-level goals provided by the ICMP to define a proposed 3-5 year "Strategic Plan for Monitoring" covering all permitted areas. The SAG will adapt the original study questions and refine the goals for individual geographic regions based on the level of information and data currently available. Specifically, they will consider what is known regarding "Occurrence, Exposure, Responses, Consequences, and Mitigation" for each geographic region of interest to suggest appropriate monitoring activities. Other parameters to be considered include those listed by the Appendix E matrix, as well as available assets and operational constraints. This strategic plan will serve as a roadmap to guide selection of appropriate monitoring projects based on region-specific considerations. The draft plan will then be circulated through a larger review group that includes NMFS HQ and the Marine Mammal Commission (MMC). The objective is to have a group-reviewed draft plan that has been developed/reviewed by experts and vetted through NMFS and MMC to present at the 2011 Monitoring Workshop.

As the overarching framework document, the ICMP will be updated to document the systematic approach and the allocation of resources for these monitoring activities. This 3-5 year strategic monitoring plan is necessary to provide sufficient lead time to put task orders in place, and procure any long-lead time material needed such as passive acoustic monitoring equipment.

Monitoring measures that are put in place to meet the above goals and focused studies will produce data sets that include short-term individual observations. These observations, in combination with parallel monitoring and data analysis efforts by others, support research efforts directed towards identifying biologically significant behavioral responses that may have either cumulative or population-level effects. These data sets will also support the assessment of population trends, including species composition, distribution, and abundance, to determine the efficacy of mitigation and monitoring measures, and increase knowledge regarding the response of marine mammals and other threatened or endangered marine species to Navy sound sources. These data sets may also help to provide important information on the geographic and temporal extent of key habitats and provide baseline information to account for natural perturbations such as El Niño or La Niña events. Additionally, the data sets will provide observational data and baseline information to determine the spatial and temporal extent of reactions to Navy operations, or indirect effects from changes in prey availability and distribution. These data sets will be managed and made available for use by the procedures outlined in Section 3.

In developing range/project-specific monitoring plans or research programs to address these top-level goals and focused studies, sponsors should strive to prevent creating situations that leave the Navy "data rich but information poor." That is, it is often easier to collect some types of information than it is to analyze and draw meaningful conclusions from the data.

[6] *HDR engineering-environmental Management (*HDR|e^{2}M*)* of Englewood, CO was awarded an indefinite-delivery / indefinite-quantity contract in April 2010 to assist with designing, managing, and performing the overall monitoring effort.

One example of this potential situation is the collection of marine mammal vocalizations using passive acoustic monitoring, where terabytes of acoustic data can be collected over the course of a given monitored event. To fully benefit from this type of monitoring and data collection investment, it is critical that sufficient funding for data analysis be factored into the program plans.

2.2 PRIORITIZATION GUIDELINES

In establishing prioritization guidelines, it is important to "begin with the end in mind." The desired end-result from Navy monitoring and mitigation conducted pursuant to ESA and MMPA requirements is a comprehensive and accurate assessment of applicable Navy military readiness and scientific research activities that involve active sonar and/or underwater detonations, performed in a manner that enables Fleet Commands, Program Executive Offices (PEOs), and other Echelon II Commands to meet their requisite operational, training, acquisition, research, development, testing, and evaluation requirements.

The guidelines presented here maximize marine resource protection by focusing Navy efforts and resources on those geographic areas where potential effects to marine mammals and other threatened or endangered marine species are most likely to occur due to concentrated and repetitive Navy activities. However, the guidelines are not intended to preclude monitoring activities in other areas of moderate or low Navy use when there might be special biological circumstances or other overriding considerations. The guidelines are intended for use when developing or modifying range/project-specific monitoring plans and monitoring-related research programs that will be considered as part of the adaptive management process described in Section 5. The guidelines are not intended to supersede the specific legal requirements that each range complex must meet for monitoring and mitigation of ongoing Navy military readiness activities as detailed in its associated LOA. Top priority will continue to be given to satisfying the mandated legal requirements across all ranges. Once legal requirements are met, additional monitoring activities will be prioritized using the guidelines that follow, consistent with availability of both funding and scientific resources.

In shaping, designing or evaluating prospective monitoring projects, sponsors should consider the following factors for each proposal:

a. Number of monitoring goals that the project addresses;

b. Relative density of marine mammals and other protected marine species in the proposed area;

c. Relative occurrence of concentrated and repetitive Navy active sonar activities in the proposed area;

d. Level of anticipated impacts to marine mammals in the area;

e. Presence of unique biological and/or physical attributes that better allow monitoring goals to be addressed;

f. Degree to which the proposed activity might provide unique contributions or additional diversity to the data set collection that will assist in meeting the top-level goals,

g. Ability to leverage and/or augment existing efforts by Navy monitoring to positive effect,

h. Availability of specialized Navy assets within a specific area to support monitoring efforts (e.g. instrumented ranges);

i. Return on investment as measured by confidence level in the likelihood of obtaining meaningful monitoring data based on factors such as prior success with the specific method itself, anticipated sea states, seasonal weather patterns, local animal densities and migration patterns, and anticipated success rate for integrating the monitoring method with training events; and

j. Degree to which the proposed activity might affect the ability of Navy Commands to meet their requisite operational, training, acquisition, research, development, testing, and evaluation requirements.

Many of the factors listed above are highly dependent on the specific location at which the proposed activity is to be conducted. To better assist planning efforts within the ICMP, a characterization of the unique attributes associated with each range complex/study area is under development. This characterization matrix is further addressed in Appendix E.

The monitoring requirements established in the MMPA Final Rules listed by Table 1 are currently in effect for 5-year periods beginning in 2009. To fully evaluate and respond to the effects of naval anthropogenic sound on living marine resources, it is anticipated that monitoring time frames extending beyond the initial 5 years will be needed.

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3. DATA COLLECTION AND MANAGEMENT

This section discusses standardized data collection and management methods in support of Navy monitoring activities, and is a required element of the ICMP under the MMPA Final Rules for Navy ranges and operating areas. The Navy makes substantial investments in monitoring programs to ensure compliance with terms of ESA consultations and MMPA authorizations, and to provide for adaptive program management. Standardized procedures are essential to make the most of this investment. The objective for this standardization is to collect data in a manner that will enable comparison between and among different geographic locations to the extent that is scientifically justifiable. These standardized approaches apply to both range/project-specific monitoring plans as well as Navy-funded R&D studies.

Improved monitoring and assessment methodologies are likely to be developed as the science surrounding marine species monitoring continues to evolve. These improvements will be reviewed and assessed annually as part of the adaptive management process conducted jointly by Navy and NMFS. This process will determine whether modifications to the standardized collection and management methods are appropriate for the upcoming year. If so, updates to the ICMP will be made to reflect the results of Navy-NMFS adaptive management decisions to incorporate the improved monitoring and assessment methodologies as standard procedures and provided to NMFS by 31 December annually. As discussed in Section 5, adaptive management reviews will be done in consultation with Navy technical experts, Fleet Commanders, and Echelon II Commands, as appropriate.

3.1 DATA COLLECTION

There is a large suite of monitoring methods that may be used to detect, locate, identify, and study the behaviors and responses of individual marine animals *in situ*. Some of the more prevalent categories of monitoring techniques and tools include:

- Visual observations made using Navy lookouts, civilian protected species observers (PSOs), vessel-based surveys, aerial surveys, shore surveys, and photo-identification;
- Acoustic monitoring using both passive and active methods; and
- Behavioral monitoring through tag attachments.

This suite of methods is continually evolving in step with advances in research. Each monitoring technique has advantages and disadvantages that vary temporally and spatially. Therefore, a combination of techniques is generally recommended so that the detection and observation of marine animals is maximized. The optimal choice of monitoring approach will vary depending on the purpose for the monitoring, the type of data to be collected, and a number of other factors such as the species of concern (whether frequently on surface, deep-diving, or cryptic), animal density, geographical location, weather, visibility, expected sea state conditions, type of Navy activities conducted in the area, and the total size of the area to be monitored. The particular choice of monitoring approaches will also be influenced by duration of monitoring period, effectiveness, practicality, impact to training, and cost.

It is beyond the scope of this framework document to fully describe this suite of monitoring methods or to prescribe "best practices" for the implementation of these independent techniques for monitoring purposes. Instead, the focus here is on prescribing both essential as well as desired data elements to be collected and recorded as "standard data" to support future data comparisons to the extent that is scientifically appropriate.

This section prescribes the data elements that are to be collected as standard practice for both range/project-specific monitoring as well as Navy-funded R&D studies. While it may not be scientifically valid to directly combine data sets from varied platforms such as shipboard and aerial surveys, the use of standardized sampling and survey protocols will be critical to meeting the overall monitoring goals, as well as assisting better data comparison between years and across different sets of observations. While detailed sampling and survey protocols are specific to independent monitoring techniques and outside the scope of this document, some overall guidelines on sample size and statistical analysis are provided by Appendix C.

Each range/operating area LOA designates particular types and quantities of military readiness activities that require mitigation, monitoring, and reporting pursuant to MMPA and ESA. The LOA details the specific mitigation measures that must be implemented when conducting these activities, and the data that is to be recorded and documented for the various compliance reports. While the information presented here is intended to highlight common data collection requirements from the LOAs, requirements imposed in the range/project-specific LOA take precedence over the information listed here.

The MMPA Final Rules pertaining to Fleet military readiness activities prescribe essential data elements that are to be recorded for individual marine mammal sightings during MFAS/HFAS Major Training Exercises (MTEs) and SINK Exercises (SINKEXs). Table 2 highlights these essential data elements. As one step towards collecting this data in a standardized manner, formatted marine species sighting forms are used by Navy lookouts during monitored military readiness activities. Appendix D provides the current Fleet version of this form. Note, while the LOAs prescribe the collection of these data elements specifically during Fleet MTEs and SINKEXs, the marine species sighting form may also be used to document sightings during other monitored military readiness activities. Its use is not strictly limited to MTEs or SINKEXs.

The MMPA Proposed Rules pertaining to RDT&E activities also prescribe the reporting of individual marine mammal sightings. For purposes of standardized data collection, PSOs monitoring RDT&E activities, as well as third-party biologists under contract to the Navy for marine species monitoring, should be tasked to collect (at minimum) the essential data elements highlighted by Table 2. They may elect to use a different format than that presented in Appendix D as long as these essential data elements are included. In addition, the associated LOA, once issued, should be verified in the event additional essential data elements are prescribed for marine species sightings associated with RDT&E activities. To the extent possible, data will be collected from all distinct habitats in the region to avoid potential sampling bias.

Table 2 also lists additional oceanographic data elements that are highly desirable to fully support analysis of the observations and associated acoustic propagation conditions.

DATA ELEMENTS TO BE RECORDED FOR INDIVIDUAL MARINE ANIMAL SIGHTINGS ASSOCIATED WITH MONITORED MILITARY READINESS ACTIVITIES	
COMMON DATA ELEMENTS	
1)	Location of sighting (lat / long)
2)	Species (if species not possible— indication of whale/dolphin/pinniped/turtle)
3)	Number of individuals
4)	Calves observed (y/n)
5)	Initial Detection Sensor
6)	Indication of specific type of platform observation made from (including, for example, type of surface vessel, i.e., FFG, DDG, or CG)
7)	Length of time observers maintained visual contact with marine animal(s)
8)	Wave height (in feet)
9)	Visibility
10)	Sonar source in use (y/n). If impulsive or explosive source in use, skip to line 15.
IF ACTIVE SONAR SOURCE IN USE:	
11)	Indication of whether animal is <200yd, 200–500yd, 500–1000yd, 1000– 2000yd, or >2000yd from sonar source in (10) above
12)	Mitigation Implementation— Whether operation of sonar sensor was delayed, or sonar was powered or shut down, and how long the delay was.
13)	If source in use (from 10 above)) is hull-mounted, true bearing of animal from ship, true direction of ship's travel, and estimation of animal's motion relative to ship (opening, closing, parallel)
14)	Observed behavior— Watchstanders shall report, in plain language and without trying to categorize in any way, the observed behavior of the animals (such as animal closing to bow ride, paralleling course/ speed, floating on surface and not swimming, etc.) [END for active source essential data elements]
IF IMPULSIVE/EXPLOSIVE SOURCES ARE BEING USED:	
15)	Whether sighting was before, during, or after detonations/exercise, and how many minutes before or after.
16)	Distance of individual/group from actual detonations—or target spot if not yet detonated—use four categories to define distance: (a) The modeled injury threshold radius (MITR) for the largest explosive used in that exercise type in that OPAREA; (b) the required exclusion zone (e.g., 1 nm for SINKEX); (c) the required observation distance (if different than the exclusion zone) (e.g., 2 nm for SINKEX); and (d) greater than the required observed distance. In this example, the observer would indicate if < MITR, from MITR — 1 nm, from 1 nm—2 nm, and > 2 nm.
17)	Observed behavior— Watchstanders will report, in plain language and without trying to categorize in any way, the observed behavior of the animals (such as animal closing to bow ride, paralleling course/ speed, floating on surface and not swimming etc.), including speed and direction.
18)	Resulting mitigation implementation—Indicate whether explosive detonations were delayed, ceased, modified, or not modified due to marine mammal presence and for how long.
19)	If observation occurs while explosives are detonating in the water, indicate munition type in use at time of marine mammal detection. [END for explosive source essential data elements]
OPTIONAL DATA ELEMENTS, PROVIDE AS AVAILABLE or KNOWN	
20)	Sound Velocity Profile for location
21)	Sea surface temperature
22)	Presence of strong gulf stream currents, fronts, and/or mesoscale eddies (y/n)
23)	Other prominent oceanographic features

Table 2: Data Elements to be recorded for individual marine animal sightings associated with monitored military readiness activities

Distribution and abundance of marine species are highly dependent on oceanographic conditions and other environmental factors. Some scientific literature suggests that animals often limit their range to certain habitat areas or broad ocean regions based on sea surface temperature, bathymetric features, and prey abundance. Thus, it is desirable to include data from additional oceanographic and environmental monitoring, predictive forecasts of oceanographic conditions, or some mix of both to account for ambient conditions. The Navy's meteorological and oceanographic community has an extensive array of ocean data gathered by satellite sensing, direct measurements, and predictive models that may be used to support this. Oceanographic conditions can be monitored by a variety of different platforms including satellites, *in situ* observation systems such as buoys, and vessel surveys. For more extensive monitoring efforts, UAVs or gliders might be utilized to obtain oceanographic data. In addition, the recent distribution of joint civilian-government agency Ocean Observing Systems, ocean monitoring satellites, and in-situ buoys offer multiple information sources that could support the Navy's protected marine species monitoring program. Whenever possible, these optional data elements should be recorded for individual marine mammal sightings or relevant groups of individual sightings when made in close proximity to each other. Note that these optional data elements, if available, are typically recorded pre- or post-monitoring by personnel other than the Navy lookouts assigned to sight marine animals.

3.2 DATA MANAGEMENT

As previously discussed, results from Navy-funded monitoring activities will establish time-series data sets that may be used to research trends in species abundance, behavioral reactions and mitigation effectiveness. The data collected through protected marine species monitoring and mitigation activities across all permitted Navy range complexes and relevant Navy-funded RDT&E activities will be incorporated into an electronic centralized data repository established under the guidance of OPNAV N45. These data will be used to support a Navy-wide analysis of monitoring and produce required reports for NMFS on behalf of the Navy Action Proponent. The electronic central repository will include data that are the result of activities conducted under the MMPA authorizations, such as monitoring data from sonar activities and underwater detonations from designated ranges and OPAREAS, marine species sighting observations, and exercise reports pertaining to protected marine species monitoring. The repository will also include annual results from Navy-funded R&D programs such as technical and professional journal articles. Due to the potential for inclusion of classified data, distribution of raw acoustic time series data from monitoring activities is subject to the written consent of the Secretary of the Navy or appointed designee. Unclassified NMFS-required monitoring reports, as specified by the MMPA Final Rules, will be made publicly available by posting on the internet.

As the ICMP matures, and greater amounts of monitoring data are recorded and available for analysis, ways of efficiently organizing this data to support discovery and access within the bounds of existing regulations will become increasingly important. The Navy's first priority is on managing the data collected in support of permitted activities. However, there is also interest in setting up links to relevant reports or a data library so that "best available" science can be easily accessed. This may include active research awards and grants, as well as annual status reports of work accomplished.

Navy is working with their contractor, HDR|e^{2}M, to develop structured procedures to address data archiving, security, and analysis needs as well as to meet specific access requirements for the various Fleet, Scientific, and General Public user groups. This development effort will continue into 2011. Initially, all visual survey data from Fleet-funded monitoring efforts will be made publically available through the OBIS-SEAMAP (Ocean Biogeographic Information System – Spatial Ecological Analysis of Megavertebrate Populations) interface and may also be integrated into other public databases. Navy and NMFS will continue to work together to develop a data-sharing process that best supports the regulatory process in a transparent manner, as well as provides public access to appropriate data products and reports. Unclassified NMFS-required monitoring reports as specified by the MMPA Final Rules are currently available on the NMFS website. These reports along with unclassified results from monitoring-related Navy R&D programs will also be publicly available from the Navy repository.

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4. REPORTING

This section addresses the overarching structure and coordination that will be used to coordinate reporting requirements from range/project-specific monitoring plans, and the recordkeeping system that tracks and documents how each range complex or operating area contributes to ongoing monitoring.

4.1 REPORT COORDINATION

The Navy is required to monitor and report on the effects of Navy actions on protected marine species. The MMPA Final Rules and LOAs specify the compilation of reports that summarize range/project-specific monitoring activities, analyses and results. These reports are submitted to the NMFS Office of Protected Resources (NMFS OPR) and provide critical inputs to the adaptive management process that allows the Navy and NMFS to assess and refine the Navy's overall monitoring effort. If there is a conflict between the reporting information described here and the requirements specified in the LOA, the LOA requirements take precedence.

Navy range action proponents are responsible for report development and submittal. The action proponents include Commander United States Fleet Forces Command (USFF), Commander Pacific Fleet (CPF), and Commander Naval Sea Systems Command (NAVSEA). Note, while Commander NAVSEA is the Action Proponent, he has designated Commander NUWC Keyport Division and Commander NSWC Panama City Division as the responsible individuals for report development and submittal. It is recognized that some information provided in the annual reports may be classified and not releasable to the public.

For the Fleet range complexes and study areas, there are two recurring reports required annually: an Annual Exercise Report and an Annual Monitoring Plan Report.

The primary purpose of the Annual Exercise Report is to report on authorized military readiness activities conducted within each range complex or study area, as well as the monitoring and mitigation performed in association with those activities. Table 3 provides a summary of contents for this multi-part report. As noted in Section 1, Anti-Submarine Warfare (ASW) military readiness activities that take place within the AFAST Study Area are covered in entirety under the AFAST MMPA Final Rules and LOA. Subsequently, only the explosives summary section is required in the Annual Exercise Report for the Cherry Point, JAX, VACAPES, and GOMEX Range Complexes.

The Annual Monitoring Plan Report describes the implementation and results from the associated range/project-specific monitoring plan. It relies on standardized data collection methods across the Navy range complexes to allow for comparison of different geographic locations. The individual range reports may be provided to NMFS within a consolidated report that includes the required Monitoring Plan Reports from multiple range complexes.

For the NAVSEA ranges, there is a single recurring annual report required on RDT&E military readiness activities authorized under their permit. This report includes an estimated number of hours of sonar operation broken down by source type as well as a report of all marine mammal sightings.

Summary Sections contained in the Annual Exercise Report
Summary of MFAS/HFAS Major Training Exercises
a) Exercise info for Integrated Coordinated, and Major Training Exercises (MTEs)
– (i) Exercise designator. – (ii) Date that exercise began and ended. – (iii) Location. – (iv) Number and types of active sources used in the exercise. – (v) Number and types of passive acoustic sources [*sic*] used in exercise. – (vi) Number and types of vessels, aircraft, etc., participating in exercise. – (vii) Total hours of observation by lookouts. – (viii) Total hours of all active sonar source operation. – (ix) Total hours of each active sonar source (along with explanation of how hours are calculated for sources typically quantified in alternate way (buoys, torpedoes, etc.)). – (x) Wave height (high, low, and average during exercise).
b) Individual marine mammal sighting info (for each sighting in each MTE).
– See list of data elements described in Section 3.1
c) An evaluation (based on data gathered during all of the MTEs) of the effectiveness of mitigation measures designed to avoid exposing marine mammals to mid-frequency sonar. This evaluation shall identify the specific observations that support any conclusions the Navy reaches about the effectiveness of the mitigation.
ASW Summary
a) Summarized information For MTEs & non-major training exercises Include total annual hours of each type of sonar source (along with explanation of how hours are calculated for sources typically quantified in alternate way (buoys, torpedoes, etc.)), plus other range-specific information.
b) Cumulative Impact Report
c) Annual (and seasonal, where practicable) depiction of non-major training exercises geographically across the Study Area.
SINKEX Summary
a) Exercise info for each SINKEX completed that year
– (i) Location. – (ii) Date and time exercise began and ended. – (iii) Total hours of observation by lookouts before, during, and after exercise. – (iv) Total number and types of rounds expended/explosives detonated. – (v) Number and types of passive acoustic sources used in exercise. – (vi) Total hours of passive acoustic search time. – (vii) Number and types of vessels, aircraft, etc., participating in exercise. – (viii) Wave height in feet (high, low, and average during exercise). – (ix) Narrative description of sensors and platforms utilized for marine mammal detection and timeline illustrating how marine mammal detection was conducted.
b) Individual marine mammal sighting info (for each sighting in each MTE).
– See list of data elements described in Section 3.1
IEER / AEER Summary
– (i) Total number of IEER and AEER events conducted. – (ii) Total expended/detonated rounds (buoys). – (iii) Total number of self-scuttled IEER rounds.
Explosives Summary
– (i) Total annual number of each type of explosive exercise (of those identified as part of the "specified activity" in this MMPA Final Rule) conducted in the action area – (ii) Total annual expended/detonated rounds (missiles, bombs, etc.) for each explosive type.

Table 3: Summary Sections contained in the Annual Exercise Report
Each range complex submits annual summaries as applicable for authorized military readiness activities.

The annual reporting requirements associated with the MMPA Final Rules are designed to provide NMFS with monitoring data from the previous year and assist NMFS in analyzing the information for subsequent LOA applications. As part of the adaptive management process described in Section 5, NMFS and the Navy will meet yearly, prior to LOA issuance, to discuss these annual reports and to determine whether mitigation or monitoring modifications are appropriate. Range/project-specific monitoring plans are then updated and submitted as part of the LOA renewal application. If substantial modification, as determined by NMFS, to the described mitigation or monitoring will occur during the upcoming season, NMFS will provide the public a period of 30 days for review and comment on the request.

There are also non-recurring reporting requirements. For both Fleet and NAVSEA ranges and study areas, these requirements include a draft "Range Complex 5-year Comprehensive Report" that analyzes and summarizes all multi-year marine mammal information gathered during authorized activities for which annual reports are required. This report is submitted at the end of the fourth year of the rule, covering activities that occurred through a specified data cutoff date.

For the Fleet ranges only, the non-recurring requirements also include a draft "Comprehensive National ASW Report" that analyzes, compares, and summarizes the active sonar data gathered from Navy lookouts pursuant to the implementation of range-specific monitoring plans. This National ASW Report is not required for the Cherry Point, JAX, VACAPES, and GOMEX Range Complexes, as active sonar data from these OPAREAS is included in the AFAST reporting requirements. Further guidance to support the preparation of these two comprehensive reports will be promulgated by OPNAV N45 in conjunction with the adaptive management process.

Table 4 provides an overall summary listing of specific report dates under the current MMPA Final Rules, current as of 16 November 2010. NMFS is responsible for establishing the specific timeline for each year's report submittals. As part of adaptive management, NMFS and the Navy are coordinating on the development of a streamlined workload plan for developing and reviewing these reports. Although the reports described will always be submitted annually at a time that allows for adequate analysis by NMFS prior to the issuance of the subsequent LOA, NMFS retains the flexibility to change those dates yearly. Therefore, regulatory text may not specify the dates that the reports are due, but each annual LOA will provide these required dates. Additionally, by way of adaptive management, the Navy may choose to combine the annual reports from multiple ranges into a Multi-Range Complex Annual Report.

The Navy shall respond to NMFS' comments and requests for additional information or clarification on the individual annual or comprehensive reports if submitted within 3 months of receipt. These reports will be considered final after the Navy has addressed NMFS' comments or provided the requested information, or 3 months after the submittal of the original submittal if NMFS does not comment by then.

It is anticipated that reporting requirements will be added pursuant to the implementation of monitoring plans and MMPA Final Rules for the NUWC Keyport Range Complex and the GOA TMAA. The ICMP plan will be updated as appropriate to reflect these requirements through the adaptive management process.

Table 4: Common reporting requirements for range complexes/study areas covered by ICMP*
(Data date: 16 November 2010)

** 2010 update: The requirements as written include specific due dates for each of the reports. As part of adaptive management, NMFS and the Navy are coordinating on the development of a streamlined workload plan for developing and reviewing these reports. Although the reports described will always be submitted annually at a time that allows for adequate analysis by NMFS prior to the issuance of the subsequent LOA, NMFS retains the flexibility to change those dates yearly. Therefore, regulatory text may not always specify the dates that the reports are due, but each annual LOA will provide these required dates.*

RANGE	Annual Exercise (or RDT&E) Report	Annual Monitoring Plan Report	5-Year Comprehensive Monitoring Report	Comprehensive National ASW Report
Hawaii Range Complex (HRC)	1 Aug cutoff / 1 Oct submit	1 Aug cutoff / 1 Oct submit	1 June 2012 cutoff / 30 Nov 2012 submit	1 Jan 2014 cutoff / June 2014 submit
Southern California (SOCAL) Range Complex	1 Aug cutoff / 1 Oct submit	1 Aug cutoff / 1 Oct submit	1 June 2012 cutoff / 30 Nov 2012 submit	1 Jan 2014 cutoff / June 2014 submit
Atlantic Fleet Active Sonar Training (AFAST) Study Area	1 Aug cutoff / 1 Oct submit	1 Aug cutoff / 1 Oct submit	1 June 2012 cutoff / 30 Nov 2012 submit	1 Jan 2014 cutoff / June 2014 submit
Cherry Point Range Complex	Annual report required, but submittal date not specified.	1 Jan cutoff / 1 Mar submit	1 Dec 2012 cutoff / 31 May 2013 submit	Not Applicable
Jacksonville (JAX) Range Complex	Annual report required, but submittal date not specified.	1 Jan cutoff / 1 Mar submit	1 Dec 2012 cutoff / 31 May 2013 submit	Not Applicable
Virginia Capes (VACAPES) Range Complex	Annual report required, but submittal date not specified.	1 Jan cutoff / 1 Mar submit	1 Dec 2012 cutoff / 31 May 2013 submit	Not Applicable
Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area	Annual RDT&E report 1 Aug cutoff / 1 Oct submit	1 Aug cutoff / 1 Oct submit	1 July 2013 cutoff / 31 Dec 2013 submit	Not Applicable
Mariana Islands Range Complex (MIRC)	15 April submit/15 Feb cutoff (not specified in LOA but derived by Navy)	15 April submit/15 Feb cutoff (not specified in LOA but derived by Navy)	15 Jul 2014 cutoff / 30 Nov 2014 submit	1 Jan 2014 cutoff / June 2014 submit
Northwest Training Range Complex (NWTRC)	Annual report required; submission date will be identified each year in the LOA.	Annual report required; submission date will be identified each year in the LOA.	1 Feb 2014 cutoff / July 2014 submit	1 Jan 2014 cutoff / June 2014 submit
Naval Undersea Warfare Center Keyport (NUWC Keyport) Range Complex	Not Applicable	PROPOSED: 1 Sep cutoff / 1 Dec submit	PROPOSED: 1 Sep 2013 [*sic*] cutoff / 30 Jun 2013 submit	Not Applicable
Gulf of Mexico (GOMEX) Range Complex	Annual report required, but submittal date not specified.	PROPOSED: 1 Jan cutoff / 1 Mar submit	PROPOSED: 1 Sep 2013 cutoff / 30 Mar 2014 submit	Not Applicable
Gulf of Alaska (GOA) Temporary Maritime Activities Area (TMAA)	PROPOSED: October cutoff/ Dec 15 submit	PROPOSED: October cutoff/ Dec 15 submit	PROPOSED: Oct 2014 cutoff / Dec 2014 submit	PROPOSED: 1 Jan 2014 cutoff / June 2014 submit

4.2 RECORDKEEPING SYSTEM

OPNAV (N45) is responsible for coordinating the development, funding, and assessment of Navy marine research, and ensuring prioritization of research monitoring projects consistent with the top-level goals and priorities established by the ICMP or other applicable legal requirements. Monitoring activities will be allocated and resourced based on the strength of particular and specific monitoring proposals. With NMFS concurrence, they will not be allocated based on maintaining an equal (or commensurate to effects) distribution of monitoring effort across the range complexes. For example, careful prioritization and planning through the ICMP (which would include a review of both past monitoring results and current scientific developments) may show that a large, intense monitoring effort in one range complex would likely provide extensive, robust and much-needed data that could be used to understand the effects of sonar on the marine environment throughout different geographical areas. In this case, it may be appropriate to have other range complexes dedicate money, resources, or staff to the specific monitoring proposal identified as "high priority" by the Navy and NMFS, in lieu of focusing on smaller, lower priority projects divided throughout their home range complexes. In the event that monitoring is allocated in this fashion, clear recordkeeping is needed to demonstrate how each range complex/project is contributing to all of the ongoing monitoring. This will be done by maintaining a record of these resource allocation decisions in the electronic central data repository previously discussed in Section 3.

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5. ADAPTIVE MANAGEMENT

The MMPA Final Rules for Navy range complexes[7] require an adaptive management process to be established. Section 5.1 describes the process that will be used to annually review, with NMFS, monitoring results, Navy RDT&E, and current science to use for potential modification of mitigation or monitoring methods. The MMPA Final Rules also prescribe a monitoring workshop to be held in 2011 to review cumulative monitoring results from 2009 and 2010. Section 5.2 discusses this monitoring workshop, as well as how and when Navy/NMFS will subsequently utilize the findings of the monitoring workshop to potentially modify subsequent monitoring and mitigation.

5.1 ANNUAL REVIEWS

The reporting requirements associated with the MMPA Final Rules are designed to provide NMFS with monitoring data from the previous year in sufficient time to allow NMFS to consider the data before reissuing subsequent LOAs. Using the data collection and reporting procedures previously described in Sections 3 and 4, the Navy's monitoring data and marine species sighting observations will be consolidated and made available for analysis. NMFS and Navy will then meet to conduct an annual Adaptive Management Review (AMR). The AMR is a multipart review at which NMFS and the Navy jointly consider prior year goals, monitoring results and advancing science to assess overall progress. The review will determine if modifications are needed in mitigation or monitoring measures to more effectively address monitoring program goals. The AMR will consider data as available from across all of the range complexes included within the ICMP. At present, only one AMR per year is planned, and it will be applicable to all range complexes covered by the ICMP. The AMR will also consider an updated matrix of goals and prioritization guidelines proposed for the following year.

OPNAV N45 is responsible for the overall AMR meeting coordination and agenda. Navy action proponents will be asked to assign staff familiar with range/project-specific monitoring results to participate in this review and present an overview of the past year's monitoring activities. Additionally, sponsors of Navy-funded monitoring-related research will be asked to participate and provide a summary of their activities and accomplishments. Other potential presentation and discussion topics for the AMR include:

- Lessons learned from previous year's monitoring efforts;
- Other (non Navy-funded) monitoring-related science advances;
- Effectiveness of existing monitoring and mitigation tools;
- Operational feasibility of new tools and technologies;
- Recommendations for refinement and analysis of monitoring and mitigation methods; and
- Recommendations for the next year's monitoring activities.

[7] *E.g.*, 50 C.F.R. § 216.175(c)(4).

If available, collaboration with regional NMFS scientists, academic scientists, and other non-Navy subject matter experts will be informally sought.

Products of the AMR include a determination as to whether mitigation or monitoring modifications are appropriate for the upcoming year, and an updated matrix of monitoring goals and prioritization guidelines. Adaptations and refinements to monitoring programs that result from the AMR will be incorporated into the range/project-specific monitoring plans as they come up for renewal in the normal course of events.

Adaptive management will also lead to updates and improvements to the overall ICMP. The updated matrix of goals and prioritization guidelines resulting from the AMR will be incorporated by an annual addendum or revision to the ICMP. Additionally, expanded descriptions of the data repository, details for data standardization protocols, expanded information on range-specific characteristics, and planning information for the 2011 Monitoring Workshop are among the candidate information to be included in future updates. Annual ICMP updates will be provided to NMFS by 31 December beginning in 2010.

With the annual AMR, NMFS and Navy will have the ability to consider new data from different sources for purposes of making minor modifications to improve the effectiveness of range/project-specific monitoring plans, or to potentially identify substantial changes for subsequent 5-year regulations. This could result in mitigation or monitoring measures being added, modified, or deleted for subsequent annual LOAs. If a request to renew an LOA indicates that a substantial modification as determined by NMFS to the described activity, mitigation, or monitoring during the upcoming season will occur, NMFS will provide the public a period of 30 days for review and comment on the request.

AMRs potentially could lead to significant restructuring of the monitoring plans put forward by individual ranges. In order to obtain robust, much-needed data that addresses high-priority monitoring goals, monitoring activities may be prioritized and resourced based on the likely contribution of specific monitoring proposals to stated monitoring goals, as well as the likely technical success of the proposed monitoring approach based on a review of past monitoring results. This is in contrast to allocating monitoring resources based on maintaining an equal (or commensurate to effects) distribution of monitoring effort across range complexes. For example, if careful prioritization and planning were to suggest that a large, intense monitoring effort in one Range Complex could be used to understand the effects of sonar throughout different geographical areas, it may be appropriate to have other Range Complexes dedicate money, resources, or staff to the specific monitoring proposal identified as "high priority" by the Navy and NMFS, in lieu of focusing on smaller, lower priority projects divided throughout their home Range Complexes.

A record of decisions and monitoring resource allocations made as a result of the AMR will be documented and maintained in the electronic central data depository previously discussed in Section 3. This will allow NMFS and other interested parties to see how each range complex is contributing to all of the ongoing monitoring (funding, staffing, and level of effort).

This adaptive management process recurs annually. However, there will be modifications to the process in 2011, when the Navy, with guidance and support from NMFS, is to host a monitoring workshop that incorporates outside experts and expanded participation.

5.2 MONITORING WORKSHOP IN 2011

As part of the adaptive management process in 2011, the Navy, with guidance and support from NMFS, will convene a monitoring workshop with participation from marine mammal and acoustic experts, as well as other interested parties. This monitoring workshop, tentatively scheduled for mid-2011 in the Metropolitan D.C. area, will present a consolidated overview of monitoring activities accomplished in 2009 and 2010 pursuant to the regulations in place to govern the unintentional taking of marine mammals incidental to authorized activities conducted on Navy ranges and operating areas. It will also include outcomes of selected monitoring-related research activities. One possible outcome of this workshop is the potential identification of substantial changes in monitoring approaches for subsequent 5-year regulations.

Participation in this jointly sponsored NMFS/Navy Workshop will be by invitation only. Participants will include, among others, recognized experts in marine species monitoring from across government, academia, and the private sector. After considering the current science and working within the framework of available resources and feasibility of implementation, monitoring workshop participants will be asked to submit their individual recommendations to the Navy and NMFS. Navy and NMFS will then analyze the input from participants and determine the best way forward from a national perspective.

The workshop will not be used to seek or achieve consensus on a way forward for the monitoring program. NMFS has statutory responsibility to prescribe regulations pertaining to monitoring and reporting, and will develop in coordination with the Navy the most effective and appropriate monitoring and reporting protocols for future authorizations. As necessary, NMFS will incorporate any changes into future LOAs and rulemakings. If the modification to the described activity, mitigation, or monitoring is determined by NMFS to be substantial, then NMFS will provide the public a period of 30 days for review and comment.

OPNAV N45 will take the lead for Navy in coordinating this monitoring workshop with NMFS. There will be a series of detailed planning meetings for this 2011 workshop starting with the 2010 AMR.

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6. ICMP NEAR-TERM DEVELOPMENT FOCUS AREAS

To be an effective planning tool, the ICMP must continue to develop and evolve over time. Specific recommendations for near-term development of the ICMP were suggested in December 2009. Progress in each of the focus areas listed below was the subject of discussion in the October 2010 AMR. This progress is also summarized below.

The three specific areas originally identified for the ICMP near-term development included:

1. **Top-level Goal Refinement**. NMFS and Navy, with input from the 2010 monitoring workshop, refined the top-level goals. These refined goals are provided in Section 2. The Navy is now working with their contractor, HDR|e^{2}M, and a newly created Scientific Advisory Group (SAG) to implement these refined goals into a 3-5 year Strategic Plan for monitoring. The current objective is to produce a group-reviewed draft Strategic Monitoring Plan that has been refined/reviewed by experts and vetted through NMFS and MMC to present at the 2011 Monitoring Workshop.

2. **Characterization of Navy Range Complexes/Study Areas**. Many of the prioritization guideline factors provided by Section 2 are highly dependent on the specific location at which the proposed monitoring activity is to be conducted. To better assist planning efforts within the ICMP, one would like to predict a confidence level for the likelihood of obtaining meaningful monitoring data in any given location based on factors such as prior success with the specific monitoring method itself, anticipated sea states, seasonal weather patterns, local animal densities and migration patterns, and anticipated success rate for integrating the monitoring method with training events at that location. For this framework document to support that level of comparative analysis, it needs to include reference information that allows the user a top-level view of attributes across the various Navy range complexes. This characterization of the unique attributes associated with each range complex/study area is under development, and the work will extend into 2011. Appendix E provides the initial framework and selected portions of the current draft matrix for the range characterization.

3. **Data Management Organization and Access Procedures Development**. Section 3 provided a preliminary description of the centralized electronic repository for data associated with the ICMP, and the types of data that might be made available, as appropriate, to various categories of users. At present, there is a mix of classified and unclassified data that falls under the ICMP umbrella. As the ICMP matures, and greater amounts of monitoring data are recorded and available for analysis, ways of efficiently organizing this data to support discovery and access within the bounds of existing regulations will become increasingly important. The Navy's first priority is on managing the data collected in support of permitted activities. However, there is also interest in setting up links to relevant reports or a data library so that "best available" science can be easily accessed. This might include active research awards and grants, as well as annual reports of work accomplished. Navy is working with their contractor, HDR|e^{2}M, to develop structured procedures to meet specific access requirements for the various Fleet, Scientific, and General Public user groups. This development effort will continue into 2011. Initially, all visual survey data from Fleet-funded monitoring efforts will be made publically available through the OBIS-SEAMAP interface and may also be integrated into other public databases. Unclassified NMFS-required monitoring reports as specified by the MMPA Final Rules are currently available on the NMFS website. These reports along

with unclassified results from monitoring-related Navy R&D programs will also be publicly available from the Navy repository.

7. ROLES AND RESPONSIBILITIES

OPNAV (N45) is responsible for maintaining and updating this ICMP, as appropriate, to reflect future regulatory agency final rulemakings, adaptive management reviews, best available science, improved assessment methodologies, or more effective protective measures. This will be done in consultation with Navy technical experts, Fleet Commanders, and Echelon II Commands as appropriate.

OPNAV (N45) shall:

- Coordinate the development, funding, and assessment of Navy marine research, ensuring prioritization of monitoring projects consistent with the top-level goals established by the ICMP or other applicable legal requirements;
- Establish an electronic central repository that includes both monitoring data from activities conducted under the MMPA authorizations and annual results from Navy-funded R&D programs;
- Review annual ESA and MMPA reports prepared by Echelon II Commands to ensure a standardized approach is maintained that will enable appropriate consolidation and comparison of data;
- Chair an annual Adaptive Management Review (AMR) with NMFS on a schedule that supports the reissuance of LOA and annual Biological Opinions (BO) to maintain uninterrupted Fleet training and operations as well as Acquisition Community RDT&E activities. Attendees should include representatives from OPNAV, Office of the Assistant Secretary of the Navy for Installations and Environment (OASN I&E), Office of Naval Research (ONR), and Echelon II commands. OPNAV (N45) may approve additional attendees;
- In conjunction with the Adaptive Management Review, submit an annual evaluation of monitoring-related goals and priorities to NMFS; and
- Co-chair planning sessions with NMFS to address detailed planning for the mid-2011 Monitoring Workshop.

USFF, CPF, NAVSEA, and other permit holders shall:

- Coordinate completion of environmental planning, permitting, consultations, and reports to support uninterrupted Fleet training and research, development, testing, and evaluation requirements;
- Conduct monitoring measures consistent with applicable NMFS MMPA Final Rules, Biological Opinions, and other governing legal requirements;
- Monitor changes in ESA species, critical habitats, Habitat Areas of Particular Concern (HAPC), sanctuaries and protected marine species regulations as it may affect Navy military readiness activities authorized under their permits; and
- Assign staff to participate in the AMR.

NAVFAC, NUWC, and other Echelon III commands have contracting authority and provide support to the permit holders through contracting, executing, and managing Fleet-funded monitoring activities as directed.

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8. REFERENCES

MMPA FINAL RULES / PROPOSED RULES:

Taking and Importing Marine Mammals; U.S. Navy Training in the Hawaii Range Complex; Final Rule, 74 Fed. Reg. 1456 (January 12, 2009) (to be codified at 50 C.F.R. pt. 216).

Taking and Importing Marine Mammals; U.S. Navy Training in the Southern California Range Complex; Final Rule, 74 Fed. Reg. 3883 (January 21, 2009) (to be codified at 50 C.F.R. pt. 216).

Taking and Importing Marine Mammals; U.S. Navy's Atlantic Fleet Active Sonar Training (AFAST); Final Rule, 74 Fed. Reg. 4844 (January 27, 2009) (to be codified at 50 C.F.R. pt. 216).

Taking and Importing Marine Mammals; U.S. Navy Training in the Cherry Point Range Complex; Final Rule, 74 Fed. Reg. 28370 (June 15, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; U.S. Navy Training in the Jacksonville Range Complex; Final Rule, 74 Fed. Reg. 28349 (June 15, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; U.S. Navy Training in the Virginia Capes Range Complex; Final Rule, 74 Fed. Reg. 28328 (June 15, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; U.S. Naval Surface Warfare Center Panama City Division Mission Activities; Final Rule, 75 Fed. Reg. 3395 (January 21, 2010) (to be codified at 50 C.F.R. § 218).

Taking and Importing Marine Mammals; Military Training Activities and Research, Development, Testing and Evaluation Conducted Within the Mariana Islands Range Complex (MIRC); Final Rule, 75 Fed. Reg. 45527 (August 3, 2010) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; Navy Training Activities Conducted Within the Northwest Training Range Complex; Final Rule, 75 Fed. Reg. 69296 (November 10, 2010) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing of Marine Mammals; U.S. Navy's Research, Development, Test, and Evaluation Activities Within the Naval Sea Systems Command Naval Undersea Warfare Center Keyport Range Complex; Proposed Rules, 74 Fed. Reg. 32264 (July 7, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Training Operations Conducted Within the Gulf of Mexico Range Complex; Proposed Rules, 74 Fed. Reg. 33960 (July 14, 2009) (to be codified at 50 C.F.R. pt. 218).

RANGE-SPECIFIC MONITORING PLANS

Hawaii Range Complex Monitoring Plan dated December 2008.

Atlantic Fleet Active Sonar Training Range Complex Monitoring Plan dated January 2009.

Southern California Range Complex Monitoring Plan dated 9 January 2009.

Jacksonville Range Complex Monitoring Plan dated February 2009.

VACAPES Range Complex Monitoring Plan dated February 2009.

Cherry Point Range Complex Monitoring Plan dated April 2009.

Gulf of Mexico Complex Monitoring Plan (draft) dated April 2009.

Mariana Islands Range Complex Monitoring Plan dated May 2010.

Northwest Training Range Complex Monitoring Plan dated June 2010.

Gulf of Alaska Temporary Maritime Activities Area Monitoring Plan (draft) dated June 2010.

OTHER REFERENCES:

CNO Memo dated 6 Mar 2006, "Mid-Frequency Active Sonar Effects Analysis Interim Policy".

DRAFT United States Navy Comprehensive Marine Species Monitoring Program dated October 2007. Naval Facilities Engineering Command Pacific, Pearl Harbor, HI. Prepared by: ManTech SRS Technologies, Inc., 3865 Wilson Boulevard, Suite 800, Arlington, VA 22203 under Contract No. N68711-02-D-8043; Task Order No. 0035 in collaboration with: Cascadia Research Collective; Centre for Research into Ecological and Environmental Modeling, University of St. Andrews; Greeneridge Sciences, Inc.; LGL Limited; Kim Holland, Ph.D. University of Hawaii; and U. S. Navy Marine Resources Support Group.

Endangered Species Act (ESA), 16 U.S.C. §1531, *et seq*.

Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions".

Marine Mammal Protection Act (MMPA), 16 U.S.C. §1361, *et seq*., as amended by the 2004 National Defense Authorization Act, Pub. L. No. 108-136, 319, 117, Stat. 1433.

National Environmental Policy Act (NEPA), 42 U.S.C. §4321, *et seq.*

OPNAVINST 5090.1C, Environmental Readiness Program Manual dated 30 October 2007.

APPENDIX A:

SOUND SOURCES AND ACTIVITIES AUTHORIZED OR ANTICIPATED TO BE AUTHORIZED UNDER THE MMPA FINAL RULES FOR FLEET TRAINING RANGE COMPLEXES / STUDY AREAS

Green: Proposed Rules Sound Source / Activity	Range AFAST	SOCAL	HRC	VACAPES	Cherry Pt	JAX	NWTRC	MIRC	GOMEX	GOA TMAA
Use of mid-frequency active sonar (MFAS) and high frequency active sonar (HFAS) sources for Fleet Training:										
AN/AQS–22 or 13 (helicopter dipping sonar)	X	X	X					X		X
AN/BQQ–10 or 5 (submarine mounted sonar)	X	X	X					X		X
AN/BQS–15 (submarine navigation)	X	X					X	X		X
AN/SLQ–25 (NIXIE—towed countermeasure)	X	X								
AN/SQQ–32 (over the side mine-hunting sonar)	X									
AN/SQS–53 (hull-mounted sonar)	X	X	X				X	X		X
AN/SQS–56 (hull-mounted sonar)	X	X	X				X	X		X
AN/SSQ–125 (AEER sonar sonobuoys)	X	X					X	X		X
MK–1 or 2 or 3 or 4 (Submarine-fired Acoustic Device Countermeasure (ADC))	X									
MK–46 or 54 (lightweight torpedoes)	X	X						X		
MK–48 (heavyweight torpedoes)	X	X	X				X	X		X
Noise Acoustic Emitters (NAE - Sub-fired countermeasure)	X									
SSQ–62 DICASS (sonobuoys)	X	X	X				X	X		X
MK-84 range tracking pingers for ASW tracking							X	X		X
Portable Undersea Tracking Range Uplink							X	X		X
Detonation of underwater explosives for Fleet Training:										
AN/SSQ–110A (IEER explosive sonobuoy) (5 lbs)	X	X	X				X	X		X
MK–48 Heavyweight Torpedo (851 lbs)		X	X				X	X		X
Airborne Mine Neutralization System (AMNS)				X						
Demolition Charges (20 lbs)		X	X	X	X	X	X	X		
AGM–65 E/F Maverick missile (78.5 lbs)		X	X	X		X	X	X		
Harpoon missile (448 lbs)		X	X				X	X		
AGM–114 Hellfire missile				X	X	X	X	X		
AGM–88 High-speed anti-radiation missile (HARM)				X			X	X		
Tube-launched Optically tracked Wire-guided (TOW) missile					X					
SLAM missile							X	X		
MK–82 Bomb / GBU-12		X	X				X	X		X
MK–83 Bomb / GBU-16 / GBU -32		X	X	X			X	X	X	X
MK–84 Bomb / GBU-10		X	X				X	X		X
5" Naval Gunfire (9.5 lbs)		X	X	X	X	X	X	X		X
76 mm rounds (1.6 lbs)		X	X				X	X		X
MK3A2 anti-swimmer concussion grenades (0.5 lbs)						X		X	X	
Training Events or Activity:										
ASW Exercise	X	X	X				X	X		X
MINEX (Neutralization, Avoidance, Countermeasures)	X	X	X	X	X	X	X	X		
MISSILEX (Air-to-Surface)		X	X	X	X	X	X	X		X
MISSILEX (Surface-to-Surface)			X							X
BOMBEX (Air-to-Surface)		X	X	X			X	X	X	X
SINKEX		X	X				X	X		X
GUNEX (Surface-to-Surface)		X	X				X	X		X
Naval Surface Fire Support			X							
FIREX with Integrated Maritime Portable Acoustic Scoring System (IMPASS)				X	X	X				
Small Arms Training with grenades						X		X	X	
Maintenance	X	X								
RDT&E (unspecified)	X	X						X		

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APPENDIX B:

Sound Sources and Activities anticipated to be authorized under the MMPA Final Rules for NAVSEA RDT&E Ranges / Study Areas

Green: Proposed Rules Sound Source / Activity	Range NUWC Keyport	 NSWC PCD
Use of mid-frequency and high frequency active sound sources for NAVSEA RDT&E:		
Acoustic communication modems, HF	X	X
Acoustic devices for general range and UUV tracking (HF)	X	
Aids to navigation (range equipment)	X	
AN/AQS-22 (helicopter dipping sonar)	X	
AN/AQS–20 (helicopter towed mine-hunting sonar)		X
AN/SQQ–32 (over the side mine-hunting sonar)		X
AN/SQS–53/56 (hull-mounted sonar, Kingfisher)		X
AN/WLD–11 RMS Navigation (HF)	X	X
F84Y (Tower-mounted parametric sonar used to simulate mine-like objects, HF)		X
Object detection and navigation sonars (multiple HF)	X	X
Range Targets with active acoustic devices (MF, HF)	X	
Sidescan Sonars (multiple HF frequencies)	X	X
Sonobuoys, active	X	
Special Test Systems with active acoustic devices (MF, HF)	X	
Sub-bottom profilers (MF, HF)	X	X
Torpedo Sonars (HF)	X	
TVSS (Toroidal Volume Search Sonar, HF)		X
Detonation of underwater explosives for NAVSEA RDT&E:		
Live Ordnance (1 – 10 lb net explosive weight)		X
Live Ordnance (11 – 75 lb net explosive weight)		X
Live Ordnance (76 – 600 lb net explosive weight)		X
Line Charges (1750 lb net explosive in 5 lb increments)		X
Projectiles (5in, 40mm, 30mm, 20mm, 76mm, 25mm, and small arms)		X
NAVSEA RDT&E Activity:		
Acoustic and non-acoustic sensor testing	X	
Countermeasure testing	X	
Impact testing	X	
Inert mine detection, classification, and localization	X	
Ordnance Live T&E		X
Projectile Firing T&E		X
Sonar T&E		X
Surf zone clearing T&E with line charges		X
Surface Operations – equipment deployment and recovery	X	X
Surface Operations – system development	X	X
Surface Operations – test support	X	X
Surface Operations – tows	X	X
UUV and UAS testing	X	
Vehicle propulsion testing	X	

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APPENDIX C:
Sample size and Statistical analysis

Specific guidelines for sample size and statistical analysis are under development. This is a PLACEHOLDER for a FUTURE UPDATE.

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APPENDIX D:
Marine Mammal Sighting Form for Navy Lookouts

Example:

A. DTG: **061234 Z JAN 09**	B. Species/Type of Mammal: **Whale**	C. Number of Mammals: **2**	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: **215** T / **1400** Yds	G. Unit Position: LAT: **123456N** LONG: **1234555E**	
H. Unit Course/Speed: **265** T / **12** Kts	I. Last Known Brg/Rng: **095** T / **900** Yds	J. Total Time Visually Observed: **14** MIN	
K. Wave Height: **4** FT	L. Visibility: **12** NM	M. MFAS Status: **ON**	N. MFAS Action Taken: **Powerdown**
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: **14** MIN	P. Maneuver Conducted: **Turn Stbd**	Q. Degrees of Course Chg: **45** DEG	R. Range Action Taken: **800** YDS
S. Action impact (note 1): **slight - degraded integrity of ASW screen, as ship maneuvered to avoid whales**			
T. Narrative of observation (note 2): **two whales paralleled ship's course, CPA of 600 yds after maneuver. Powered down MFAS for 14 min until lost sight of whales.**			

Data Fields:

A. DDHHMM Z MMM YY
B. WHALE / DOLPHIN / PORPOISE / SEAL / SEAL LION / TURTLE /GENERIC (i.e unknown)
C. Number
D. YES / NO
E. VISUAL / AURAL
F. Bearing in Degrees True / Range in Yards
G. Position: DDMMSS N/S DDDMMSS E/W
H. Course in Degrees True / Speed in Knots
I. Bearing in Degrees True / Range in Yards
J. Minutes
K. Feet
L. Nautical Miles
M. NO / YES
N. Powerdown -6dB / Powerdown -10dB / Shutdown / None
O. Minutes
P. Turn STBD / Turn PORT / -
Q. Degrees
R. Range in Yards
S. Tactical Degradation Assessment examples:
   - None
   - Slight - Degraded ASW screen integrity when ship maneuvered to open whales.
   - Moderate - Lost Contact when power reduced.
   - Significant - Engagement interrupted when MFAS was Shutdown.
T. Observation examples:
   - Dolphins sighted at 1200 YDS off Port bow, closing the ship. Maneuvered to confirm Bow Riding and continued MFAS operations
   - Pod of whales sighted fin slapping 600 YDS off STBD bow, paralleling ships course. Ship maneuvered to Port to open range.
   - Porpoises sighted 250 YDS off STBD Beam, opening ship. Powered down MFAS by -6dB until they opened to 1000 YDS. Lost sight astern.
   - DragonSlayer 12, flying NW at 60 kts, 1200FT, spotted pod of dolphins within 150 YDS of DICASS Buoy 12. Buoy was passive at the time, and remained so until dolphins were seen leaving the area. 80% cloud layer at 3500 FT. Photos taken.

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USS_______________ DAILY MARINE MAMMAL LOG

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

Note 1: Tactical Degradation Assessment. Impact examples: None. Slight - Degraded ASW screen when ship maneuvered to open whales. Moderate: Lost Contact when power reduced. Significant: Engagement interrupted when MFAS was Shutdown.

Note 2: Describe actions of marine mammals and ship's reactions. Aircraft include altitude. Narrative examples: Dolphins sighted at 1200 YDS off Port bow, closing the ship, CPA of 600 YDS. Powered down MFAS for 35 min until lost sight of whales.

Porpoises sighted by Lookouts using NVGs, range 550 YDS, opening the ship. Powered down MFAS -6dB for 10 min until outside of 1000 YDS.

LoneWolf 42, flying SW at 60kts, 1200 FT, sighted pod of dolphins within 100 YDS DICASS 12. Buoy was not active at the time.

Example:

A. DTG: 061234 Z JAN 09	B. Species/Type of Mammal: Whale	C. Number of Mammals: 2	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: 215 T / 1400 Yds	G. Unit Position: LAT: 123456N LONG: 1234555E	
H. Unit Course/Speed: 265 T / 12 Kts	I. Last Known Brg/Rng: 095 T / 900 Yds	J. Total Time Visually Observed: 14 MIN	
K. Wave Height: 4 FT	L. Visibility: 12 NM	M. MFAS Status: ON	N. MFAS Action Taken: Powerdown
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: 14 MIN	P. Maneuver Conducted: Turn Stbd	Q. Degrees of Course Chg: 45 DEG	R. Range Action Taken: 800 YDS
S. Action impact (note 1): slight - degraded integrity of ASW screen, as ship maneuvered to avoid whales			
T. Narrative of observation (note 2): two whales paralleled ship's course, CPA of 600 yds after maneuver. Powered down MFAS for 14 min until lost sight of whales.			

Data Fields:

A. DDHHMM Z MMM YY
B. WHALE / DOLPHIN / PORPOISE / SEAL / SEAL LION / TURTLE /GENERIC (i.e unknown)
C. Number
D. YES / NO
E. VISUAL / AURAL
F. Bearing in Degrees True / Range in Yards
G. Position: DDMMSS N/S DDDMMSS E/W
H. Course in Degrees True / Speed in Knots
I. Bearing in Degrees True / Range in Yards
J. Minutes
K. Feet
L. Nautical Miles
M. NO / YES
N. Powerdown -6dB / Powerdown -10dB / Shutdown / None
O. Minutes
P. Turn STBD / Turn PORT / -
Q. Degrees
R. Range in Yards
S. Tactical Degradation Assessment examples:
   - None
   - Slight - Degraded ASW screen integrity when ship maneuvered to open whales.
   - Moderate - Lost Contact when power reduced.
   - Significant - Engagement interrupted when MFAS was Shutdown.
T. Observation examples:
   - Dolphins sighted at 1200 YDS off Port bow, closing the ship. Maneuvered to confirm Bow Riding and continued MFAS operations
   - Pod of whales sighted fin slapping 600 YDS off STBD bow, paralleling ships course. Ship maneuvered to Port to open range.
   - Porpoises sighted 250 YDS off STBD Beam, opening ship. Powered down MFAS by -6dB until they opened to 1000 YDS. Lost sight astern.
   - DragonSlayer 12, flying NW at 60 kts, 1200FT, spotted pod of dolphins within 150 YDS of DICASS Buoy 12. Buoy was passive at the time, and remained so until dolphins were seen leaving the area. 80% cloud layer at 3500 FT. Photos taken.

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APPENDIX E:
Characterization of Navy Range Complexes / Study Areas

Many of the prioritization guideline factors provided by Section 2 are highly dependent on the specific location at which the proposed monitoring activity is to be conducted. This appendix will present reference information that allows the user a top-level view of attributes across the various Navy range complexes.

A preliminary draft matrix has been developed, and is undergoing a broad group review. The current framework is provided here as a PLACEHOLDER for the full matrix and selected portions of the DRAFT matrix are provided as an example of content. The complete draft matrix will be available for consideration at the 2011 Monitoring workshop.

This example matrix pulls information from a variety of documents, including environmental compliance documentation, Letters of Authorization, Biological Opinions, Marine Resource Assessments, Range Monitoring Plans, and Range Monitoring Reports to name a few. It is a work in progress.

The matrix is organized into two primary sections. The first section shows the general characteristics of each range. These characteristics are expected to remain generally the same over time.

This matrix becomes quite sizable once all the information is filled in. For presentation purposes, the range complexes and study areas have been organized into four groups. These groups are shown by the color coding. The first group includes the "Big Three" (AFAST, SOCAL, and HRC), the second group includes the remaining areas that are under the cognizance of Fleet Forces Command, and the third group is the remaining areas under Pacific Fleet Command. The fourth group is RDT&E ranges that are under the Naval Sea Systems Command.

	AFAST	SOCAL	HRC	VACAPES	Cherry Pt	JAX	GOMEX	MIRC	NWTRC	GOA	NUWC Keyport	NSWC PCD
General Description												
Occurrence of Marine Mammals												
Seasonal migration patterns												
Physical geography / Bathymetry												
Weather patterns												
Major Currents												
National Marine Sanctuaries												
Level of Fleet activities												
Other Shipping												
Unique range assets												

The second section of the matrix highlights monitoring considerations for each range complex or study area. Information in this section is captured from Fleet Exercise Reports, Monitoring Reports, Marine Resource Assessments, as well as an ongoing review of available science. The information in this section is expected to change over time, particularly as advances are made to monitoring techniques and technology. This section of the matrix will be reviewed and updated as appropriate during the Adaptive Management Reviews. Preliminary information is included in the draft version of the matrix, and is subject for discussion and review by the Scientific Advisory Group. This section of the matrix will continue to be filled out more completely as information is drawn from the 2010 Monitoring Reports.

	AFAST	SOCAL	HRC	VACAPES	Cherry Pt	JAX	GOMEX	MIRC	NWTRC	GOA	NUWC Keyport	NSWC PCD
Unique biological opportunities												
Biological data-gaps												
Monitoring Considerations *- Factors that contribute to certain types of monitoring being difficult or less effective*												
- Instrumented Range												
- Passive acoustic												
- Visual Surveys (general)												
- Aerial surveys												
- Ship surveys												
- Photo-ID												
- Tagging												

DRAFT EXAMPLE OF SECTION 1- GENERAL CHARACTERISTICS FOR EACH RANGE:

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RANGE COMPLEX	**AFAST**	**SOCAL**	**HRC**
General Description	The AFAST Study Area encompasses the waters and their associated substrates within and adjacent to existing Operating Areas (OPAREAs), located along the East Coast and within the Gulf of Mexico. It extends east from the Atlantic Coast of the U.S. to 45° W. long. and south from the Atlantic and Gulf of Mexico Coasts to approximately 23° N. lat., but not encompassing the Bahamas. Overall, this is greater than 2.1 million square nautical miles (nm²). The areas where training events will most likely occur in the AFAST Study Area cover approximately 1.0 million square nautical miles (nm²).	The SOCAL Range Complex consists of 120,000 nm² of sea area from approximately Dana Point California to San Diego. It extends extends southwest-from southern California in an approximately 700 by 200 nm rectangle with the seaward comers at 27'30'00" N. lat.; 127'1 0'04" W. long. and 24'00'01" N. lat.; 125'00'03" W. long.	The HRC consists of 235,000 square nautical miles (nm²) of ocean areas. Geographically it encompasses the open ocean (outside 12 nautical miles [nm] from land), offshore waters (within 12 nm from land), and onshore areas located on or around the islands of the Hawaiian Islands chain. While it is irregularly shaped, the range complex is roughly bounded by the points: 179W 43N; 150W 43N; 154W 17N; and 179W 16 N.
Occurrence of marine mammals	43 species of marine mammals (7 mysticetes, 29 odontocetes, 6 pinnipeds, and one sirenian (manatee)) that may be observed either seasonally or year- round in the AFAST study area; seven are endangered. In addition, there are six species of threatened and endangered sea turtles that may occur either seasonally or year- round in parts of the AFAST study area. Low densities of animals preclude large sample sizes and generally result in a relatively small number of sightings during surveys.	41 potential marine mammal species or separate stocks with possible or confirmed occurrence. This includes 34 cetacean species (whales, dolphins, and porpoises), six pinnipeds (sea lions, fur seals and true seals) and one sea otter species.	27 species of marine mammals may be observed either seasonally or year-round in the Hawaiian Islands Range Complex, seven of them are listed as endangered. Four species of threatened and endangered sea turtles. Apparent low densities of marine mammals in areas where the Navy trains.
Seasonal migration patterns	Humpback and North Atlantic right whales make extensive annual migrations to low-latitude mating and calving grounds in the winter and to high-latitude feeding grounds in the summer. These migrations are thought to occur during these seasons due to the presence of highly productive waters and associated cetacean prey species at high latitudes and warm water temperatures at low latitudes. The West Indian manatee generally reside along the Southeastern Atlantic coast and the Gulf of Mexico and may migrate farther north during warm months but would be limited primarily to nearshore waters.	Variation in oceanographic and climatic conditions within Southern California has a dramatic influence on marine mammal distribution, species assemblages likely to be present, foraging, and breeding success.	Most of the central north Pacific stock of humpback whales migrate south to Hawaii in winter for breeding and calving from December through April. Green turtles occur in the coastal waters surrounding the Main Hawaiian Islands throughout the year and also migrate seasonally to the Northwestern Hawaiian Islands to reproduce.

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RANGE COMPLEX	**AFAST**	**SOCAL**	**HRC**
Physical Geography / Bathymetry	Significant variance due to large extended area encompassed by the study area. The Atlantic Fleet Study Area has a much larger shallow-water region available in comparison to the Pacific Fleet ranges because of the wide continental shelf.	The seafloor beneath the SOCAL OPAREA is comprised of a series of unique basins, steep escarpments, seamounts, and troughs that extend seaward for over 250 km. The maximum water depths in the Study Area are found over the abyssal plain in the SOCAL OPAREA and exceed 5,000 m.	In general, the Hawaiian Ridge forms a continuous barrier, exerting a dramatic influence over oceanic current patterns along the seafloor in this region. Bathymetric features include a steep, narrow continental margin and a seafloor comprised of depressed island moats, seamounts, submarine canyons and submerged banks.
Weather patterns	Significant variance due to large extended area encompassed by the study area.	Semi-arid, Mediterranean climate characterized by a well-defined cool, wet season. Semi-permanent high-pressure system creates a repetitive pattern of early morning fog, hazy afternoon sunshine, and daytime onshore breezes. Temperatures are relatively stable throughout the year.	The Hawaiian Islands are located along the northern edge of the tropics, but best described as subtropical. Persistent NE trade winds. Seasonal temperatures vary only slightly throughout the year.
Major Currents	The western continental margin of any ocean basin is the location of intense boundary currents. The Gulf Stream is the western boundary current of the North Atlantic Ocean. The Gulf Stream is part of a larger current system called the Gulf Stream System, which also includes the Loop Current in the Gulf of Mexico and the Florida Current in the Atlantic, between the Straits of Florida and Cape Hatteras. The Gulf Stream is a powerful surface current, carrying warm water into the cooler North Atlantic, and exerting a considerable influence on the oceanographic conditions in each OPAREA.	Three major surface currents: the California Current (slow equatorward flow), the California Countercurrent (northward flow), and an inshore coastal current.	Mean coast currents are to the west at variable speeds. Primary surface currents include: North Equatorial Current (to the west) and Hawaiian Lee Counter Current (to the east).
National Marine Sanctuaries	Five in AFAST. Stellwagen Bank NMS, USS Monitor NMS, Gray's Reef NMS, Flower Garden Banks NMS, and Florida Keys NMS.	One in SOCAL. Channel Islands NMS.	Two in HRC. Hawaiian Islands Humpback Whale National Marine Sanctuary Papahānaumokuākea Marine National Monument

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RANGE COMPLEX	**AFAST**	**SOCAL**	**HRC**
Level of Fleet Activities	High. Navy OPAREAs in AFAST include designated ocean areas near fleet concentration areas (i.e., homeports) where the majority of routine Navy training and RDT&E occur. The majority of Atlantic Fleet active sonar activities occur in open ocean areas. While the Atlantic Fleet also has shorebased support facility requirements for ASW training, they are not concentrated in one geographic area, which provides greater potential for operational flexibility than in the Pacific Fleet Study Areas. Major training exercises (MTE) include: • Southeastern Integrated Training Initiative (SEASWITI) - 4 events annually, 5 to 7 days per entire event. • Integrated ASW Course (IAC) - 5 events annually, 2 to 5 days per entire event. • Group Sails - 20 events annually, 2 to 3 days per entire event. • Composite Training Unit Exercise (COMPTUEX) - 5 events annually, 21 days per entire event. • Joint Task Force Exercise (JTFEX.) - 2 events annually, 10 days per entire event. It should be noted that sonar is typically not in use throughout an entire event. [LOA 2009].	High. There were a total of 11 MTEs within the SOCAL Range Complex between 01 August 2008 and 03 August 2009. Of the 11, there were six MTEs between the end of January to 01 August 2009. All told, there were only 114 non-consecutive cumulative days involving MTEs within SOCAL out of the approximately 368 days between 01 August 2008 to 03 August 2009, and only 59 days of non-consecutive cumulative MTE out of approximately 192 days between 24 January 2009 and 03 August 2009. For in-water unit-level training and major training event (MTE) using sonar and explosives, only a limited subset of the overall range complex is used.	High. The large training area available to deployed forces within the HRC allows training to take place using a geographic scope that replicates possible real world events, with the channels between islands providing geography necessary for opposed transit scenarios. For in-water unit level training and major training events (MTE) using sonar and explosives, a much more limited subset of the range complex is used.
Other Shipping	The waters off the U.S. Atlantic coast support a large volume of maritime traffic heading to and from foreign ports as well as traffic traveling north and south to various U.S. ports. Commercial shipping comprises a large portion of this traffic, and a number of commercial ports are located along the Atlantic and Gulf of Mexico U.S. coasts.	There are three major commercial ports in SOCAL: Los Angeles, Long Beach, and San Diego. There are four primary shipping lanes: two run south along Mexico's west coast, one extends west towards the central and western North Pacific, and another stretches nort along the U.S. west coast up to the San Francisco area and beyond.	The Hawaiian Islands serve as a major port for international shipping. Transoceanic shipping lanes extend offshore from the region in several directions: north towards Alaka; northeast towards Washington, Oregon, and California; east towards the Panama Canal; southwest towards Guam and Wake Island; and northwest towards Japan and Okinawa.

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RANGE COMPLEX	**AFAST**	**SOCAL**	**HRC**
Unique range assets	Geographically-fixed monitoring sites off the coasts of North Carolina (Onslow Bay) and Florida (Jacksonville) have been established to support consistent ongoing visual shipboard and aerial surveys, as well as passive acoustic monitoring. Data collected by a consortium of researchers from Duke University, the University of North Carolina at Wilmington, the University of St. Andrews, and NMFS Northeast Fisheries Science Center under a pilot study that started in 2007 established a longitudinal baseline of marine species distribution and abundance in Navy training areas during periods when training is not occurring at the site. This baseline provides the foundation for a monitoring program designed to provide meaningful data on potential long term effects to marine species that may be chronically exposed to training activities.	Fixed Hydrophone range at SOAR. Availability to the Floating Instrument Platform, FLIP. FLIP is a 355 foot long manned spar buoy designed as a stable research platform for oceanographic research. FLIP is owned by the US Navy and operated by the Marine Physical Laboratory (MPL), Scripps Institution of Oceanography, University of California, San Diego. Homeported in San Diego, FLIP is towed to its operating area in the horizontal position and through ballast changes is "flipped" to the vertical position to become a stable spar buoy with a draft of 300 feet. http://www.mpl.ucsd.edu/resources/flip.intro.html. Collaborations with California Cooperative Oceanic Fisheries Investigation (CalCOFI) for environmental data analyses.	Fixed hydrophone range at PMRF. A number of shallow, nearshore water ranges (e.g., Puuloa Underwater Range, Ewa Training Minefield, Barbers Point Underwater Range, and Lima Landing) that are used for underwater detonation training (i.e. mine neutralization, demolition of debris).

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RANGE COMPLEX	**VACAPES**	**CHERRY POINT**	**JACKSONVILLE**	**GOMEX**
General Description	The VACAPES OPAREA, located off the east coast of the United States, includes the nearshore area from just off the mouth of the Delaware Bay south to Cape Hatteras and extends seaward into waters more than 4,000 m deep. The surface water areas of the Range Complex covers the coast of Delaware, Maryland, Virginia, and North Carolina, encompassing 27,661 nm².	The CHERRY POINT OPAREA, located along the coast of North and South Carolina, extends 127 nm seaward from the 3 nm state waters boundary. Water depth in the OPAREA ranges from approximately 10 to 4,000 meter (m). It encompasses 18,617 square nautical miles (nm²), of which12,529 nm² of subsurface area is greater than 100 fathoms (600 ft) in depth.	The northernmost point of the JAX Range Complex OPAREA is located just north of Wilmington, North Carolina (34°37' N) in waters less than 20 m deep, while the easternmost boundary lies 281 nm offshore of Jacksonville, Florida (77°00' W in waters with a bottom depth of nearly 2,000 m. The JAX/CHASN OPAREA covers 66,505 square miles [mi²]) of ocean area. The majority of the western (shoreward) boundary of the JAX/CHASN OPAREA is located approximately 3 nautical miles (NM) off the southeast U.S. coast.	GOMEX study area encompasses the northern or U.S. waters of the Gulf of Mexico and includes the Florida Straits. The study area occupies waters offshore of all five U.S. Gulf coast states: Texas (TX), Louisiana (LA), Mississippi (MS), Alabama (AL), and Florida (FL) and extends seaward approximately to the U.S. exclusive economic zone (EEZ). The study area is bounded to the south and southwest by the Mexican-U.S. maritime boundary and in the southeast by the Cuba-U.S. maritime boundary. Covering 384,152 square kilometers (km2) of the marine environment, the study area spans coastal to deepwater habitats and encompasses waters shallower than 10 m in depth near the Florida Keys to waters greater than 3,000 m in depth near center of the GOMEX.
Occurrence of marine mammals	41 marine mammal species with possible or confirmed occurrences in the VACAPES OPAREA. Six cetacean species, five sea turtle species, and two fish species listed as threatened or endangered and under the jurisdiction of the NMFS occur in the Action Area. The calving ground of the North Atlantic right whale, located seaward of southern Georgia and northern Florida, is designated under the ESA as critical habitat in the Action Area.	34 marine mammal species are expected to occur regularly in the marine waters off North Carolina within the CHPT Range Complex. There are 32 cetacean species (whales, dolphins, and porpoises), one pinniped species (true seal) and one sirenian species (manatee) In addition there are five species of threatened and endangered sea turtles.	35 species of marine mammals are documented to occur within or immediately adjacent to the JAX/CHSN OPAREA. This includes 7 mysticetes, 25 odontocetes, 2 pinnipeds, and 1 sirenian (manatee). Seven species are endangered. In addition, there are six species of threatened and endangered sea turtles that are documented as occuring in the JAX/CHSN OPAREA.	29 species of marine mammals with potential occurrence in the GOMEX study area. (28 cetaceans and one sirenian species [manatees]). Seven marine mammal species listed as Federally-endangered under the Endangered Species Act (ESA) occur or have the potential to occur in the area.

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RANGE COMPLEX	**VACAPES**	**CHERRY POINT**	**JACKSONVILLE**	**GOMEX**
Seasonal migration patterns	During the winter (as early as November and through March), right whales may be found in coastal waters off North Carolina, Georgia, and northern Florida. The coastal waters of the Carolinas are suggested to be a migratory corridor for the North Atlantic right whale. There have also been opportunistic sightings of right whales in deep waters of the VACAPES OPAREA. North Atlantic right whale sightings in very deep offshore waters of the western North Atlantic are infrequent. However, there is limited evidence suggesting that a regular offshore component exists to their distributional and migratory cycle. Humpback whales occur on the continental shelf and in deep waters of the VACAPES OPAREA in fall, winter, and spring during migrations between calving grounds in the Caribbean and feeding grounds off the northeastern U.S.	During the winter (as early as November and through March), right whales may be found in coastal waters off North Carolina, Georgia, and northern Florida. The coastal waters of the Carolinas are suggested to be a migratory corridor for the North Atlantic right whale. There have also been opportunistic sightings of right whales in deep waters of the CHPT OPAREA. Humpback whales occur on the continental shelf and in deep waters of the CHPT OPAREA in fall, winter, and spring during migrations between calving grounds in the Caribbean and feeding grounds off the northeastern U.S.	North Atlantic right whales migrate to the coastal waters of the southeastern U.S. to calve from November through March. The waters off Georgia and northern Florida are the only known calving ground for the North Atlantic right whale. As waters warm in the spring, juvenile loggerhead, green, and Kemp's ridley sea turtles migrate northward along the U.S. Atlantic Coast in search of developmental feeding grounds. As waters cool in the fall, most sea turtles emigrate out of temperate inshore waters and travel southward at least as far as Cape Hatteras to avoid cold stunning. Although many sea turtles within the JAX/CHASN OPAREA may not exhibit extensive migrations, large concentrations of sea turtles during the spring and fall migration periods may still be expected; these large concentrations result from the combination of individuals, originating from other areas along the U.S. east coast, transiting through the area in addition to the presence of year-round residents.	
Physical Geography / Bathymetry	The VACAPES OPAREA includes the nearshore area from just off the mouth of Delaware Bay south to Cape Hatteras and extends seaward into waters more than 4,000 m (13,120 ft) deep. Along the Atlantic coast, the continental shelf extends from the shoreline to a depth of about 200 m (656 ft). At the shelf edge, the shelf gives way abruptly to the continental slope. The continental slope extends to water depths of between 2,000 and 4,000 m (6,560 and 13,120 ft). The	Large, sand shoals extend from the barrier islands off southern North Carolina. Water depths near these shoals are among the shallowest in the CHPT OPAREA; the depth of the seafloor decreases rapidly so that the shoal crests are found in <10 m of water off Cape Lookout and Cape Hatteras. Seaward of Cape Hatteras and Hatteras Canyon, the ocean bottom deepens rapidly, reaching the maximum water depth in the CHPT OPAREA of 4,000 m approximately 150 km from shore.	Seafloor includes low relief, relatively gentle gradients, and smooth bottom surfaces exhibiting features contoured by erosional processes from the Gulf Stream. The sea floor beneath the JAX/CHASN OPAREA is notably featureless. The wide, flat Florida-Hatteras Shelf, which is marked by several shallow depressions, underlies nearly half of the OPAREA. The remainder of the sea floor beneath the OPAREA consists of the northern two-thirds of Blake Plateau lying at depths between	The GOMEX is distinguished by an enormous river delta, limestone islands, expansive and relatively flat continental-shelf areas, submarine canyons, steep escarpments, sea fans, and a central deep, flat basin where water depths reach a maximum of 3,767 m.

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RANGE COMPLEX	**VACAPES**	**CHERRY POINT**	**JACKSONVILLE**	**GOMEX**
	continental slope is the most prominent physiographic feature along the mid-Atlantic continental margin and is interlaced with numerous submarine canyons. Four submarine canyons—Norfolk, Washington, Accomac, and Baltimore—are found within the VACAPES OPAREA.		approximately 700 and 1,400 m.	
Weather patterns		Prevailing westerly winds result in a tropical/ subtropical climate south of Cape Hatteras. The proximity of the Gulf Stream Current to coastal North Carolina has a strong effect in the generation of cyclonic, extra-tropical storms in winter as cold, dry continental air meets the warm, moist air over Gulf Stream waters. From June through November, tropical cyclones are formed in warm, equatorial waters of the North Atlantic Ocean and Caribbean Sea and often move northward along the southeastern U.S. coast following the path of the Gulf Stream	Prevailing westerly winds result in a tropical/subtropical climate south of Cape Hatteras. Annual extremes in precipitation along the coastline bordering the OPAREA are wide-ranging. The proximity of the Gulf Stream to the southeast U.S. coast has a strong effect in the generation of cyclonic, extra-tropical storms in winter as cold, dry continental air meets the warm, moist air over Gulf Stream waters. Thunder storms and major storm systems occur in the region most often during summer and fall as hot, humid air masses collide with passing fronts. Most major storms, including hurricanes, occur in the JAX/CHASN OPAREA during the North Atlantic hurricane season which occurs annually from June through November.	Subtropical. In general, summer weather conditions in the GOMEX study area are relatively consistent and stable with winds predominantly out of the southeast while winter weather conditions are more variable with winds predominantly from the east or northeast. The eastern Gulf is characterized by a distinct wet season during summer and a dry season during winter; however no distinct seasonal variation in precipitation is evident in the northern Gulf.
Major Currents	Gulf Stream. In VACAPES, the Gulf Stream is approximately 50 km (27 NM) wide and 1,000 m (3,280 ft) deep. Surface velocity ranges from 3.7 to 9.3 kilometers per hour (km/hr) (2.0 to 5.0 knots [kn]), and temperature ranges from 25 to 28oC (77 to 82oF).	Gulf Stream. OPAREA is dominated by the strong northeasterly flowing Gulf Stream, a current which effectively forms an oceanographic barrier separating the warm, tropical/ subtropical waters found to the south from the cool, temperate waters found to the north.	The Gulf Stream Current flows north along the U.S. southeast coast, and is the dominant surface current in the northwestern Atlantic Ocean, South Atlantic Bight, and JAX/CHASN OPAREA.	Warm (>26°C) Caribbean Sea surface waters form the Yucatan Current, which flows into the GOMEX through the Yucatan Channel. The Gulf Stream Loop Current is the dominant surface current in the central and eastern GOMEX. The Florida Current is a strong, east-northeast flowing current that connects the Loop Current to the Gulf Stream at the entrance to the Florida Straits. Deep water circulation

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RANGE COMPLEX	**VACAPES**	**CHERRY POINT**	**JACKSONVILLE**	**GOMEX**
				in the GOMEX is not nearly as well understood as surface water circulation.
National Marine Sanctuaries	No NMS in the VACAPES OPAREA.	One NMS in CHERRY POINT OPAREA. USS Monitor NMS.	One in JAX Range Complex. Gray's Reef NMS.	Two in the Study Area. Florida Keys National Marine Sanctuary. Flower Garden Banks National Marine Sanctuary, located on the outer edge of the continental shelf approximately 193 km and 172 km southeast of Galveston, TX.
Level of Fleet Activities	High. The VACAPES OPAREA is a major area of military usage. The DoD has used the area extensively for military and National Aeronautics and Space Administration (NASA) training, testing, and ordnance and rocket firing exercises. The Fleet Air Control Surveillance Facility (FACSFAC) VACAPES provides fleet surveillance and functional area support services that include scheduling, monitoring, and controlling air traffic from just south of Nantucket Island, Massachusetts, to Charleston, South Carolina, and eastward more than 371 km (200 NM) into the Atlantic Ocean. The types of explosive events that occur within the VACAPES Range Complex include: underwater detonations associated with Mine Exercises (MINEX), Surface-to-Surface Firing Exercises (FIREX specifically with platforms using 5" shells), Surface-to-Surface Missile Exercises (MISSILEX),	Training Events authorized in LOA for 1 year ending June 2010: (A) Mine Neutralization (20 lb NEW charges) - 20 (B) MISSILEX (Air-to-Surface; Hellfire missile) - 8 (C) MISSILEX (Air-to-Surface; TOW) - 8 (D) FIREX with IMPASS - 2	Training Events authorized for June 2009 - June 2010: (A) Mine Neutralization (20 lb NEW charges) - 12 (B) MISSILEX (Air-to-Surface; Hellfire missile) - 70 (C) MISSILEX (Air-to-Surface; Maverick) – 3 (D) FIREX with IMPASS – 10 (E) Small Arms Training with MK3A2 anti-swimmer concussion grenade (0.5 lbs NEW) - 80 HE	

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RANGE COMPLEX	**VACAPES**	**CHERRY POINT**	**JACKSONVILLE**	**GOMEX**
	and Bombing Exercises (BOMBEX).			
Other Shipping	VACAPES is in the direct path of commercial shipping traffic traveling between New York, Boston, and Miami and other ports in the southeast. Ships transiting within or in the vicinity of the VACAPES Range Complex may use any one of over 15 shipping lanes that intersect the range complex. One shipping lane runs roughly parallel to the coast and serves as a connecting route between domestic ports to the north and south of the range complex.	The CHPT OPAREA lies between the major commercial shipping ports of Baltimore, New York, and Boston to the north and Savannah, Jacksonville, and Miami to the south. Several other ports are located in the vicinity of the CHPT OPAREA including: Morehead City and Wilmington in North Carolina; Norfolk, VA; and Charleston,SC. Ships transiting within or in the vicinity of the CHPT OPAREA may use any one of the nine major waterways that intersect the OPAREA. Five of these waterways are oriented roughly north-south and run parallel to the coastline. The remaining four waterways are oriented roughly perpendicular to the coast and serve as connecting routes between coastal ports and offshore waterways.	The JAX/CHASN OPAREA lies just offshore of several major commercial shipping ports including: Jacksonville, Florida; Savannah, Georgia; and Charleston, South Carolina. Ships transiting within or in the vicinity of the JAX/CHASN OPAREA may use any one of over 20 major waterways that intersect the OPAREA.	A large volume of ship traffic navigates the GOMEX. Commercial (domestic and international) shipping comprises the vast majority of this traffic. Nine primary shipping lanes radiate north from the Yucatan Straits into the study area while several major shipping lanes bisect the Florida Straits.
Unique range assets		Geographically-fixed monitoring site off the coast of North Carolina (Onslow Bay) was established to support consistent ongoing visual shipboard and aerial surveys, as well as passive acoustic monitoring. Data collected by a consortium of researchers from Duke University, the University of North Carolina at Wilmington, the University of St. Andrews, and NMFS Northeast Fisheries Science Center under a pilot study that started in 2007 established a longitudinal baseline of marine species distribution and abundance in Navy training areas during periods when training is not occurring at the site.	Geographically-fixed monitoring sites off the coast of Florida (Jacksonville) have been established to support consistent ongoing visual shipboard and aerial surveys, as well as passive acoustic monitoring. Data collected by a consortium of researchers from Duke University, the University of North Carolina at Wilmington, the University of St. Andrews, and NMFS Northeast Fisheries Science Center established a longitudinal baseline of marine species distribution and abundance in Navy training areas during periods when training is not occurring at the site. This baseline provides the foundation for a monitoring program designed to provide meaningful data on potential long term effects	

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RANGE COMPLEX	VACAPES	CHERRY POINT	JACKSONVILLE	GOMEX
		This baseline provides the foundation for a monitoring program designed to provide meaningful data on potential long term effects to marine species that may be chronically exposed to training activities.	to marine species that may be chronically exposed to training activities.	

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RANGE COMPLEX	**MIRC**	**NWTRC**	**GOA**
General Description	The MIRC study area encompasses a 501,873-square-nautical mile (nm²) area around the islands, including Guam, Tinian, Saipan, Rota, Farallon de Medinilla, and also includes ocean areas in both the Pacific Ocean and the Philippine Sea. The Mariana Islands Range Complex (MIRC) Study Area is bounded by a pentagon with the following five corners: 16°46'29.3376" N. lat., 138°00'59.835" E. long.; 20°02'24.8094" N. lat., 140°10'13.8642" E. long.; 20°3'27.5538" N. lat., 149°17'41.0388" E. long.; 7°0'30.0702" N. lat., 149°16'14.8542" E. long; and 6°59'24.633" N. lat, 138°1'29.7228" E. long.	The maritime component of the Northwest Training Range Complex includes 122,440 square nautical miles (nm2) of surface/ subsurface ocean operating areas (OPAREAs) that extend west to 250 nautical miles (nm) beyond the coast of Washington, Oregon, and Northern California. For range management and scheduling purposes, the NWTRC is divided into numerous sub-component ranges or training areas used to conduct training and Research, Development, Test, and Evaluation (RDT&E) activities (Unmanned Aerial Systems [UASs] only). The NWTRC Inshore Area includes all air, land, sea, and undersea ranges and OPAREAs inland of the coastline and including Puget Sound.	Gulf of Alaska (GOA) Temporary Maritime Activities Area (TMAA) is composed of 42,146 square nautical miles (nm2) of surface and subsurface ocean training area. TMAA is approximately 300 nautical miles (nm) in length by 150 nm in width and situated south of Prince William Sound and east of Kodiak Island. The TMAA's northern boundary is located approximately 24 nm south of the shoreline of the Kenai Peninsula, which is the largest proximate landmass. The only other shoreline close to the TMAA is Montague Island, which is located 12 nm north of the TMAA. The approximate middle of the TMAA is located 140 nm offshore.
Occurrence of marine mammals	32 potential marine mammal species or separate stocks with possible or confirmed occurrence in the marine waters associated with the MIRC Range Complex: 29 cetaceans (whales, dolphins, and porpoises), 2 pinnipeds (seals), and 1 sirenia (dugong). While survey data is limited, an overview of watchstander data collected during major exercises in Hawaii and MIRC broadly suggests the number of animals encountered in the vicinity of an exercise in MIRC is not much different than the numbers encountered in Hawaii.	32 species of marine mammals known to occur in the NWTRC Study Area: 7 species of baleen whales (mysticetes), 19 species of toothed whales (odontocetes), 5 species of seals and sea lions (pinnipeds), and the sea otter (mustelid).	26 species of marine mammals with possible or confirmed occurrence in the waters of the GOA, but not all inhabit waters within the TMAA. The TMAA is well outside the normal range of six of these species and they are not expected to be present given their documented habitat preferences. The 20 species that occur in the TMAA include 7 species of baleen whales (mysticetes), 8 species of toothed whales /dolphins/porpoises (odontocetes), and 5 species of seals and sea lions (pinnipeds). [DEIS, 2009].
Seasonal migration patterns	Some baleen whale species, such as the humpback whale, make extensive annual migrations in the northern hemisphere to low-latitude mating and calving grounds in the winter and to high-latitude feeding grounds in the summer.	The gray whale (Eschrichtius robustus) transits through the Study Area during annual migrations between northern feeding grounds and breeding lagoons in Mexico. While gray whales can be found along the Washington coast year-round, they are more common during January and March when they are migrating along the coast.	For many species, the TMAA constitutes a small portion of their total range given seasonal migrations to warmer waters where breeding and calving occur. These species, for example, include the humpback whale (Megaptera noveangliae) and gray whale (Eschrichtius robustus), which both feed in Alaska waters in roughly the May to September timeframe.

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RANGE COMPLEX	**MIRC**	**NWTRC**	**GOA**
Physical Geography / Bathymetry	The seafloor of the MIRC is characterized by the Mariana Trench, the Mariana Basin, the Mariana Ridge, ridges, numerous seamounts, hydrothermal vents, and volcanic activity. These areas are comprised of very deep water (2,000 meters or more) with a very rapid transition from the shelf to deep water. It is located at the intersection of the Philippine and Pacific crustal plates. The collision of the two plates has resulted in the subduction of the Pacific Plate beneath the Philippine Plate forming the Mariana Trench. The Mariana Trench is over 1,410 mi (2,269 km) long and 71 mi (114 km) wide. The deepest point in the trench and on Earth, Challenger Deep, is found 338 mi (544 km) southwest of Guam in the southwestern extremity of the trench. The Mariana Islands are volcanic islands developed west of the Mariana Trench, an active subduction zone where one section of the ocean crust is pushed beneath another.	In general, the bathymetry of the offshore regions of the Pacific Northwest coast is smooth due to the long history of sediment accumulation. Northern California is characterized by the scarcity of submarine canyons and the absence of other conspicuous relief features. The continental shelf off of the Washington coast varies in width from 25 to 60 km and is broken by six canyons ; the canyons represent 5 to 20 km wide breaks in the otherwise smooth bathymetry along the coast.	The TMAA spans both coastal and deepwater habitats ranging from approximately 426 feet (ft) to over 12,000 ft in depth. The GOA forms a large, semicircular bight opening southward into the North Pacific Ocean. The GOA is characterized by a broad and deep continental shelf containing numerous troughs, seamounts, and ridges.
Weather patterns	The MIRC is regularly struck by typhoons. Based on records compiled by the U.S. Navy Joint Typhoon Warning Center, islands within the MIRC Study Area were affected by typhoons in 37 of the 50-year period between 1955 and 2005 (National Marine Forecast Center, 2005).	The Pacific Northwest region has a mild and varied climate with only rare occurrences of severe weather such as thunderstorms or tornadoes. The normal movement of air masses is from west to east, so most of the systems moving across the region have been moderated by traveling over the Pacific Ocean. As a result, winter minimum temperatures and summer maximum temperatures in the region are greatly moderated. The Pacific Ocean also provides unlimited moisture to air masses traveling across the Pacific, so there is abundant rainfall in western Washington, Oregon, and northwestern California.	The GOA has a typical maritime climate, being somewhat warmer than adjacent land areas in winter and somewhat cooler than these land areas in summer. The region exhibits highly variable environmental conditions. The GOA is exposed to storms off the North Pacific Ocean. Consequently, it frequently experiences high winds and precipitation. Winds in the central GOA are primarily from the east or northeast, due to the interaction of the Pacific High with the GOA Low. Wind speeds often exceed 50 miles (mi) per hour except during the summer, when winds are relatively calm. Along the coast, this general circulation pattern may be altered locally by downslope surface winds following major river valleys that empty into the GOA, or by winds blowing through gaps in the ranges of mountains that border the GOA. The GOA remains ice-free for the entire year. Portions of bays and inlets may be covered by ice or may have floating glacial ice during the coldest months.

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RANGE COMPLEX	**MIRC**	**NWTRC**	**GOA**
Major Currents	North Equatorial Current	The coasts of Washington and Oregon are located in an eastern boundary current system where the North Pacific Current divides into the northward flowing Alaskan Current and the southward flowing California Current. Seasonal mean shelf currents in the upper water column along the Pacific coastline are southward from early spring to summer, and northward the remainder of the year.	The general ocean circulation in the Gulf of Alaska is dominated by the cyclonic Alaska Gyre. The gyre includes the Alaska Current and Alaskan Stream and the eastward-flowing North Pacific Current along the southern expanses of the Gulf of Alaska. Nearshore flow is dominated by the westward-flowing Alaskan Coastal Current and is less organized than the flow found along the shelf break and slope.
National Marine Sanctuaries	Marianas Trench Marine National Monument (MTMNM)	Olympic Outer Coast NMS is located within the northern boundaries of the Pacific Northwest OPAREA along the Pacific coast of Washington.	There are no NMSs located within the boundaries of the GOA TMAA.
Level of Fleet Activities	One multi-strike group type exercise in the summer each calendar year. Valiant Shield and nearshore explosive events are appropriate for marine mammal monitoring within the MIRC, with the understanding that major exercise undergo significant schedule changes based on real-world commitments which may or may not therefore limit the availability of monitoring within these major exercises. In the MIRC study area, the Navy intends to conduct 3 exercises during a 5-year period that may include both SURTASS LFA and MFA active sonar sources. The expected duration of this exercise, commonly referred to as a "combined exercise", is approximately 14 days. Based on an exercise of this length, an LFA system would be active (i.e., actually transmitting) for no more than approximately 25 hours.	The NWTRC Study Area is unique in that it offers training across the spectrum of naval missions in all weather conditions (including cold water operations) and over many varied environments from deep ocean to shallow inland waters and from coastal beaches to mountains in close proximity to the homeport of units in the Pacific Northwest.	Limited. The Proposed Action consists of Navy training activities that occur during the period between April and October in one or two major exercises or focused activity periods. These exercises or activity periods would each last up to 21 days and consist of multiple component training activities. During these focused activity periods, intermittent Navy Unit Level Training (ULT) could also occur. However, outside of these focused activity periods, during the other 46-49 weeks of the year, the Navy does not train within the TMAA or other areas of the GOA. [DEIS 12/2009]

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RANGE COMPLEX	**MIRC**	**NWTRC**	**GOA**
Other Shipping	The proposed MIRC ASW areas are away from harbors but may include heavily traveled shipping lanes, although shipping lanes are a small portion of the overall range complex.	Commercial vessels enter and cross the Pacific Northwest OPAREA and Puget Sound Study Area on a routine basis. Along the western U.S. coast, commercial shipping routes are highly structured and controlled, even in open ocean areas. No major port cities are located along the outer coasts of northern California or Washington State; however, the Port of Portland is situated in northern Oregon and serves as a terminal for marine transportation along the western U.S. coast. Puget Sound represents the nation's third largest naval port complex and includes three major port cities in the regions' shared waters: Seattle, Vancouver, and Tacoma.	Two primary shipping lanes radiate from the Gulf of Alaska to Honolulu, Hawaii and San Francisco, California. The Alaska Marine Highway System operates a ferry network throughout Alaska and consists of nearly 14,500 km of coastal ocean routes. Important ports in the area include Kodiak, Alaska's largest commercial fishing port, and Valdez, the southern terminus of the 1,300-km trans-Alaska pipeline that originates in Prudhoe Bay.
Unique range assets	The MIRC is of particular significance for the training of U.S. military forces in the Western Pacific because of its location. As the westernmost complex in U.S. territory, it provides the only opportunity for forward-deployed U.S. forces to train on U.S.-owned lands without having to return to Hawaii or the continental United States. The premier capability of the MIRC is the combination of large ocean and airspace to support undersea, surface, air, and space warfare training combined with land-based ranges. Training may be conducted within a few miles of land masses so that battle situations may be realistically simulated. There is room and space to operate within proximity of land but at safe distances from other simultaneous training activities.	The NWTRC serves as the principle "backyard" training range for those units homeported in the Pacific Northwest area, including those aviation, surface ship, submarine, and Explosive Ordnance Disposal (EOD) units homeported at Naval Air Station (NAS) Whidbey Island, Naval Station (NAVSTA) Everett, Puget Sound Naval Shipyard, and Naval Base Kitsap (NBK) Bremerton, NBK-Bangor, formerly known as Submarine Base (SUBASE) Bangor. Additionally, the NWTRC supports other non-resident users and their training requirements to include Naval Special Warfare (NSW) units. Inshore ranges for underwater demolition training found at Crescent Harbor Underwater EOD Range, Indian Island Underwater EOD Range, and Floral Point Underwater EOD Range.	

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RANGE COMPLEX	**NUWC Keyport Division**	**NSWC Panama City Division**
General Description	The NAVSEA NUWC Keyport Range Complex is composed of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site,and Quinault Underwater Tracking Range (QUTR) Site. Portions of the QUTR Site fall outside the 12-nautical mile (22-kilometer) Territorial Waters boundary established by Presidential Proclamation 5928. The combined waters of the Range Complex are less than 100 nm^2.	The NSWC PCD study area includes existing military operating areas within the Gulf of Mexico [W-151 (Pensacola OPAREA), W155 (Panama City OPAREA), and W-470] and St. Andrew's Bay (SAB) from the mean high water line (average high tide mark) out to 120 nautical miles [NM] offshore.
Occurrence of marine mammals	25 species of marine mammals are known to occur in Washington waters including 19 cetacean species, 5 pinniped species, and the sea otter (mustelid); however, several are seen only rarely. Seven marine mammal species listed as Federally-endangered under the Endangered Species Act (ESA) occur or have the potential to occur in the area.	29 marine mammal species may occur in the NSWC PCD Study Area (28 cetaceans and one sirenian species [manatees]). 21 of these marine mammal species regularly occur here. The other 8 are extralimital. Of those marine mammals potentially occurring in St. Andrew Bay and the NSWC PCD Study Area, seven marine mammal species are currently listed as endangered under the Endangered Species Act.
Seasonal migration patterns	The gray whale (Eschrichtius robustus) transits through the vicinity of NUWC Keyport during annual migrations between northern feeding grounds and breeding lagoons in Mexico. While gray whales can be found along the Washington coast year-round, they are more common during January and March when they are migrating along the coast.	Some baleen whale species, such as humpback and North Atlantic right whales, make extensive annual migrations to low-latitude mating and calving grounds in the winter and to high-latitude feeding grounds in the summer. However, given the relatively shallow waters of the NSWC PCD study area, of the mysticetes, only the Bryde's Whale might be expected to regularly occur. Long migrations are not typical of Bryde's whales.
Physical Geography / Bathymetry		Wide coastal shelf 52 NM distance offshore to 183 meters (m) (600 feet [ft]) water depth, including bays and harbors. Typically sand bottom.
Weather patterns		Subtropical. In general, summer weather conditions in the NSWC PCD study area are relatively consistent and stable with winds predominantly out of the southeast while winter weather conditions are more variable with winds predominantly from the east or northeast. No distinct seasonal variation in precipitation is evident in the northern Gulf. Seas less than 0.91 m (3 ft) 80 percent of the time (summer) and less than 0.91 m (3 ft) 50 percent of the time (winter).
Major Currents	For the QUTR site, the waters along the Washington coast are dominated by the southward flowing California Current and are considered to have the greatest volume of upwelling in North America.	Warm (>26°C) Caribbean Sea surface waters form the Yucatan Current, which flows into the GOMEX through the Yucatan Channel. The Gulf Stream Loop Current is the dominant surface current in the central and eastern GOMEX. The Florida Current is a strong, east-northeast flowing current that connects the Loop Current to the Gulf Stream at the entrance to the Florida Straits. Deep water circulation in the GOMEX is not nearly as well understood as surface water circulation.
National Marine Sanctuaries	QUTR Site is in the Olympic Coast National Marine Sanctuary (OCNMS).	None in the Study Area.

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RANGE COMPLEX	**NUWC Keyport Division**	**NSWC Panama City Division**
Level of Fleet Activities	NUWC Keyport schedules the Keyport Range Site to be used an average of 55 days/year, the DBRC Site an average of 200 days/year, and the QUTR Site an average of 14 days/year of offshore use and minimally for surf-zone activities.	NSWC PCD provides in-water RDT&E for expeditionary maneuver warfare, operations in extreme environments, mine warfare, maritime special operations, and coastal operations. 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
Other Shipping	Commercial vessels enter and cross the Pacific Northwest OPAREA and Puget Sound Study Area on a routine basis. Puget Sound represents the nation's third largest naval port complex and includes three major port cities in the regions' shared waters: Seattle, Vancouver, and Tacoma. However, regular commercial shipping activiity through the QUTR Site is not as busy as it is farther north into the Strait of San Juan de Fuca.	Seven of Florida's deepwater ports are located on the GOM, three of which are within the NSWC PCD Study Area: Port of Pensacola, Port of Panama City, and Port St. Joe. Port St. Joe in Gulf County is currently inactive. Approximately 45 percent of U.S. shipping tonnage passes through GOM ports.
Unique range assets	Located adjacent to NUWC Keyport, the Keyport Range site provides approximately 1.5 square nautical miles (nm2) (5.1 square kilometers [km2]) of shallow underwater testing, including in-shore shallow water sites and a shallow lagoon to support integrated undersea warfare systems and vehicle maintenance and engineering activities.	Specialized surface craft to support the deployment and recovery of underwater unmanned vehicles (UUVs), sonobuoys, inert mines, mine-like objects (MLOs), Versatile Exercise Mine (VEM) systems, and other test systems. Specialized surface vessels are also utilized as a tow platform for systems that are designed to be deployed by helicopters.

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Appendix B – NSWC PCD Monitoring Plan

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FINAL MONITORING PLAN

NAVAL SURFACE WARFARE CENTER PANAMA CITY DIVISION (NSWC PCD)

For Marine Mammal Protection Act (MMPA) Authorization

JANUARY 2009

List of Acronyms and Abbreviations

LIST OF ACRONYMS AND ABBREVIATIONS

AFAST	Atlantic Fleet Active Sonar Training
ATOC	Acoustic Thermometry of Ocean Climate
BO	Biological Opinion
CNO-N45	Chief of Naval Operations Environmental Readiness Division
ESA	Endangered Species Act
FY	Fiscal year
HRC	Hawaii Range Complex
ICMP	Integrated Comprehensive Monitoring Plan
ITA	Incidental Take Authorization
LOA	Letter of Authorization
MCM	Mine countermeasures
MFAS	Mid-frequency active sonar
MMO	Marine Mammal Observer
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NSWC PCD	Naval Surface Warfare Center Panama City Division
R&D	Research and development
RDT&E	Research, development, test, and evaluation
SOCAL	Southern California
SURTASS	Surveillance Towed Array Sensor System
VACAPES	Virginia Capes

Naval Surface Warfare Center Panama City Division (NSWC PCD) Monitoring Plan

INTRODUCTION

This monitoring plan for the Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area has been developed to provide marine mammal and sea turtle monitoring as required under the Marine Mammal Protection Act (MMPA) of 1972 and the Endangered Species Act (ESA).

In order to issue an Incidental Take Authorization (ITA) for an activity, Section 101(a)(5)(a) of the MMPA states that National Marine Fisheries Service (NMFS) must set forth "requirements pertaining to the monitoring and reporting of such taking." The MMPA implementing regulations at 50 CFR Section 216.104(a)(13) note that a request for a Letter of Authorization (LOA) must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present (NMFS, 2005).

While the Endangered Species Act (ESA) does not have specific monitoring requirements, recent Biological Opinions (BOs) issued by the NMFS have included terms and conditions requiring the Navy to develop a monitoring program.

In addition to the NSWC PCD Monitoring Plan, a number of Navy range complex monitoring plans are being developed for protected marine species, primarily marine mammals and sea turtles, as part of the environmental planning and regulatory compliance process associated with a variety of activities. The goals of these monitoring plans are to assess the impacts of testing activities on marine species and the effectiveness of the Navy's current mitigation practices.

Navy-wide Integrated Comprehensive Monitoring Program (ICMP):

The Integrated Comprehensive Monitoring Program (ICMP) is Navy-wide and will provide the overarching structure and coordination that compiles data from range-specific monitoring plans. The NSWC PCD Plan is one component of the ICMP and many similar studies outlined here will also be implemented in other range complexes (Figure 1). The overall objective of the ICMP is to assimilate relevant data collected across Navy range complexes and action areas to answer questions pertaining to the impact of mid-frequency active sonar (MFAS) and explosives on marine mammals and sea turtles.

The primary objectives of the ICMP are to:

- Coordinate monitoring of Navy events, particularly those involving MFAS and underwater detonations (explosives), for compliance with the terms and conditions of ESA Section 7 consultations or MMPA authorizations;
- Coordinate data collection to support estimating the number of individual marine mammals and sea turtles exposed to sound levels above current regulatory thresholds;
- Assess the adequacy of the Navy's current marine species mitigation;
- Add to the knowledge base on potential behavioral and physiological effects to marine species from MFAS and underwater detonations; and

- Assess the practicality and effectiveness of a number of mitigation tools and techniques (some not yet in use).

Additional Navy funded research and development (R&D) studies and ancillary research collaborations with academia and other institutions will be integrated as available to enhance the data pool, and will be used in part to address objectives of the ICMP. Lastly, as an adaptive management strategy, the NSWC PCD Monitoring Plan will integrate elements from Navy-wide marine mammal research into the regional monitoring and data analysis proposed in this plan when new technologies and techniques become available.

NSWC PCD Monitoring Plan:

The NSWC PCD Monitoring Plan is one component of the overall effort the Navy is undertaking to understand its potential effects and the associated biological consequences to protected marine species. The NSWC PCD Monitoring Plan has been designed as a collection of focused "studies" to gather data that will allow NSWC PCD to address the following questions which are described fully in the following sections:

1. What are the behavioral responses of marine mammals and sea turtles that are exposed to mid-frequency active/high frequency active (MFA/HFA) sonar and explosives at specific levels?
2. Is the Navy's suite of mitigation measures for MFA/HFA sonar and explosives effective at avoiding TTS, injury, and mortality of marine mammals and sea turtles?

Marine Species Within the NSWC PCD Study Area:

There are 20 marine mammal species or separate stocks with possible or confirmed occurrence in the NSWC PCD Study Area including whales, dolphins, and one manatee species (DON, 2007). The sperm whale is also protected under the ESA. Additionally, four species of threatened and endangered sea turtles exist in the NSWC PCD Study Area.

This monitoring plan has been designed to gather data on all species of marine mammals and sea turtles that are observed in the NSWC PCD Study Area. The plan recognizes that deep-diving and cryptic species of marine mammals such as beaked whales, sperm whales and minke whales, have low probabilities of visual detection (Barlow and Gisiner, 2006). Therefore, many methods will be utilized to attempt to address this issue (e.g., passive acoustic monitoring).

Data will be collected by Navy personnel, government contractors, academic institutions, or research organizations that will utilize qualified, professional marine mammal and sea turtle biologists. While annual reports will be prepared and provided to the NMFS in fulfillment of the MMPA LOA requirements, data collection, synthesis, and interpretation is expected to be an on-going process over many years. It is not likely that firm conclusions can be drawn on most questions within a single year of monitoring effort due to the difficulty in achieving sufficient sample sizes for statistical analysis. The Navy will provide annual reports to the NMFS in fulfillment of the MMPA LOA requirements. The annual report will provide information on the amount and spatial/temporal distribution of monitoring effort as well as summaries of data collected and any preliminary results that may be available from analysis.

MONITORING PLAN

The monitoring methods proposed for use during NSWC PCD research, development, test, and evaluation (RDT&E) activities include a combination of individual elements designed to allow a comprehensive assessment to be conducted. These elements include:

- Visual (vessel, and aerial surveys)
- Passive acoustic monitoring
- Marine mammal observers on Navy platforms

Sonar operations associated with NSWC PCD RDT&E activities are in the mid- (1kHz to 10kHz) and high (above 10kHz) frequency ranges. Over 90 percent of all NSWC PCD RDT&E sonar activities encompass high frequency active (HFA) sonar systems while less then 10 percent encompass mid-frequency active (MFA) sonar systems. The various sonar systems tested within the NSWC PCD Study Area range in frequencies of 1 kHz to 5,000 kHz. The types of explosive events that occur within the NSWC PCD Study Area include: underwater detonations associated with mine countermeasures (MCM) systems, line charges, and projectile firing operations.

The proposed effort for conducting the NSWC PCD monitoring is shown in Table 1. While the effort presented in Table 1 represents the most realistic prediction of the amount of monitoring that can be accomplished per year, there may be instances within any given year where test event schedules shift, survey crew availability becomes limited, or extreme weather precludes effective sampling. In case of monitoring delay based on these conditions, monitoring effort will be re-scheduled at the next available opportunity. In the event that a particular target activity is not available within the remainder of a particular year, monitoring may have to be made up in a following year.

Data collection and reporting will begin in FY10, once the NSWC PCD LOA is issued and the monitoring plan is finalized (See Table 1 for year by year implementation schedule). Data will also be collected from Navy range complex monitoring plans (i.e. Southern California [SOCAL] and Hawaii Range Complex [HRC]) and compiled in order to compare and analyze data from all the individual Navy monitoring efforts under the ICMP. All available data for the NSWC PCD Study Area will be included in the annual report to the NMFS including an evaluation of the effectiveness of any given element within the NSWC PCD monitoring program. All subsequent analysis shall be completed in time for Navy's five year report to NMFS.

The following subsections provide an overview for the studies to be performed through NSWC PCD monitoring.

STUDY 1

This study attempts to address the following question: What are the behavioral responses of marine mammals and sea turtles that are exposed to MFA/HFA sonar and explosives?

In order to address this question, there is a need to observe marine mammals and sea turtles not only at the surface, but to the extent possible in the water column. While shipboard surveys are preferable in many ways (slow speed, offshore survey ability and duration, close approaches), they do not allow for observation of animals that are below the ocean surface as do aerial surveys. Therefore, for this study, a combination of aerial surveys, vessel surveys, and passive acoustic monitoring may be used. For explosive events, current mitigation measures by Navy test event

participants include monitoring the exclusion zone (size depends on the type and size of the explosives being used) prior to detonation and post detonation.

Methods

Visual Surveys:

In order to conduct visual surveys, the following requirements must be met: 1) the ability to conduct aerial or shipboard surveys in the vicinity of the detonation point; and 2) testing events that occur close enough to shore that re-fueling does not become an issue with the aerial survey team.

Given that there may be significant annual variability in which test events occur more frequently within the NSWC PCD Study Area, the Navy proposes to visually survey two HFA/MFA sonar activities and two different types of explosive test events per year. If the AN/SQS-53 C sonar is to be operated, it would be monitored as one of the HFA/MFA sonar activities. If a multiple detonation event occurs, it would be monitored as one of the explosive events. Due to logistics and safety reasons this may not be possible; nevertheless, the Navy is committed to monitoring four test events per year.

For specified NSWC PCD RDT&E activities, aerial or vessel surveys will be used one to two days prior to, during (if safely possible), and one to five days post detonation. The variation in the number of days after a test activity allows for the detection of animals that gradually return to an area, if they indeed do change their distribution in response to underwater detonation events.

Surveys will include any specified exclusion zone around a particular detonation point plus 2,000 yards (1,829 meters) beyond the exclusion zone. For vessel-based surveys a passive acoustic system (hydrophone or towed array) could be used to determine if marine mammals are in the area before and/or after a detonation event. Depending on animals sighted, it may be possible to conduct visual surveys of animals outside of the exclusion zone (detonations could be delayed if marine mammals or sea turtles are observed within the exclusion zone) to record behavioral responses to the detonations.

When conducting a particular survey, the survey team will collect:

1) Species identification and group size
2) Location and relative distance from the detonation site
3) The behavior of marine mammals and sea turtles including standard environmental and oceanographic parameters
4) Date, time and environmental and oceanographic conditions associated with each observation
5) Direction of travel relative to the detonation site; and
6) Duration of the observation.

Animal sightings and relative distance from a particular detonation site will be used post-survey to determine potential received energy and pressure (dB re 1 micro Pa-sec and pounds per square inch). This data will be used, post-survey, to estimate the number of marine mammals and sea turtles exposed to different received levels (energy and pressure based on distance to the source, bathymetry, oceanographic conditions and the type and size of detonation) and their corresponding behavior.

Brief aerial- or vessel-based surveys of the detonation area, taking into account local oceanographic currents, will be conducted for stranded animals over a two day period post detonation event. If any distressed, injured or stranded animals are observed, an assessment of the animal's disposition (alive, injured, dead, or degree of decomposition) will be reported immediately to the NSWC PCD Environmental Office Point of Contact (POC) for appropriate action (notification to the NMFS Regional Stranding Coordinator).

All available data will be included in the Navy's annual report to NMFS. All subsequent analysis shall be completed in time for Navy's five year report to the NMFS.

Passive Acoustic Monitoring:

The Navy's goal is to use a hydrophone or towed array whenever shipboard surveys are being conducted. The towed array would be deployed during daylight hours for each of the days the ship is at sea for survey operations.

A hydrophone or array is towed from the boat and can detect and localize marine mammals that vocalize and would be used to supplement the ship-based systematic line-transect surveys (particularly for species such as beaked whales that are rarely seen). The ability of the hydrophone to detect marine mammals will depend on the speed of the boat, as well as the length and the frequency range of the hydrophone or towed array. The hydrophone or towed array would need to detect low frequency vocalizations (< 1,000 Hz) for baleen whales (McDonald and Fox, 1999; Mellinger and Clark, 2003) and relatively high frequency (up to 30 kHz) for odontocetes such as sperm whales (Watkins, 1980).

Marine Mammal Observers on Navy Platforms:

Marine mammal observers (MMOs) will be placed on a Navy platform during one of the test events being monitored per year. Qualifications must include expertise in species identification of regional marine mammal and sea turtle species and experience collecting behavioral data. Experience as a NMFS marine mammal observer is preferred, but not required. Navy biologists and contracted biologists will be used; contracted MMOs must have appropriate security clearance to board Navy platforms. MMOs will not be placed aboard Navy platforms for every Navy testing event, but during specifically identified opportunities deemed appropriate for data collection efforts. Additionally, the events selected for MMO participation will take into account safety, logistics, and operational concerns.

MMOs will observe from the same height above water as the RDT&E marine observers. Of note, these MMOs will not be part of the Navy's formal reporting chain of command during their data collection efforts; RDT&E marine observers will continue to serve as the primary reporting means within the Navy chain of command for marine mammal sightings. The only exception is that if an animal is observed by an MMO within the shutdown zone that has not been observed by the RDT&E marine observer, the MMO will inform the RDT&E marine observer of the sighting to take the appropriate action through the chain of command.

The MMOs will collect species identification, behavior, direction of travel relative to the Navy platform, and distance first observed. All MMO sighting will be conducted according to a standard operating procedure (SOP).

STUDY 2

This study attempts to address the following question: Is the Navy's suite of mitigation measures for MFA/HFA sonar and explosives effective at avoiding injury and mortality of marine mammals and sea turtles?

It is the Navy's position that the suite of mitigation measures for explosives are effective at avoiding exposures of marine mammals to levels of energy or pressure from explosives that would result in harm or mortality of marine mammals. Through several methods, this study will provide the scientific data needed to support that position. The Navy will conduct aerial surveys before and after two HFA/MFA sonar activities and two explosive test events per year to determine whether animals have been injured in the NSWC PCD Study Area, and conduct a comparison of professional MMOs and RDT&E marine observers.

Methods

RDT&E Marine Observer Comparison:

RDT&E marine observers are provided with extensive training to detect anything in the water 360 degrees around Navy platforms. This includes marine mammals and sea turtles. The Navy feels strongly that despite the fact that RDT&E marine observers are not biologists trained to identify specific marine animal species, they do have the skills to reasonably detect all marine mammals and sea turtles that are visible at the surface. In order to provide the scientific data to support this position, the Navy will initiate a side-by-side comparison of Navy RDT&E marine observer's ability to detect marine mammals at sea with sightings made by professional MMOs. It is assumed that the abilities of RDT&E marine observers and professional MMOs will vary; therefore, it is important that data be collected from many locations, in many environmental conditions, with many different RDT&E marine observers and MMOs. Therefore, as part of the overall Navy monitoring effort, some of the data will be collected within the NSWC PCD Study Area. The goal is to perform the RDT&E marine observer comparison during one test event per year.

MMO qualifications must include expertise in species identification of regional marine mammal and sea turtle species and experience collecting behavioral data. Experience as a NMFS marine mammal observer is preferred, but not required. Navy biologists and contracted biologists will be used; contracted MMOs must have appropriate security clearance to board Navy platforms. As noted above, MMOs will not be placed aboard Navy platforms for every NSWC PCD RDT&E activity, but during specifically identified opportunities deemed appropriate for data collection efforts. Additionally, the activities selected for MMO participation will take into account safety, logistics, and operational concerns associated with such an endeavor. MMOs will observe from the same height above water as the RDT&E marine observers. RDT&E marine observers will officially be on duty and will maintain the same responsibilities (no more, no less). MMOs will not be part of the Navy's formal reporting chain of command during their data collection efforts; RDT&E marine observers will continue to serve as the primary reporting means within the Navy chain of command for marine mammal sightings. The only exception would be if an animal is observed by the MMO within the shutdown zone that has not been observed by the RDT&E marine observer, the MMO will inform the RDT&E marine observer of the sighting to take the appropriate action through the chain of command.

To the extent practicable, the MMO and test marine observer will avoid cueing each other when they observe a marine mammal. The MMOs will collect species identification, behavior, direction of travel relative to the Navy platform, and distance first observed. All MMO sighting will be conducted according to a SOP to allow for consolidation of data from all range complex monitoring plans. If needed based on NSWC PCD RDT&E requirements, two MMOs and/or RDT&E marine observers will be aboard, and work on rotating two hour shifts to avoid fatigue.

The following comparisons will be made between MMOs and the RDT&E marine observers:

1. Rate of detection: Comparison of the number of animals sighted per hour (or other appropriate sighting period)

2. Distance of sighting: Comparison of the distance where the sighting was first made
3. Distance estimation: Consistency of sighting distance estimates
4. Animal size estimation: Comparison of animal size estimation (either by actual length or by grouping – small or dolphin size, medium and large)
5. Direction of travel relative to the ship or by compass bearing
6. Behavior categorization: Comparison of the categorized behaviors.

Aerial surveys:

An aerial survey team will conduct pre- and post-aerial surveys, taking local oceanographic currents into account, of the NSWC PCD Study Area. These aerial surveys will be the same as those conducted for other NSWC PCD monitoring studies. However, for this study in particular, survey data will include identification of any distressed, injured or stranded animals in the NSWC PCD Study Area. The Navy proposes to conduct this type of monitoring during two sonar activities and two explosive test events per year.

Species composition of marine animals will be reported. If any distressed, injured or stranded animals are observed, an assessment of the animal's disposition (alive, injured, dead, or degree of decomposition) will be reported immediately to the NSWC PCD Environmental Office POC for appropriate action (notification to the NMFS Regional Stranding Coordinator).

IMPLEMENTATION – ANALYSIS – REPORTING

For all field monitoring conducted in support of this plan, it will be the responsibility of any contracted researchers to obtain and maintain the appropriate permits.

Table 1 provides detail on how the NSWC PCD Monitoring Plan will be fully implemented from fiscal year 2010 to fiscal year 2014 (FY10 to FY14). The implementation of this monitoring plan will not officially commence until August 2009, after the issuance of the LOA. The NSWC PCD Monitoring Plan will be implemented gradually in the last few months of FY09, with full ramp up in 2010 as contracts are issued, SOPs are developed, and statisticians are consulted for input on sample size and analysis. Many of the study hours may overlap when implemented, allowing for data to be collected for more than one study simultaneously. Therefore, the hours in Table 1 represent those spent on each study, but are not necessarily an additive number of hours per method, per year. Collecting data concurrently for more than one study will only be initiated if the data integrity is not compromised.

The Navy will be investing significant funding and resources towards monitoring programs and intends to conduct the research in a scientifically valid and robust manner. The Navy is committed to conducting research until these questions have been addressed to the satisfaction of both the NMFS and the Navy. Therefore, it is in the best interest of the Navy to choose studies wisely in the NSWC PCD Study Area and Navy range complexes that are the most likely to collect large data sets, and will enable the Navy and the NMFS to answer the required questions. Some field methods may be applied throughout the NSWC PCD Study Area and Navy range complexes, while other methodologies may be specially selected for one or two areas within the NSWC PCD Study Area or Navy range complex that are most likely to produce the best quality data. For example, in Hawaii, there are some baseline data on odontocetes from previous tagging (Baird et al., 2006), which can be used to provide a context for any tagging data collected during test events.

Using the Acoustic Thermometry of Ocean Climate (ATOC) and Surveillance Towed Array Sensor System (SURTASS) Monitoring Programs as a guideline for success it is clear that the key to the success of the monitoring plan's execution and analysis is using scientific professionals that are the top of their field. It is the Navy's intention that monitoring be implemented by a team of qualified, professional marine mammal and sea turtle biologists who are experts in their field. This team of experts will include statistical analysts to analyze data and make recommendations as to when they are beginning to see a pattern in the data and/or when the study designs need to be altered for more robust data collection. This adaptive management process will provide a critical feedback loop to allow for adapting to new methods and evolving methodology. The process will be transparent to the public through annual reports to the NMFS under the MMPA permit as well as encouraging the scientific team to publish results as they become available.

New technology and techniques will be incorporated as part of the Navy's adaptive management strategy. Adaptive measures and feedback from the experts will allow flexibility within a given year and/or within years so as to best achieve monitoring plan goals and take into consideration shifting demands, inclement weather and other unforeseen events. For example, flexibility is incorporated to monitor an alternate but equal NSWC PCD RDT&E activity within the year and/or in a following year if test event schedule changes, is delayed or cancelled. This flexibility ensures monitoring will occur under optimal circumstances and conditions.

Implementation

Integrated Comprehensive Monitoring Program (ICMP):

The ICMP is currently in development by the Navy, with Chief of Naval Operations Environmental Readiness Division (CNO-N45) having the lead. The program does not duplicate the monitoring plans for individual areas (e.g. Atlantic Fleet Active Sonar Training [AFAST], HRC, SOCAL, Virginia Capes [VACAPES]); instead it is intended to provide the overarching coordination that will support compilation of data from NSWC PCD and range-specific monitoring plans as well as Navy funded research and development (R&D) studies. The ICMP will coordinate the monitoring programs' progress towards meeting its goals and develop a data management plan. A program review board is also being considered to provide additional guidance. The ICMP will be evaluated annually to provide a matrix for progress and goals for the following year, and will make recommendations on adaptive management for refinement and analysis of the monitoring methods.

Due to the complexity of the ICMP and large number of U.S. Navy range complexes and associated activities, the Navy is considering the dedication of a Program Manager to oversee the ICMP. Specific qualifications, roles and responsibilities are yet to be determined but may include the oversight and coordination of all Navy monitoring plans.

Reporting:

The Navy will provide monitoring reports to the NMFS Headquarters in fulfillment of the MMPA LOA requirements. The reports will provide information on the amount and spatial/temporal distribution of monitoring effort as well as summaries of data collected and any preliminary results that may be available from analysis. All subsequent analysis shall be completed in time for Navy's five year report to the NMFS.

Data collected from the NSWC PCD Monitoring Plan will be added to a Navy-wide analysis of monitoring from permitted Navy range complexes via the ICMP. All available data will be included in Navy's annual report and individual test event reports as detailed in the requirements specified in the NMFS MMPA LOA. All subsequent analysis shall be completed in time for Navy's five year report to the NMFS. The Navy's reports will provide information on the amount and spatial/temporal distribution of monitoring effort as well as summaries of data collected and any preliminary results that may be available from the analysis. All data will be considered pre-decisional during the course of the research studies to prevent premature conclusions from being drawn. While data will be prepared and analyzed over the course of the five years of the LOA, under no circumstances will conclusions be represented before the studies are completed. Final conclusions cannot be published nor information released outside of their organization without the written consent of the Secretary of the Navy or their designee.

Implementation

Table 1. Summary of studies planned each year within the NSWC PCD Study Area.

STUDY 1 (behavioral responses)						
	FY10	**FY11**	**FY12**	**FY13**	**FY14**	**FY15**
Aerial or Vessel surveys	Award monitoring contract, develop SOP, obtain permits	2 sonar activities and 2 explosive events per year	2 sonar activities and 2 explosive events per year	2 sonar activities and 2 explosive events per year	2 sonar activities and 2 explosive events per year	2 sonar activities and 2 explosive events per year
Marine Mammal Observers	Opportunistic as staff and SOP developed	1 explosive event per year	1 explosive event per year	1 explosive event per year	1 explosive event per year	1 explosive event per year
STUDY 2 (mitigation effectiveness)						
	FY10	**FY11**	**FY12**	**FY13**	**FY14**	**FY15**
Marine mammal observers/lookout comparison	Opportunistic as staff and SOP developed	1 explosive event per year	1 explosive event per year	1 explosive event per year	1 explosive event per year	1 explosive event per year
Vessel or Aerial surveys before and after training events	Award monitoring contract, develop SOP, obtain permits	2 sonar activities and 2 explosive events per year	2 sonar activities and 2 explosive events per year	2 sonar activities and 2 explosive events per year	2 sonar activities and 2 explosive events per year	2 sonar activities and 2 explosive events per year

Note: Study 1 and 2 will be conducted simultaneously when possible

References

REFERENCES

Barlow, J. and R. Gisiner, 2006. Mitigating, monitoring and assessing the effects of anthropogenic sound on beaked whales. Journal of Cetacean Research and Management. 7:239-249.

DON (Department of the Navy), 2007. Marine Resource Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Final Report. Contract # N62470-02-D-9997, CTO 0030. Prepared by Geo Marine, Inc., Hampton, VA.

McDonald, M. A., and C. G. Fox, 1999. Passive acoustic methods applied to fin whale population density estimation. Journal of the Acoustical Society of America. 105:2643-2651.

Mellinger, D. K., and C. W. Clark. 2003. Blue whale (*Balaenoptera musculus*) sounds from the North Atlantic. Journal of the Acoustical Society of America. 114:1108-1119.

NMFS (National Marine Fisheries Service), 2005. Office of Protected Resources. Marine Mammal Protection Act (MMPA) of 1972. Policy, guidance, and regulations documents. http://www.nmfs.noaa.gov/pr/pdfs/laws/mmpa_regs_216.pdf

Watkins, W. A., 1980. Acoustics and the behavior of sperm whales. In R.-G. Busnel and J.F. Fish (eds.), Animal sonar systems. Plenum, New York. 1135 pp.

Implementation

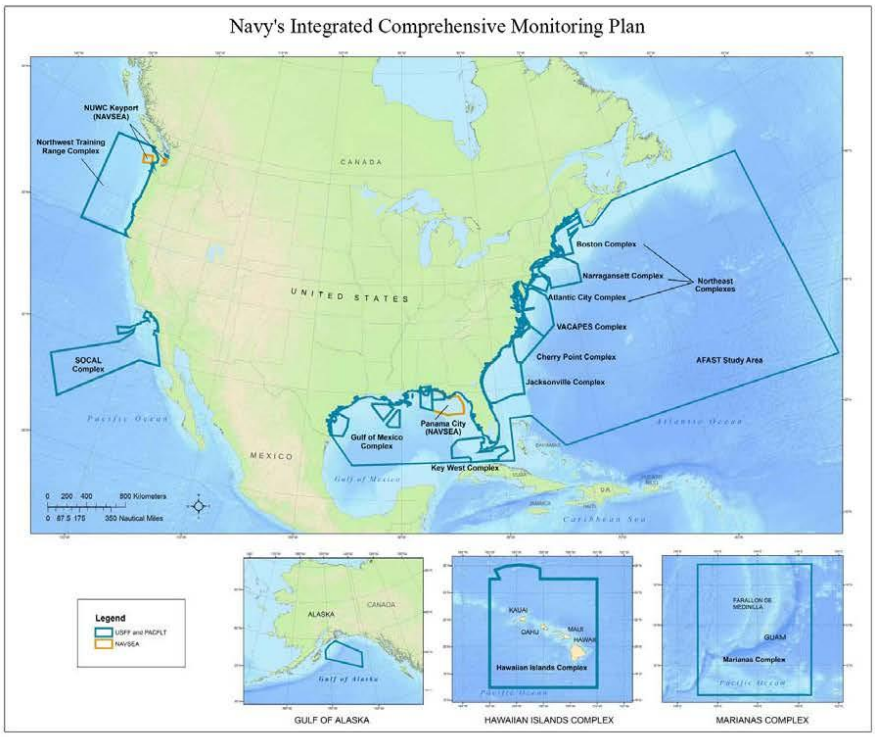

Figure 1. Range Complexes Included in the Integrated Comprehensive Monitoring Program

Appendix C – May 2012 Aerial Monitoring Survey Trip Report

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Naval Surface Warfare Center
Panama City Division (NSWC PCD)

Marine Species Monitoring

AERIAL MONITORING SURVEYS
TRIP REPORT

August 2012

ACRONYMS AND ABBREVIATIONS

DON	Department of the Navy
ft	feet
GOM	Gulf of Mexico
h	hour(s)
ICMP	Integrated Comprehensive Monitoring Program
km	kilometer(s)
km^2	square kilometer(s)
m	meter(s)
min	minute(s)
nmi	nautical mile(s)
nmi^2	square nautical mile(s)
NSWC PCD	Naval Surface Warfare Center Panama City Division
OPAREA	Operating Area
RDT&E	Research, Development, Test, and Evaluation
SPUE	Sightings Per Unit Effort
U.S.	United States

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Section 1 Introduction

Aerial surveys for marine-species monitoring occurred during 20 through 26 May 2012 for two research, development, test, and evaluation (RDT&E) events related to the AN/AQS-20 sonar system. These surveys were conducted off the west coast of Florida in the Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area in the Gulf of Mexico (GOM). The AN/AQS-20 is a high-frequency active sonar system used in mine detection during mine countermeasures operations.

As part of the requirements for compliance with the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, the United States (U.S.) Navy developed the Integrated Comprehensive Monitoring Program (ICMP; U.S. Navy 2010). The ICMP applies by regulation to those activities on U.S. Navy training ranges and operating areas (OPAREAs) for which the U.S. Navy has sought and received incidental take authorizations. To support the U.S. Navy in meeting regulatory requirements for monitoring established under the NSWC PCD Final Rule (NMFS 2010), and to provide a mechanism to assist with coordination of program objectives under the ICMP, monitoring of marine mammals and sea turtles (protected marine species) during these test events included visual surveys from a fixed-wing aircraft.

Section 2 Methods

Study Area

The NSWC PCD Study Area includes both territorial (waters that are between 0 and 22 kilometers [km] (0 and 12 nautical miles [nmi])) and non-territorial (waters that are beyond the 22 km [12 nmi] limit) waters. Monitoring conducted for protected marine species during the AN/AQS-20 sonar test events was focused within the Tango Field of the NSWC PCD Study Area (**Figure 1**). The test area for the AN/AQS-20 sonar system is approximately 22 km (12 nmi) offshore, covers an area approximately 21 square kilometers (km^2) (6 square nautical miles [nmi^2]) in size, and ranges in bottom depth from 28 to 35 meters (m) (92 to 115 feet [ft]).

Aerial-Based Monitoring

Aerial-based monitoring was performed over a 7-day period from 20 through 26 May 2012 (**Table 1**). Survey methods were generally consistent with currently accepted Distance Sampling theory (Buckland et al. 2001) and followed a well-established protocol used for aerial surveys throughout all U.S. Navy range complexes (e.g., Smultea et al. 2009). A survey altitude and speed of approximately 305 m (1,000 ft) and 185 km/hour (h) (100 knots) was maintained while on-effort, but might have varied slightly based on weather conditions in the area. Once a marine mammal sighting was made, a focal-follow circling session was attempted at 305 m (1,000 ft) or higher if conditions were appropriate (Smultea et al. 2009; refer to the survey methods on page 4 of this document). A lower altitude of approximately 210 to 250 m (700 to 800 ft) was established after focal-follow sessions for photographic purposes to provide sharper images required for species identification.

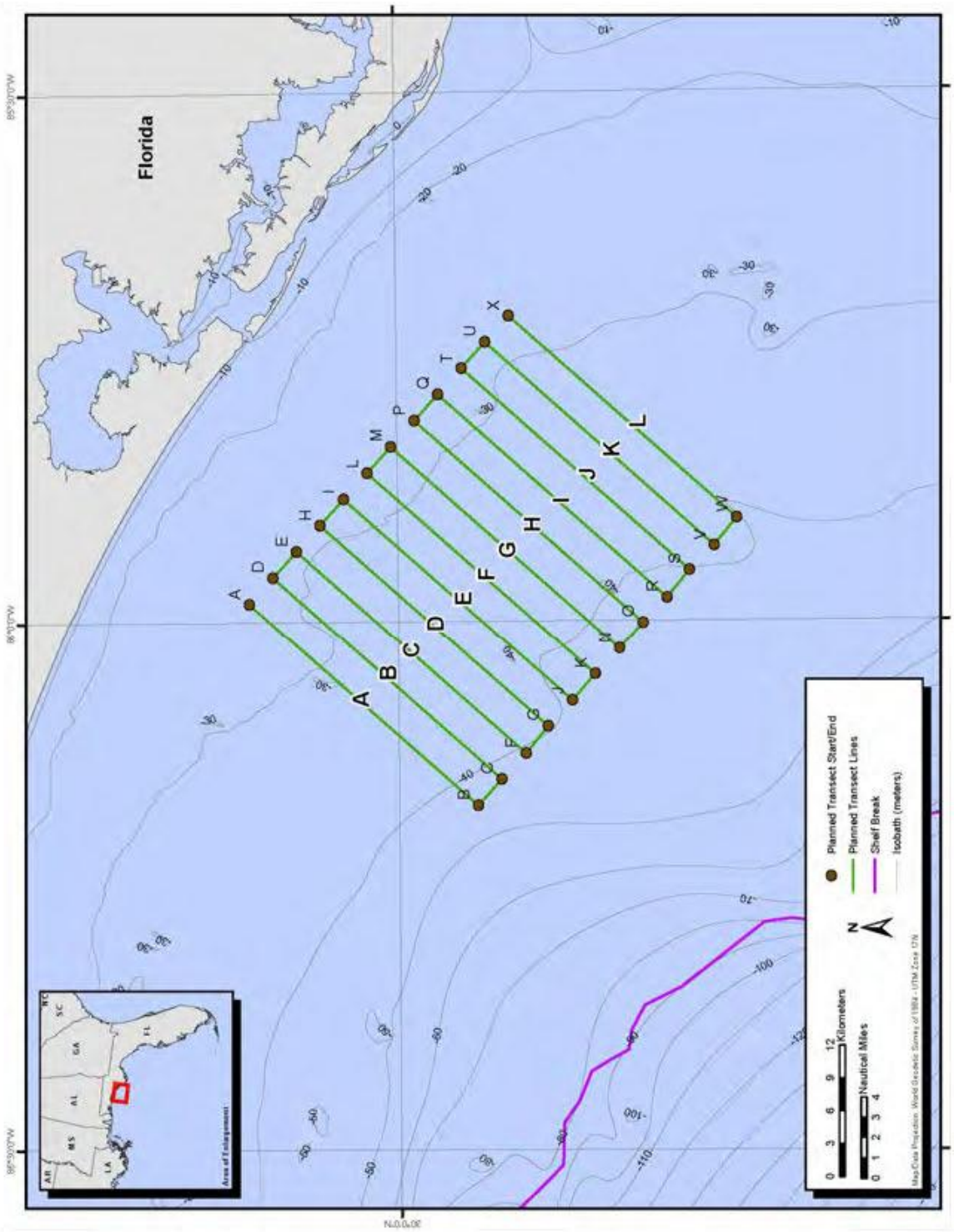

Figure 1. Pre-planned Track Lines for the Monitoring Effort for the AN/AQS-20 Sonar Test Events for 20-26 May 2012 in the NSWC PCD Study Area

Table 1. Summary of NSWC PCD Monitoring Effort

Date	Description	Start Time	Stop Time	Total Survey Minutes[1]	Total On-Effort Minutes	Trackline On-Effort Distance (km)	Trackline On-Effort Distance (nmi)
20 May	Transect Survey (Before First Event)	14:29	16:47	138	101	316.7	171.0
21 May	Transect Survey (Before First Event)	09:27	11:50	143	101	340.9	184.1
22 May	Transect Survey (During First Event)	11:16	13:52	156	101	324.1	175.0
23 May	Transect Survey (After[2] First-Event/Before Second Event)	09:02	11:39	157	101	342.8	185.1
24 May	Transect Survey (Before Second Event)	08:57	12:30	213	101	308.0	166.3
25 May	Transect Survey (During Second Event)	08:10	12:07	237	193	632.6	341.6
26 May	Transect Survey (After Second Event)	08:02	11:38	215	105	313.2	169.1
Total				**1,259 (≈21 h)**	**803 (≈13.4 h)**	**2,578.3 km**	**1,392.2 nmi**

Notes: [1]Total Survey Minutes reflect minutes expended in the range/area of interest and include both on-effort (systematic) and off-effort (cross-legs between transects, and circling for focal follows or species ID) total minutes. Total Survey Minutes may not match the difference between Start Time and Stop Time in the table due to differences in rounding. [2] Survey results in the following subsection are reported based on requirements outlined in NMFS (2010), as a monitoring event constitutes effort conducted 2 days before a test event, 1 day during a test event, and 1 day after a test event. There were 2 days with no test activity between the first and second test events; therefore, the same day that served as monitoring effort after the first event also served as the first day of monitoring before the second test event.

The observation platform was a Cessna T337H Turbo Skymaster aircraft operating out of Northwest Florida Beaches International Airport, Panama City Beach, Florida. Seven surveys were conducted following pre-planned transect lines covering the entire AN/AQS-20 sonar test area. The lines were defined by waypoints designed to extend beyond the entire range (if permitted by U.S. Navy and U.S. Air Force flight operations) during each survey day for a total flight-time window of about 4 h (**Table 1, Figure 1**). Aerial observers (**Table 2**) were experienced with line-transect survey methodology, had experience in identification of Atlantic marine mammal and sea turtle species, were knowledgeable of marine mammal biology and behavior, and had previous experience conducting marine mammal and sea turtle observations.

Table 2. Observers and Roles

Observer	Role(s)
Lenisa Blair	Observer
Jennifer Latusek-Nabholz	Chief Scientist/Observer

Survey effort was designed to include the entirety of the AN/AQS-20 test area. Twelve parallel tracklines running approximately northeast–southwest, measuring 27.8 km (15 nmi) in length, and spaced approximately 3.7 km (2 nmi) apart, were flown during "systematic" efforts throughout the surveys. The lines provided a total survey coverage area (hereinafter referred to as the survey area) of approximately 986 km^2 [287 nmi^2] (**Figure 1**). Planned lines were followed when possible, but exact lines followed for each survey day were subject to modifications as a result of range exclusion by unfavorable weather conditions in the Tango Field of the NSWC PCD Study Area (**Table 1, Figures 2 through 9**). Monitoring effort during the first AN/AQS-20 sonar system tests on 22 May was delayed for 1 h and 15 minutes (min) due to range exclusion from a U.S. Air Force mission involving use of a live missile.

The general survey approach was:

1. Team followed pre-planned transect lines and waypoints using methods described by Smultea et al. (2009) until a sighting occurred. Variables such as sea state, glare, and visibility were recorded for each transect flown and whenever conditions changed.
2. Upon sighting a marine mammal/sea turtle group, data recorder entered basic sighting information per established protocol (Smultea et al. 2009). As outlined in the NSWC PCD Study Area Monitoring Plan (DON 2010), information included: (1) species identification and group size; (2) location (relative to observation platform); (3) the behavior of marine mammal(s) (or turtle[s], when behavior was known); (4) date, time, and environmental and oceanographic conditions associated with each observation; (5) direction of travel relative to true North; and (6) duration of the observation.
3. If the species appeared suitable for a focal follow, the aircraft increased altitude to approximately 365 to 455 m (1,200 to 1,500 ft) and radial distance to approximately 0.5 to 1.0 km (0.3 to 0.5 nmi). Then, the aircraft circled the sighting to obtain detailed behavioral information as long as possible and logistically feasible (i.e., Beaufort sea state, visibility, group size, behavior, dive times, aircraft considerations [e.g., fuel], etc.). Focal follows occurred for a minimum of 5 min and included an observer taking digital photographs of the group when possible.
4. If the sighting was not selected for a focal follow, and species and group size were unknown, the aircraft circled the sighting to obtain digital photographs for confirmation of species identification and to estimate group size/composition.

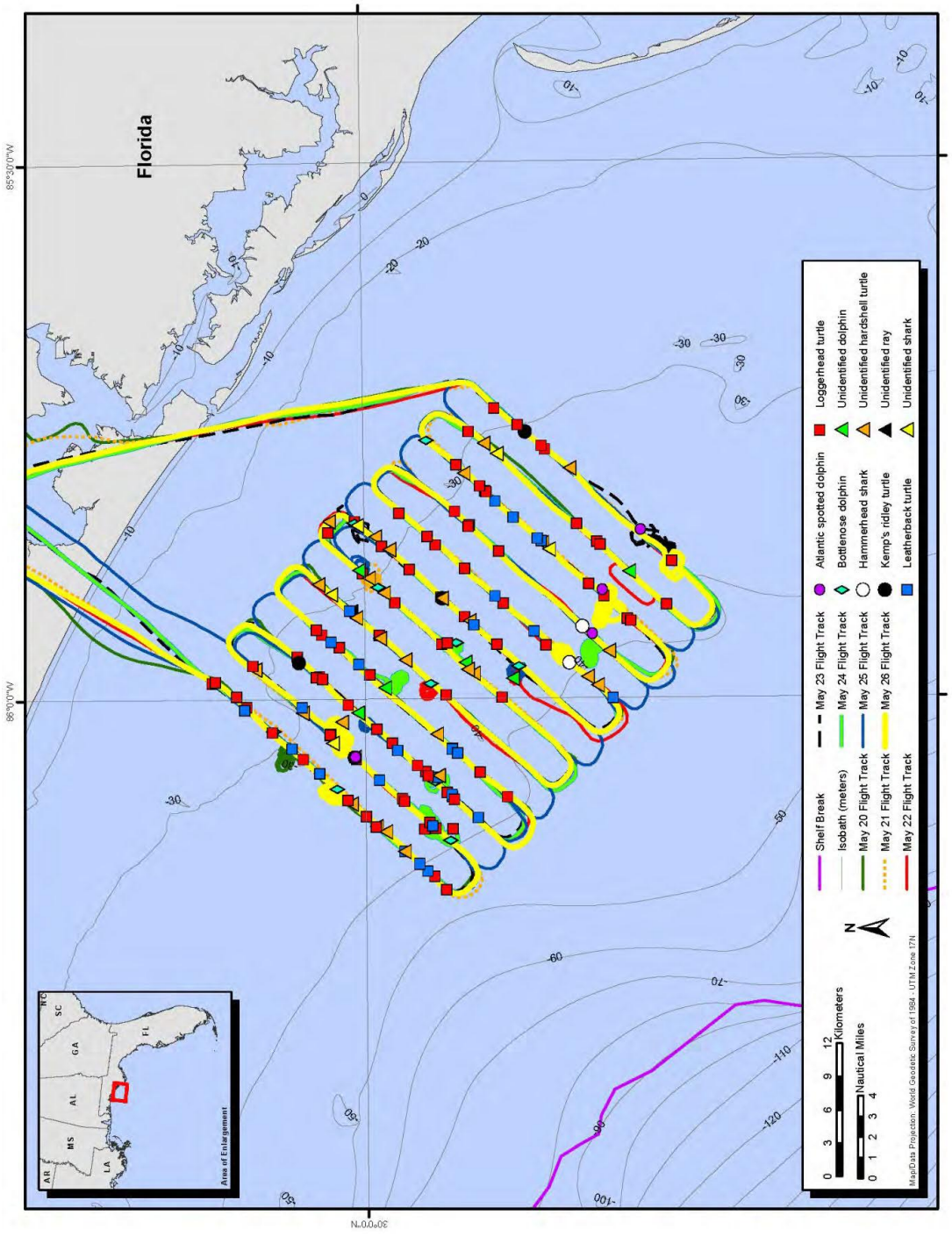

Figure 2. Location of All Cetacean and Sea Turtle Sightings Recorded Throughout the AN/AQS-20 Survey Period (20-26 May 2012)

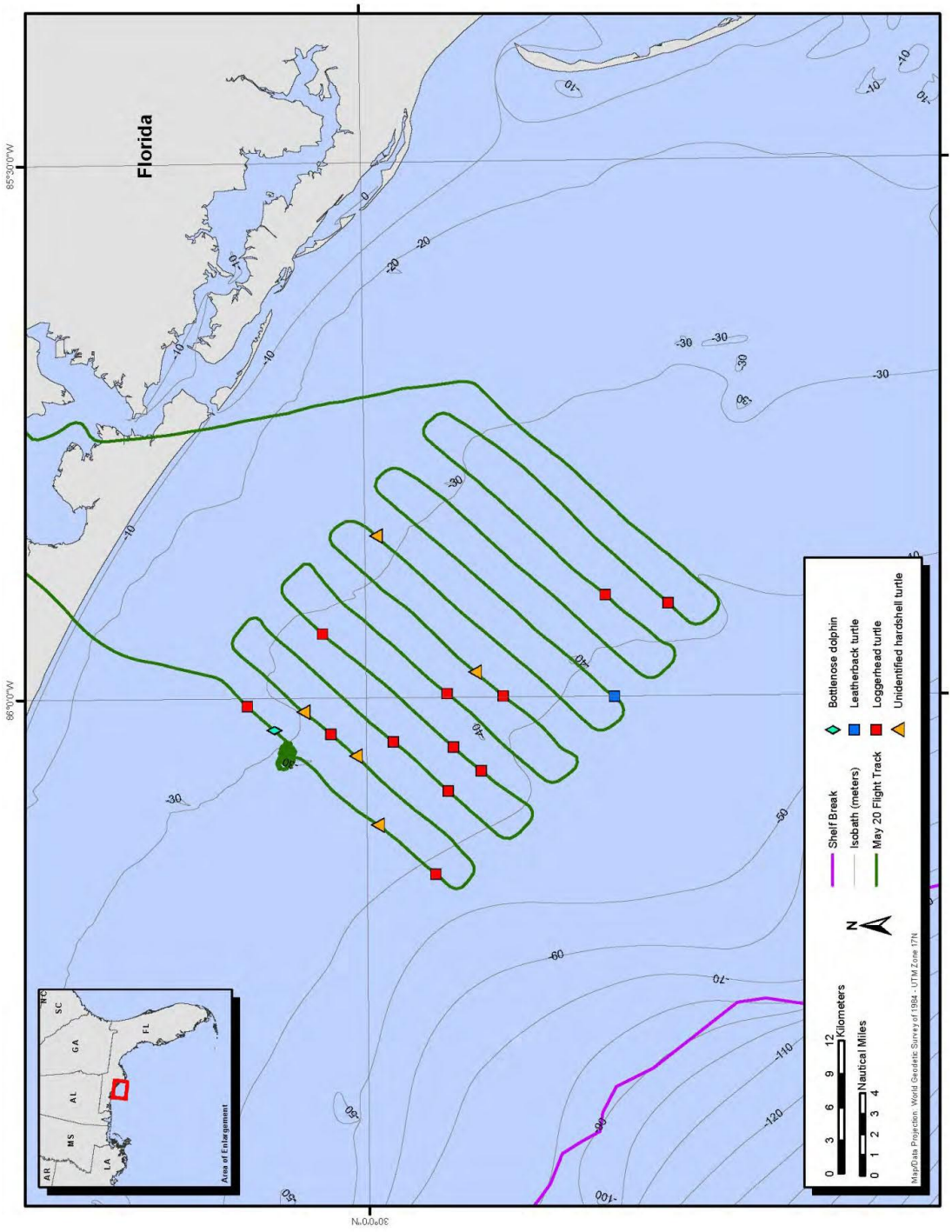

Figure 3. Survey Flight Track Conducted Before the AN/AQS-20 Sonar Test Event (20 May 2012)

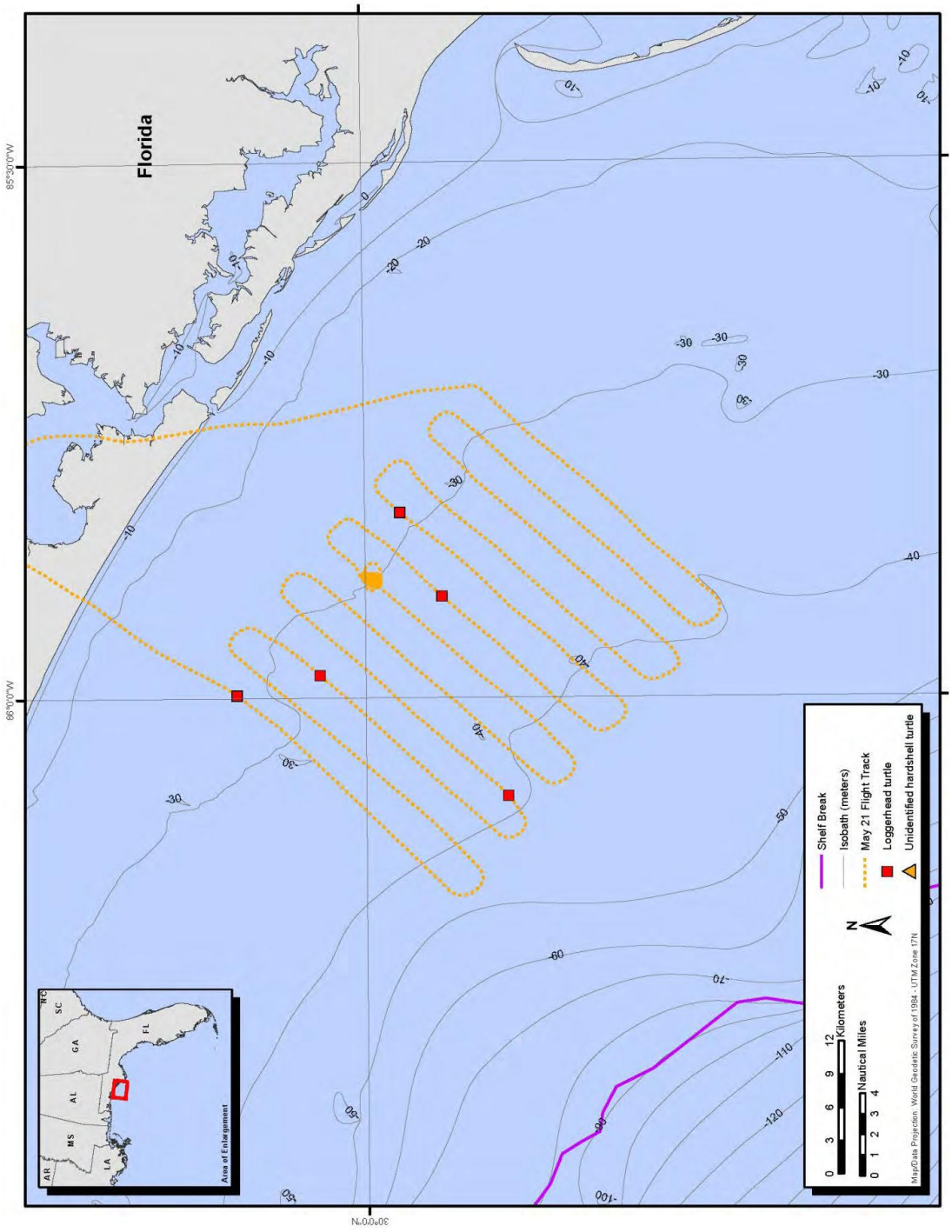

Figure 4. Survey Flight Track Conducted Before the AN/AQS-20 Sonar Test Events (21 May 2012)

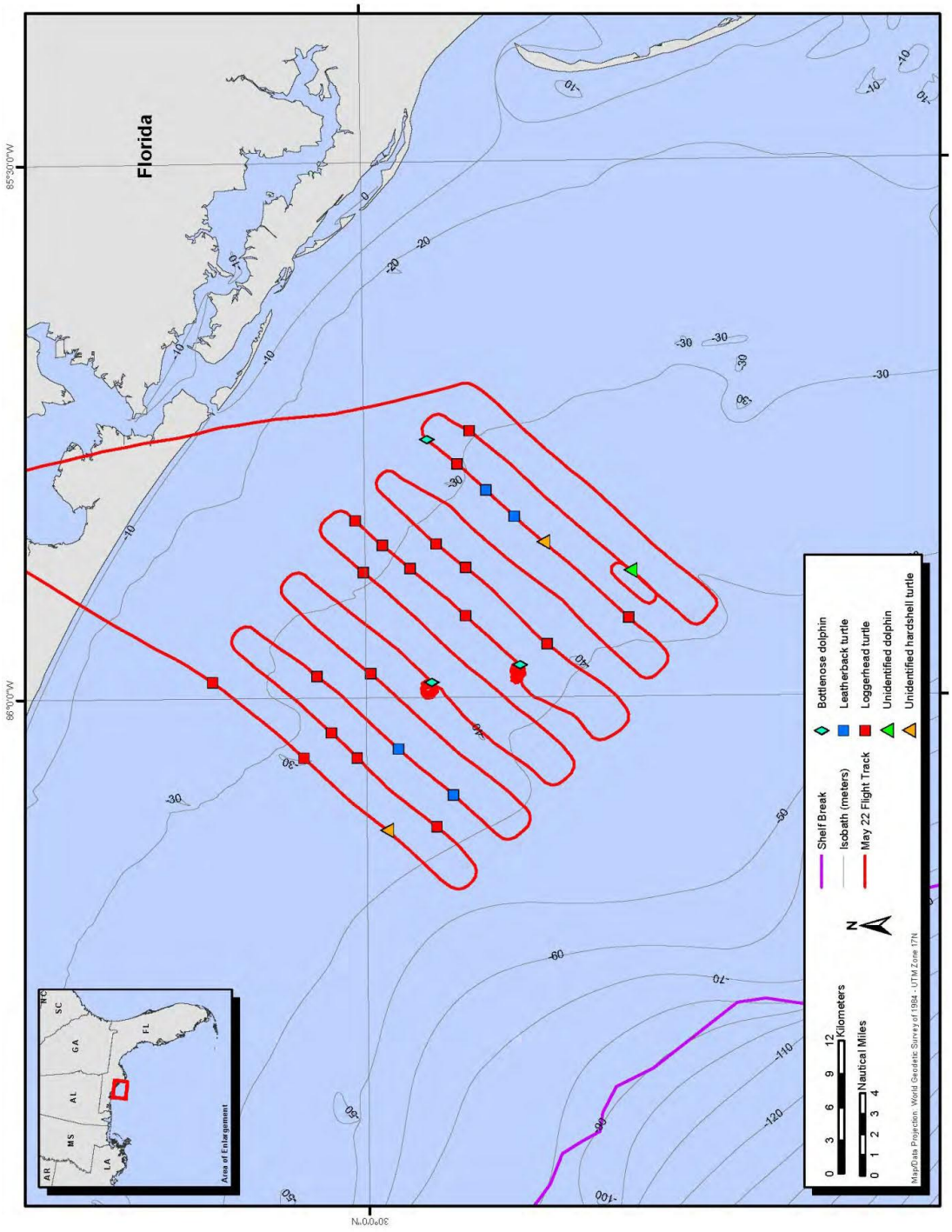

Figure 5. Location of Cetacean and Sea Turtle Sightings Recorded During the AN/AQS-20 Sonar Test Events (22 May 2012)

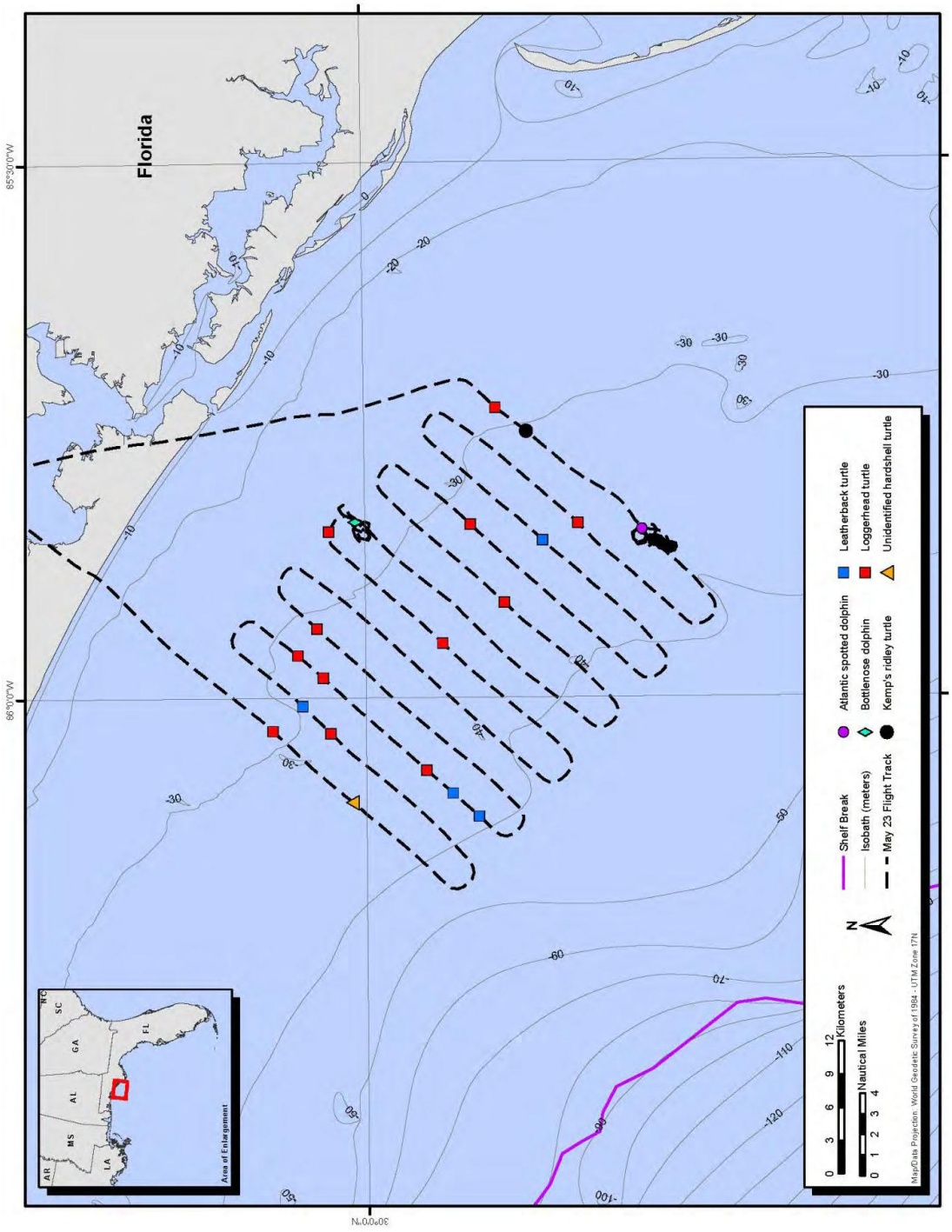

Figure 6. Location of Sea Turtle Sightings Recorded After the First AN/AQS-20 Sonar Test Event and Before the Second Sonar Test Event (23 May 2012)

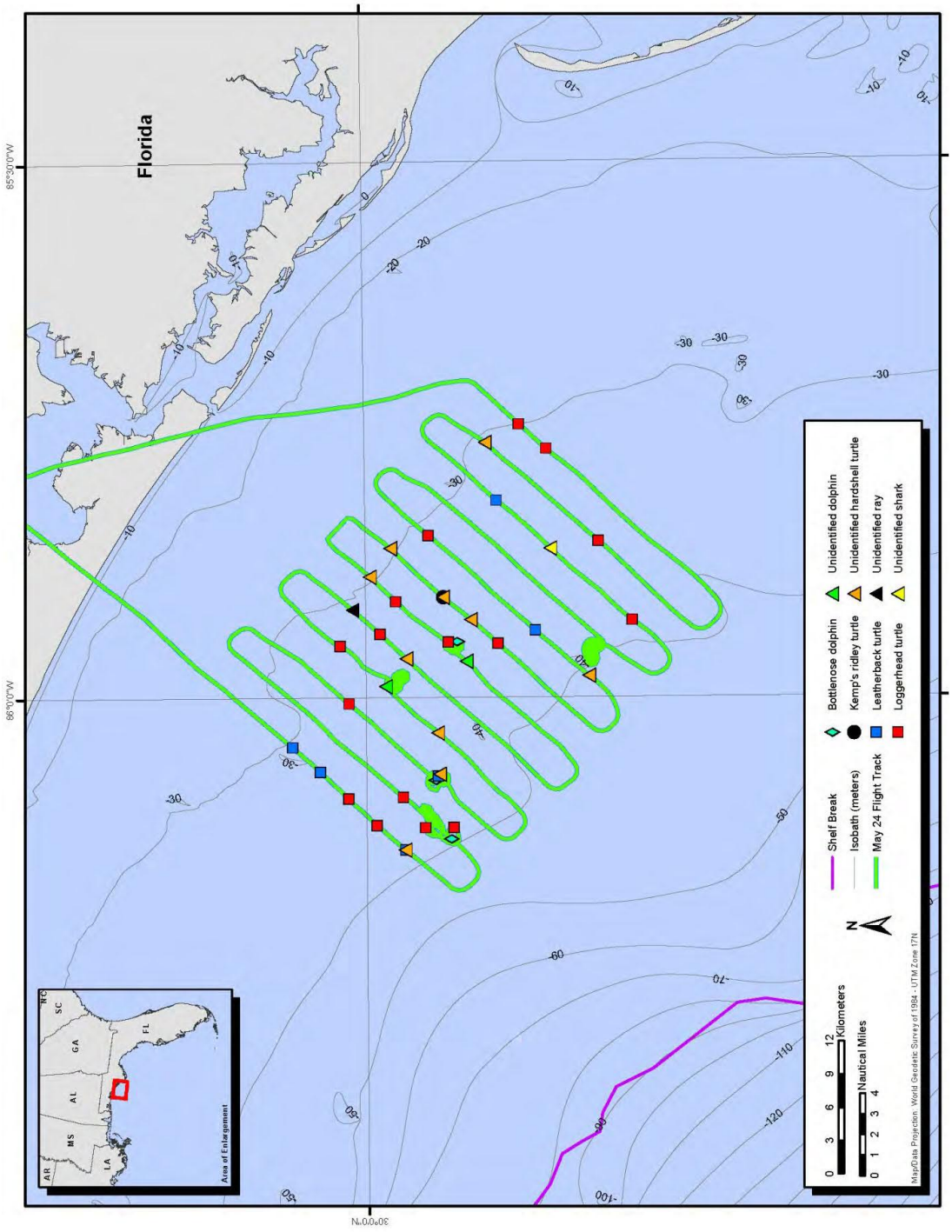

Figure 7. Location of Cetacean and Sea Turtle Sightings Recorded Before the Second Sonar Test Event (24 May 2012)

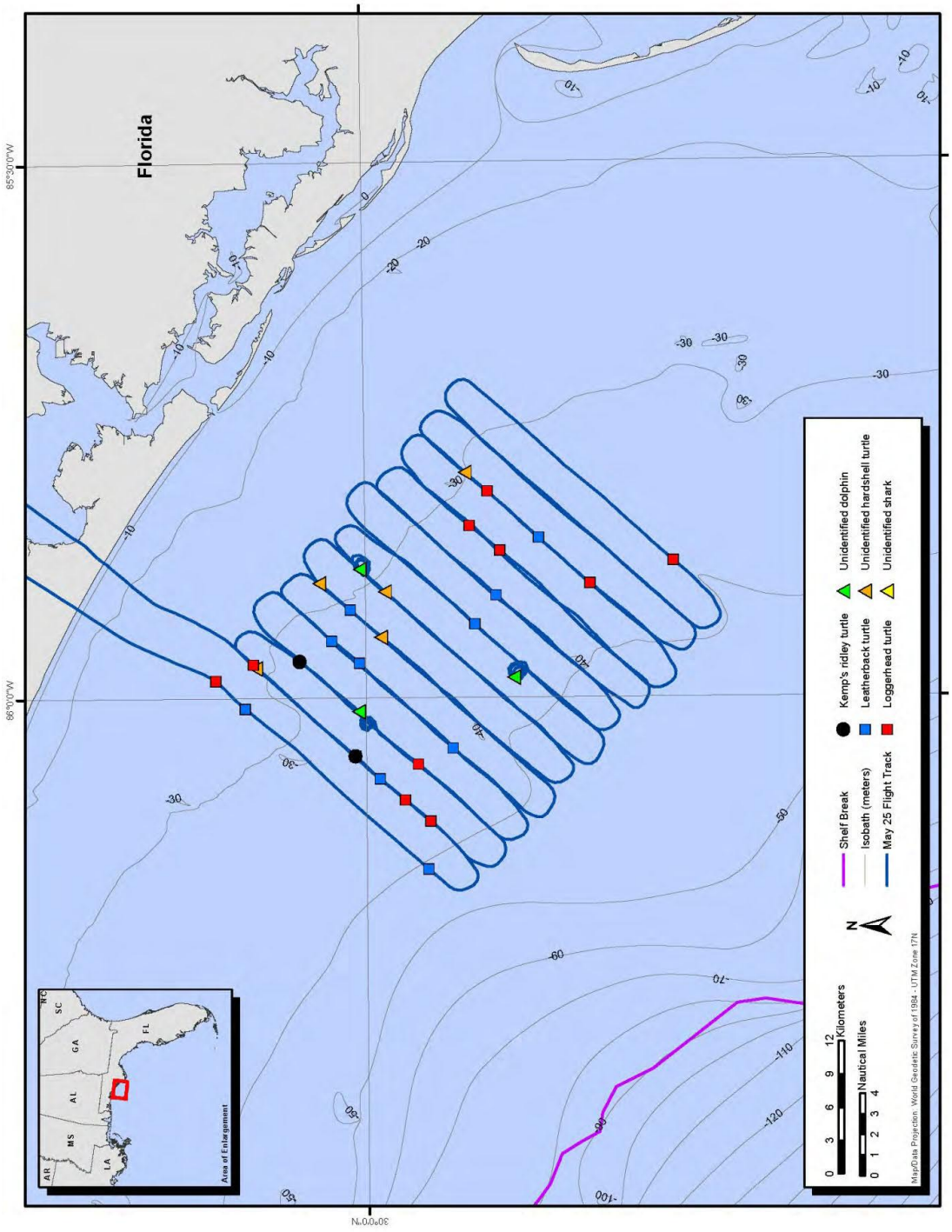

Figure 8. Location of Cetacean and Sea Turtle Sightings Recorded During the Second Sonar Test Event (25 May 2012)

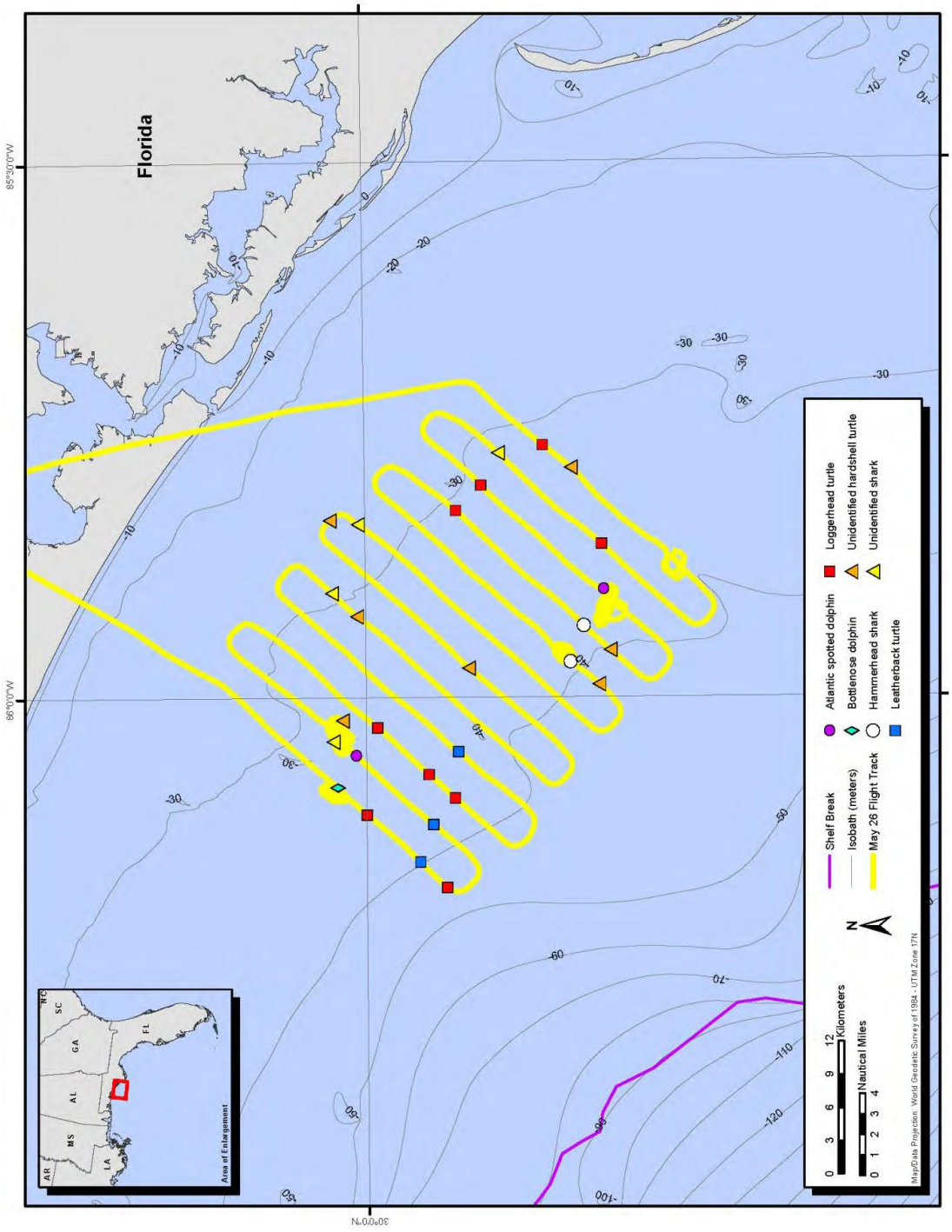

Figure 9. Location of Cetacean and Sea Turtle Sightings Recorded After the Second Sonar Test Event (26 May 2012)

Section 3 Results

Survey Effort

Observers visually surveyed 2,578 km (1,392 nmi) of on-effort tracklines and 3,983 km (2,151 nmi) of total trackline (including the systematic transects, cross-legs between transects, and circling for focal follows or species ID) during seven days for 13.4 h of on-effort status (**Table 1**). Beaufort sea state ranged from 1 to 4, and all sightings were made in Beaufort sea states between 1 and 4 (**Table 3**). **Appendix A** contains a detailed description of environmental, oceanographic, and sighting conditions. Survey results in the following subsection are reported based on requirements outlined in NMFS (2010), as a monitoring event constitutes effort conducted 2 days before a test event, 1 day during a test event, and 1 day after a test event. There were 2 days with no test activity between the first and second test events; therefore, the same day that served as monitoring effort after the first event also served as the first day of monitoring before the second test event.

Sightings

Twenty sightings of cetaceans and 156 sightings of sea turtles were recorded during times of both on-effort and off-effort, which encompassed approximately 21 h of total survey flight time within the survey area (**Figure 2, Table 3**).

Sightings per unit effort (SPUE) was calculated as the total number of cetacean (n=18) or sea turtle (n=152) sightings made on-effort divided by total survey on-effort (t=13.4 h and d=2,578 km [1,392 nmi]), resulting in an estimate for the number of sightings per h and number of sightings per km (number of sightings per nmi). For this monitoring effort, the SPUE for cetaceans was equal to 1.3 sightings per h or 0.0070 sightings per km (0.013 sightings per nmi) and the SPUE for sea turtles was equal to 11.3 sightings per h or 0.059 sightings per km (0.11 sightings per nmi).

Two sightings of cetaceans and 24 sightings of sea turtles were made prior to the first test event on 20 and 21 May 2012 (**Figures 3-4, Table 3**). Four sightings of cetaceans and 26 sightings of sea turtles were made during the first test event on 22 May 2012 (**Figure 5, Table 3**). Two sightings of cetaceans and 21 sightings of sea turtles were made after the first test event and before the second test event on 23 May 2012 (**Figure 6, Table 3**). Six sightings of cetaceans, 35 sightings of sea turtles, 2 sightings of unidentified sharks, and 1 sighting of an unidentified ray were made before the second test event on 24 May 2012 (**Figure 7, Table 3**). Three sightings of cetaceans and 30 sightings of sea turtles were made during the second test event on 25 May 2012 (**Figure 8, Table 3**). Three sightings of cetaceans, 20 sightings of sea turtles, and 6 sightings of sharks were made after the second test event on 26 May 2012 (**Figure 9, Table 3**).

Sightings were comprised of four groups of Atlantic spotted dolphins (*Stenella frontalis*), ten groups of bottlenose dolphins (*Tursiops truncatus*), six groups of unidentified dolphins, four Kemp's ridley turtles (*Lepidochelys kempii*), 29 leatherback turtles (*Dermochelys coriacea*), 91 loggerhead turtles (*Caretta caretta*), 32 unidentified hardshell turtles, one unidentified ray, two hammerhead sharks (*Sphyrna* sp.), and six unidentified sharks (**Figure 2, Table 3**). **Table 4** provides a summary of the sightings recorded, which includes group information and environmental data. Bottom depth for each sighting was estimated in 10-m (30-ft) ranges from the maps from Geographic Information System plots of latitude and longitude for sightings.

Table 3. Summary of Sightings

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
Before NSWC PCD AN/AQS-20 First Test Event Sightings – 20 May 2012																
1	20/5/12	CC	1	1	1	-	14:30	-	2	30.096	-86.007	029	0.6 (2.0)	045	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
2	20/5/12	TT	9	9	3	0	14:31	14:49	2	30.075	-86.029	040	0.4 (1.3)	270	30 (98)	Group of 9 bottlenose dolphins traveling W and WSW. See **Appendix B** for focal follow data.
3	20/5/12	Unid HST	1	1	1	-	14:53	-	2	29.991	-86.118	028	0.6 (2.0)	315	40 (131)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
4	20/5/12	CC	1	1	1	-	14:55	-	2	29.944	-86.165	040	0.4 (1.3)	000	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
5	20/5/12	Unid HST	1	1	1	-	15:01	-	1	30.009	-86.054	027	0.6 (2.0)	Unk.	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
6	20/5/12	CC	1	1	1	-	15:02	-	1	30.029	-86.033	018	0.9 (3.0)	180	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
7	20/5/12	Unid HST	1	1	1	-	15:03	-	1	30.051	-86.0128	035	0.4 (1.3)	135	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
8	20/5/12	CC	1	1	1	-	15:12	-	3	29.978	-86.041	024	0.7 (2.3)	135	40	Loggerhead turtle resting at the surface. No disturbance detected.
9	20/5/12	CC	1	1	1	-	15:14	-	3	29.934	-86.087	030	0.5 (0.27)	045	40	Loggerhead turtle resting at the surface. No disturbance detected.
10	20/5/12	CC	1	1	1	-	15:19	-	2	29.907	-86.068	035	0.4 (1.3)	225	40	Loggerhead turtle resting at the surface. No disturbance detected.
11	20/5/12	CC	1	1	1	-	15:20	-	2	29.929	-86.046	060	0.2 (0.66)	Unk.	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
12	20/5/12	CC	1	1	1	-	15:25	-	2	30.035	-85.940	035	0.4 (1.3)	045	40	Loggerhead turtle resting at the surface. No disturbance detected.
13	20/5/12	CC	1	1	1	-	15:33	-	3	29.934	-85.996	039	0.4 (1.3)	000	40	Loggerhead turtle resting at the surface. No disturbance detected.
14	20/5/12	CC	1	1	1	-	15:41	-	3	29.888	-85.999	042	0.3 (0.98)	045	40	Loggerhead turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
Before NSWC PCD AN/AQS-20 First Test Event Sightings – 20 May 2012 (continued)																
15	20/5/12	Unid HST	1	1	1	-	15:42	-	3	29.911	-85.976	032	0.5 (0.27)	045	40	Unidentified hardshell turtle resting at the surface. No disturbance detected.
16	20/5/12	Unid HST	1	1	1	-	15:49	-	4	29.990	-85.848	042	0.3 (0.98)	045	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
17	20/5/12	DC	1	1	1	-	15:58	-	4	29.798	-86.000	040	0.4 (1.3)	315	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
18	20/5/12	CC	2	2	2	-	16:20	-	3	29.805	-85.905	035	0.4 (1.3)	315	40 (131)	Two loggerhead turtles resting at the surface. No disturbance detected.
19	20/5/12	CC	1	1	1	-	16:36	-	4	29.754	-85.913	032	0.5 (0.27)	225	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
Before NSWC PCD AN/AQS-20 First Test Event Sightings – 21 May 2012																
1	21/5/12	CC	1	1	1	-	09:28	-	2	30.104	-85.997	045	0.3 (0.98)	090	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
2	21/5/12	CC	1	1	1	-	09:28	-	2	30.104	-85.997	055	0.2 (0.66)	315	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
3	21/5/12	CC	1	1	1	-	09:49	-	2	30.037	-85.978	028	0.6 (2.0)	000	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
4	21/5/12	CC	1	1	1	-	09:57	-	3	29.885	-86.091	030	0.5 (0.27)	090	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
5	21/5/12	TT	25	25	9	0	10:24	10:47	3	29.989	-85.895	055	0.2 (0.66)	270	30 (98)	Group of approximately 25 bottlenose dolphins sighted traveling E. Varied group dispersal. See **Appendix B** for focal follow data.
6	21/5/12	CC	1	1	1	-	10:54	-	3	29.937	-85.905	024	0.7 (2.3)	270	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
7	21/5/12	CC	1	1	1	-	11:09	-	3	29.971	-85.827	045	0.3 (0.98)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
During NSWC PCD AN/AQS-20 First Test Event Sightings – 22 May 2012																
1	22/5/12	CC	1	1	1	-	11:16	-	2	30.124	-85.984	035	0.4 (1.3)	090	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
During NSWC PCD AN/AQS-20 First Test Event Sightings – 22 May 2012 (continued)																
2	22/5/12	CC	1	1	1	-	11:19	-	2	30.051	-86.055	043	0.3 (0.98)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
3	22/5/12	Unid HST	1	1	1	-	11:22	-	2	29.984	-86.123	012	1.5 (1.2)	000	40 (131)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
4	22/5/12	CC	1	1	1	-	11:27	-	2	29.943	-86.121	025	0.7 (2.3)	045	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
5	22/5/12	CC	1	1	1	-	11:30	-	2	30.007	-86.055	022	0.8 (2.6)	000	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
6	22/5/12	CC	1	1	1	-	11:31	-	2	30.028	-86.032	035	0.4 (1.3)	135	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
7	22/5/12	CC	1	1	1	-	11:38	-	2	30.039	-85.979	024	0.7 (2.3)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
8	22/5/12	DC	1	1	1	-	11:41	-	2	29.974	-86.047	025	0.7 (2.3)	045	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
9	22/5/12	CC	1	1	1	-	11:43	-	2	29.929	-86.091	031	0.5 (0.27)	045	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
10	22/5/12	DC	1	1	1	-	11:43	-	2	29.929	-86.091	055	0.2 (0.66)	135	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
11	22/5/12	CC	1	1	1	-	11:52	-	2	29.996	-85.977	028	0.7 (2.3)	315	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
12	22/5/12	TT	2	2	2	0	12:01	12:12	2	29.946	-85.985	035	0.4 (1.3)	225	40 (131)	Two bottlenose dolphins traveling SW, milling and playing. See **Appendix B** for focal follow data.
13	22/5/12	CC	1	1	1	-	12:26	-	2	30.001	-85.882	032	0.5 (0.27)	000	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
14	22/5/12	CC	1	1	1	-	12:29	-	2	30.007	-85.834	030	0.5 (0.27)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
15	22/5/12	CC	1	1	1	-	12:30	-	2	29.985	-85.857	050	0.3 (0.98)	090	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
16	22/5/12	CC	1	1	1	-	12:31	-	2	29.963	-85.879	030	0.5 (0.27)	315	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
17	22/5/12	CC	1	1	1	-	12:33	-	2	29.918	-85.924	040	0.4 (1.3)	045	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
During NSWC PCD AN/AQS-20 First Test Event Sightings – 22 May 2012 (continued)																
18	22/5/12	TT	7	7	4	1	12:35	12:55	2	29.875	-85.970	035	0.4 (1.3)	225	40 (131)	Group of approximately 7 bottlenose dolphins milling and traveling slowly SW. See **Appendix B** for focal follow data.
19	22/5/12	CC	1	1	1	-	13:03	-	2	29.852	-85.951	030	0.5 (0.27)	225	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
20	22/5/12	CC	1	1	1	-	13:06	-	2	29.918	-85.879	022	0.8 (2.6)	270	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
21	22/5/12	CC	1	1	1	-	13:07	-	2	29.942	-85.856	045	0.3 (0.98)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
22	22/5/12	CC	1	1	1	-	13:22	-	2	29.786	-85.926	040	0.4 (1.3)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
23	22/5/12	Unid HST	1	1	1	-	13:25	-	2	29.855	-85.855	040	0.4 (1.3)	270	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
24	22/5/12	DC	1	1	1	-	13:26	-	2	29.878	-85.831	032	0.5 (0.27)	270	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
25	22/5/12	DC	1	1	1	-	13:27	-	2	29.901	-85.807	033	0.5 (0.27)	203	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
26	22/5/12	CC	1	1	1	-	13:28	-	2	29.924	-85.782	029	0.6 (2.0)	045	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
27	22/5/12	TT	2	2	2	0	13:29	-	2	29.949	-85.759	030	0.5 (0.27)	225	30 (98)	Two bottlenose dolphins sighted briefly while off-effort.
28	22/5/12	CC	1	1	1	-	13:31	-	2	29.914	-85.751	022	0.8 (2.6)	045	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
29	22/5/12	CC	1	1	1	-	13:31	-	2	29.914	-85.751	020	0.8 (2.6)	Unk.	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
30	22/5/12	Unid	1	1	1	0	13:37	-	2	29.784	-85.882	030	0.5 (0.27)	225	40 (131)	One unidentified dolphin sighted briefly and not re-sighted.
After NSWC PCD AN/AQS-20 First Test Event and Before NSWC PCD AN/AQS-20 Second Test Event Sightings – 23 May 2012																
1	23/5/12	CC	1	1	1	-	9:04	-	2	30.076	-86.030	028	0.8 (2.6)	090	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
2	23/5/12	Unid HST	1	1	1	-	9:07	-	2	30.011	-86.097	022	0.8 (2.6)	158	40 (131)	Unidentified hardshell turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
After NSWC PCD AN/AQS-20 First Test Event and Before NSWC PCD AN/AQS-20 Second Test Event Sightings – 23 May 2012 (continued)																
3	23/5/12	CC	1	1	1	-	9:17	-	2	30.029	-86.032	039	0.4 (1.3)	090	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
4	23/5/12	DC	1	1	1	-	9:18	-	2	30.051	-86.007	042	0.3 (0.98)	225	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
5	23/5/12	CC	1	1	1	-	9:23	-	2	30.055	-85.960	037	0.4 (1.3)	045	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
6	23/5/12	CC	1	1	1	-	9:24	-	2	30.035	-85.981	055	0.2 (0.66)	270	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
7	23/5/12	CC	1	1	1	-	9:24	-	2	30.035	-85.981	050	0.3 (0.98)	135	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
8	23/5/12	CC	1	1	1	-	9:28	-	2	29.951	-86.067	035	0.4 (1.3)	045	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
9	23/5/12	DC	1	1	1	-	9:29	-	2	29.930	-86.089	038	0.4 (1.3)	270	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
10	23/5/12	DC	1	1	1	-	9:30	-	2	29.909	-86.111	042	0.3 (0.98)	225	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
11	23/5/12	CC	1	1	1	-	9:39	-	2	30.039	-85.935	045	0.3 (0.98)	045	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
12	23/5/12	CC	1	1	1	-	9:39	-	2	30.039	-85.935	035	0.4 (1.3)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
13	23/5/12	CC	1	1	1	-	9:56	-	2	29.937	-85.949	045	0.3 (0.98)	045	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
14	23/5/12	CC	1	1	1	-	10:00	-	2	30.029	-85.844	022	0.8 (2.6)	180	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
15	23/5/12	TT	20	20	4	0	10:01		2	30.008	-85.835	018	0.9 (3.0)	045	30 (98)	Group of approximately 20 bottlenose dolphins sighted traveling NE. No disturbance detected.
16	23/5/12	CC	1	1	1	-	10:20	-	2	29.887	-85.911	042	0.3 (0.98)	180	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
17	23/5/12	CC	1	1	1	-	10:28	-	2	29.914	-85.838	035	0.4 (1.3)	000	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
18	23/5/12	CC	1	1	1	-	10:40	-	2	29.855	-85.853	033	0.5 (0.27)	000	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
19	23/5/12	DC	1	1	1	-	10:40	-	2	29.855	-85.853	029	0.6 (2.0)	000	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
20	23/5/12	CC	1	1	1	-	10:50	-	2	29.827	-85.837	032	0.5 (0.27)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
After NSWC PCD AN/AQS-20 First Test Event and Before NSWC PCD AN/AQS-20 Second Test Event Sightings – 23 May 2012 (continued)																
21	23/5/12	SF	9	15	14	1	10:58	11:31	2	29.774	-85.843	035	0.4 (1.3)	000	40 (131)	Group of 9 Atlantic spotted dolphins travelling slowly to the north. See **Appendix B** for focal follow data.
22	23/5/12	LK	1	1	1	-	11:37	-	2	29.868	-85.752	055	0.2 (0.66)	270	40 (131)	Kemp's ridley turtle resting at the surface. No disturbance detected.
23	23/5/12	CC	1	1	1	-	11:38	-	2	29.893	-85.729	036	0.4 (1.3)	090	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
Before NSWC PCD AN/AQS-20 Second Test Event Sightings – 24 May 2012																
1	24/5/12	DC	1	1	1	-	9:00	-	2	30.063	-86.046	028	0.6 (2.0)	315	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
2	24/5/12	DC	1	1	1	-	9:01	-	2	30.037	-86.069	022	0.8 (2.6)	045	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
3	24/5/12	CC	1	1	1	-	9:02	-	2	30.015	-86.094	038	0.4 (1.3)	000	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
4	24/5/12	CC	1	1	1	-	9:03	-	2	29.992	-86.119	032	0.5 (0.27)	315	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
5	24/5/12	DC	1	1	1	-	9:04	-	2	29.969	-86.142	040	0.4 (1.3)	225	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
6	24/5/12	Unid HST	1	1	1	-	9:04	-	2	29.969	-86.142	029	0.6 (2.0)	090	40 (131)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
7	24/5/12	TT	1	1	1	-	9:08	-	2	29.931	-86.132	020	0.8 (2.6)	045	40 (131)	One bottlenose dolphin sighted traveling northeast. No disturbance detected.
8	24/5/12	CC	1	1	1	-	9:09	-	2	29.952	-86.121	Unk.		Unk.	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected. Sighting made off-effort.
9	24/5/12	CC	1	1	1	-	9:11	-	2	29.929	-86.121	Unk.		Unk.	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected. Sighting made off-effort.
10	24/5/12	CC	1	1	1	-	9:22	-	2	29.970	-86.092	035	0.4 (1.3)	225	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
11	24/5/12	CC	1	1	1	-	9:33	-	2	30.014	-86.005	033	0.5 (0.27)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
Before NSWC PCD AN/AQS-20 Second Test Event Sightings – 24 May 2012 (continued)																
12	24/5/12	TT	1	1	1	-	9:36	9:45	2	29.944	-86.077	030	0.5 (0.27)	180	40 (131)	One bottlenose dolphin sighted traveling south. See **Appendix B** for focal follow data.
13	24/5/12	DC	1	1	1	-	9:43	-	2	29.942	-86.073	Unk.		Unk.	40 (131)	Leatherback turtle resting at the surface. No disturbance detected. Sighting made off-effort.
14	24/5/12	Unid HST	1	1	1	-	9:47	-	2	29.940	-86.071	045	0.3 (0.98)	Unk.	40 (131)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
15	24/5/12	Unid HST	1	1	1	-	9:54	-	2	29.942	-86.033	040	0.4 (1.3)	000	40 (131)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
16	24/5/12	Unid	8	8	8	-	9:56	10:17	2	29.984	-85.989	030	0.5 (0.27)	225	30 (98)	Group of 8 unidentified dolphins travelling southwest. See **Appendix B** for focal follow data.
17	24/5/12	CC	1	1	1	-	10:20	-	2	30.020	-85.951	032	0.5 (0.27)	000	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
18	24/5/12	Unid ray	1	1	1	-	10:25	-	2	30.010	-85.918	006	2.9 (9.5)	Unk.	30 (98)	One unidentified ray. No disturbance detected.
19	24/5/12	CC	1	1	1	-	10:26	-	2	29.988	-85.940	025	0.7 (2.3)	045	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
20	24/5/12	Unid HST	1	1	1	-	10:27	-	2	29.967	-85.963	049	0.3 (0.98)	225	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
21	24/5/12	Unid HST	1	1	1	-	10:27	-	2	29.967	-85.963	020	0.8 (2.6)	Unk.	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
22	24/5/12	Unid	1	3	3	-	10:38		2	29.918	-85.966	025	0.7 (2.3)	225	40 (131)	Group of 3 unidentified dolphins sighted behind a boat. No disturbance detected.
23	24/5/12	TT	7	7	7	1	10:39	11:00	2	29.926	-85.948	Unk.		270	30 (98)	Group of 7 bottlenose dolphins seen traveling while circling for unidentified dolphins above. See **Appendix B** for focal follow data. Sighting made off-effort.
24	24/5/12	CC	1	1	1	-	10:50	-	2	29.933	-85.948	Unk.		270	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected. Sighting made off-effort.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
Before NSWC PCD AN/AQS-20 Second Test Event Sightings – 24 May 2012 (continued)																
25	24/5/12	CC	1	1	1	-	11:03		2	29.975	-85.910	035	0.4 (1.3)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
26	24/5/12	Unid HST	1	1	1	-	11:04	-	2	29.996	-85.887	030	0.5 (0.27)	225	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
27	24/5/12	Unid HST	1	1	1	-	11:08	-	1	29.979	-85.860	040	0.4 (1.3)	225	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
28	24/5/12	LK	2	2	2	-	11:10	-	1	29.937	-85.906	055	0.2 (0.66)	090	30 (98)	Kemp's ridley turtle resting at the surface. No disturbance detected.
29	24/5/12	Unid HST	1	1	1	-	11:10	-	1	29.937	-85.906	056	0.2 (0.66)	090	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
30	24/5/12	Unid HST	1	1	1	-	11:11	-	1	29.914	-85.927	022	0.8 (2.6)	135	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
31	24/5/12	Unid HST	1	1	1	-	11:11	-	1	29.914	-85.927	020	0.8 (2.6)	090	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
32	24/5/12	CC	1	1	1	-	11:12	-	1	29.892	-85.949	050	0.3 (0.98)	090	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
33	24/5/12	Unid HST	1	1	1	-	11:18	-	1	29.818	-85.980	040	0.4 (1.3)	315	40 (131)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
34	24/5/12	DC	1	1	1	-	11:20	-	1	29.862	-85.938	039	0.4 (1.3)	180	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
35	24/5/12	CC	1	1	1	-	11:24	-	1	29.948	-85.848	035	0.4 (1.3)	135	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
36	24/5/12	SF	41	60	60	5	11:34	11:58	1	29.815	-85.940	025-030	0.7 (2.3)-0.5 (0.27)	090	40 (131)	Group of 60 Atlantic spotted dolphins seen traveling and surface-active travel to the east. See **Appendix B** for focal follow data.
37	24/5/12	CC	1	1	1	-	12:03	-	1	29.783	-85.928	025	0.7 (2.3)	045	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
38	24/5/12	Unid shark	1	1	1	-	12:06	-	1	29.849	-85.861	019	0.8 (2.6)	225	40 (131)	One unidentified shark, seen heading southwest. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
Before NSWC PCD AN/AQS-20 Second Test Event Sightings – 24 May 2012 (continued)																
39	24/5/12	DC	1	1	1	-	12:08	-	1	29.893	-85.816	028	0.6 (2.0)	090	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
40	24/5/12	Unid shark	1	1	1	-	12:13	-	1	29.901	-85.762	047	0.3 (0.98)	Unk.	30 (98)	One unidentified shark. No disturbance detected.
41	24/5/12	Unid HST	1	1	1	-	12:13	-	1	29.901	-85.762	052	0.2 (0.66)	090	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
42	24/5/12	CC	1	1	1	-	12:17	-	1	29.810	-85.854	050	0.3 (0.98)	225	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
43	24/5/12	CC	1	1	1	-	12:28	-	1	29.852	-85.768	035	0.4 (1.3)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
44	24/5/12	CC	1	1	1	-	12:29	-	1	29.874	-85.745	042	0.3 (0.98)	135	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
During NSWC PCD AN/AQS-20 Second Test Event Sightings – 25 May 2012																
1	25/5/12	CC	1	1	1	-	8:10	-	3	30.122	-85.983	032	0.5 (0.27)	315	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
2	25/5/12	DC	1	1	1	-	8:11	-	3	30.098	-86.009	031	0.5 (0.27)	000	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
3	25/5/12	CC	1	1	1	-	8:11	-	3	30.098	-86.009	028	0.6 (2.0)	270	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
4	25/5/12	DC	1	1	1	-	8:11	-	3	30.098	-86.009	036	0.4 (1.3)	270	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
5	25/5/12	DC	1	1	1	-	8:17	-	4	29.950	-86.160	042	0.3 (0.98)	000	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
6	25/5/12	CC	1	1	1	-	8:21	-	4	29.948	-86.115	038	0.4 (1.3)	045	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
7	25/5/12	CC	1	1	1	-	8:22	-	4	29.968	-86.095	055	0.2 (0.66)	225	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
8	25/5/12	DC	1	1	1	-	8:23	-	4	29.989	-86.075	049	0.3 (0.98)	225	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
9	25/5/12	CC	1	1	1	-	8:24	-	4	30.009	-86.054	037	0.4 (1.3)	000	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
10	25/5/12	LK	1	1	1	-	8:24	-	4	30.009	-86.054	050	0.3 (0.98)	225	30 (98)	Kemp's ridley turtle resting at the surface. No disturbance detected.
11	25/5/12	Unid HST	1	1	1	-	8:28	-	4	30.089	-85.971	029	0.6 (2.0)	225	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
During NSWC PCD AN/AQS-20 Second Test Event Sightings – 25 May 2012 (continued)																
12	25/5/12	LK	1	1	1	-	8:31	-	4	30.053	-85.965	048	0.3 (0.98)	270	30 (98)	Kemp's ridley turtle resting at the surface. No disturbance detected.
13	25/5/12	CC	1	1	1	-	8:35	-	4	29.958	-86.062	039	0.4 (1.3)	045	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
14	25/5/12	DC	1	1	1	-	8:42	-	4	29.929	-86.047	039	0.4 (1.3)	225	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
15	25/5/12	DC	1	1	1	-	8:47	-	4	30.027	-85.947	027	0.4 (1.3)	225	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
16	25/5/12	Unid HST	1	1	1	-	9:07	-	4	29.984	-85.900	028	0.7 (2.3)	045	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
17	25/5/12	Unid	3	3	3	-	9:08	-	4	30.004	-85.880	027	0.4 (1.3)	045	30 (98)	Three unidentified dolphins, seen heading northeast. No disturbance detected.
18	25/5/12	DC	1	1	1	-	9:29	-	4	29.893	-85.904	036	0.4 (1.3)	045	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
19	25/5/12	CC	1	1	1	-	9:48	-	3	29.817	-85.894	025	0.7 (2.3)	000	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
20	25/5/12	DC	1	1	1	-	9:50	-	3	29.859	-85.851	042	0.3 (0.98)	225	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
21	25/5/12	CC	1	1	1	-	9:52	-	3	29.900	-85.807	043	0.3 (0.98)	090	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
22	25/5/12	CC	1	1	1	-	10:07	-	3	29.749	-85.873	036	0.4 (1.3)	045	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
23	25/5/12	Unid HST	1	1	1	-	10:34	-	3	29.918	-85.790	044	0.3 (0.98)	045	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
24	25/5/12	CC	1	1	1	-	10:39	-	3	29.915	-85.839	038	0.4 (1.3)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
25	25/5/12	CC	1	1	1	-	10:40	-	3	29.890	-85.863	040	0.4 (1.3)	225	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
26	25/5/12	DC	1	1	1	-	11:02	-	2	29.911	-85.931	035	0.4 (1.3)	225	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
27	25/5/12	Unid	1	1	1	-	11:04	-	2	29.879	-85.981	022	0.8 (2.6)	Unk.	30 (98)	One unidentified dolphin. Seen briefly, but did not re-sight. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
During NSWC PCD AN/AQS-20 Second Test Event Sightings – 25 May 2012 (continued)																
28	25/5/12	Unid HST	1	1	1	-	11:23	-	1	30.037	-85.893	022	0.8 (2.6)	225	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
29	25/5/12	DC	1	1	1	-	11:24	-	1	30.012	-85.918	046	0.3 (0.98)	045	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
30	25/5/12	Unid HST	1	1	1	-	11:25	-	2	29.987	-85.943	039	0.4 (1.3)	Unk.	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
31	25/5/12	DC	1	1	1	-	11:39	-	3	30.005	-85.967	026	0.6 (2.0)	225	30 (98)	Leatherback turtle resting at the surface. No disturbance detected.
32	25/5/12	Unid	1	1	1	-	11:47	-	2	30.005	-86.012	020	0.8 (2.6)	Unk.	30 (98)	One unidentified dolphin. Seen briefly but did not re-sight. No disturbance detected.
33	25/5/12	CC	1	1	1	-	12:06	-	2	30.091	-85.968	030	0.5 (0.27)	000	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
After NSWC PCD AN/AQS-20 Second Test Event Sightings – 26 May 2012																
1	26/5/12	TT	16	22	22	1	8:07	8:29	2	30.023	-86.083	027	0.6 (2.0)	045	30 (98)	Group of 22 bottlenose dolphins traveling slowly to the northeast. See **Appendix B** for focal follow data.
2	26/5/12	CC	1	1	1	-	8:31	-	2	30.000	-86.109	031	0.5 (0.27)	225	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
3	26/5/12	CC	1	1	1	-	8:31	-	2	30.000	-86.109	035	0.4 (1.3)	090	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
4	26/5/12	DC	1	1	1	-	8:33	-	1	29.957	-86.153	025	0.7 (2.3)	000	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
5	26/5/12	CC	1	1	1	-	8:34	-	1	29.935	-86.177	031	0.5 (0.27)	045	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
6	26/5/12	DC	1	1	1	-	8:37	-	1	29.945	-86.118	035	0.4 (1.3)	225	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
7	26/5/12	SF	18	18	18	-	8:40	9:05	1	30.008	-86.054	026	0.6 (2.0)	180	30 (98)	Multiple subgroups of Atlantic spotted dolphins surface-active travel to the south. See **Appendix B** for focal follow data

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
After NSWC PCD AN/AQS-20 Second Test Event Sightings – 26 May 2012 (continued)																
8	26/5/12	Unid shark	1	1	1	-	8:43	-	1	30.026	-86.040	Unk.		Unk.	30 (98)	One unidentified shark. No disturbance detected. Sighting made off-effort.
9	26/5/12	Unid HST	1	1	1	-	8:44	-	1	30.019	-86.021	Unk.		Unk.	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected. Sighting made off-effort.
10	26/5/12	CC	1	1	1	-	9:16	-	1	29.991	-86.027	050	0.3 (0.98)	270	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
11	26/5/12	CC	2	2	2	-	9:18	-	1	29.949	-86.079	045	0.4 (1.3)	090	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
12	26/5/12	CC	1	1	1	-	9:19	-	1	29.923	-86.094	048	0.3 (0.98)	090	40 (131)	Loggerhead turtle resting at the surface. No disturbance detected.
13	26/5/12	DC	1	1	1	-	9:25	-	1	29.925	-86.051	032	0.5 (0.27)	180	40 (131)	Leatherback turtle resting at the surface. No disturbance detected.
14	26/5/12	Unid shark	1	1	1	-	9:34	-	1	30.027	-85.902	030	0.5 (0.27)	Unk.	30 (98)	One unidentified shark. No disturbance detected.
15	26/5/12	Unid HST	1	1	1	-	9:35	-	1	30.006	-85.924	036	0.4 (1.3)	000	30 (98)	Unidentified hardshell turtle diving when sighted.
16	26/5/12	Unid HST	1	1	1	-	9:47	-	1	29.916	-85.972	042	0.3 (0.98)	045	40 (131)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
17	26/5/12	Unid HST	1	1	1	-	9:53	-	1	30.028	-85.834	Unk.		Unk.	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected. Sighting made off-effort.
18	26/5/12	Unid shark	1	1	1	-	9:54	-	1	30.005	-85.838	050	0.3 (0.98)	Unk.	30 (98)	One unidentified shark. No disturbance detected.
19	26/5/12	Unid HST	1	1	1	-	10:05	-	1	29.810	-85.988	022	0.8 (2.6)	Unk.	40 (131)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
20	26/5/12	S	1	1	1	-	10:06	-	1	29.833	-85.967	025	0.7 (2.3)	Unk.	40 (131)	One hammerhead shark seen splashing. No disturbance detected.
21	26/5/12	CC	1	1	1	-	10:23	-	1	29.926	-85.8260	031	0.5 (0.27)	090	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
22	26/5/12	S	1	1	1	-	10:28	-	1	29.823	-85.934	043	0.3 (0.98)	Unk.	40 (131)	One hammerhead shark. No disturbance detected.
23	26/5/12	Unid HST	1	1	1	-	10:29	-	1	29.801	-85.956	029	0.6 (2.0)	Unk.	40 (131)	Unidentified hardshell turtle diving when sighted.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track m (ft)	Heading	Bottom Depth† m (ft)	Behavioral Summary
After NSWC PCD AN/AQS-20 Second Test Event Sightings – 26 May 2012 (continued)																
24	26/5/12	SF	9	9	9	1	10:34	11:07	1	29.806	-85.899	035	0.4 (1.3)	090	40 (131)	Group of 9 Atlantic spotted dolphins surface-active travel to the east. See **Appendix B** for focal follow data.
25	26/5/12	CC	1	1	1	-	11:13	-	1	29.906	-85.802	039	0.4 (1.3)	090	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.
26	26/5/12	Unid shark	1	1	1	-	11:18	-	1	29.891	-85.772	040	0.4 (1.3)	Unk.	30 (98)	One unidentified shark. No disturbance detected.
27	26/5/12	CC	2	2	2	-	11:22	-	1	29.808	-85.858	032	0.5 (0.27)	090	40 (131)	Two loggerhead turtles resting at the surface. No disturbance detected.
28	26/5/12	Unid HST	1	1	1	-	11:35	-	1	29.832	-85.786	042	0.3 (0.98)	180	30 (98)	Unidentified hardshell turtle resting at the surface. No disturbance detected.
29	26/5/12	CC	1	1	1	-	11:36	-	1	29.855	-85.765	036	0.4 (1.3)	000	30 (98)	Loggerhead turtle resting at the surface. No disturbance detected.

*Key:
SF = Atlantic spotted dolphin (*Stenella frontalis*)
TT = Bottlenose dolphin (*Tursiops truncatus*)
Unid = Unidentified dolphin
CC = Loggerhead turtle (*Caretta caretta*)
DC = Leatherback turtle (*Dermochelys coriacea*)
LK = Kemp's ridley turtle (*Lepidochelys kempii*)
Unid HST = Unidentified hardshell turtle
S = Hammerhead shark (*Sphyrna* sp.)
Unid ray = Unidentified ray
Unid shark = Unidentified shark

†Bottom depths were estimated by mapped figures. Precise estimation is not listed here, but is available upon request.

Table 4. Summary of Sightings Recorded during Monitoring for AN/AQS-20 Sonar Test Events

Species	Number of Sightings	Bottom Depths m (ft)
Atlantic Spotted Dolphin	4	30-40 (98-131)
Bottlenose Dolphin	10	30-40 (98-131)
Unidentified Dolphin	6	30-40 (98-131)
Kemp's Ridley Turtle	4	30-40 (98-131)
Leatherback Turtle	29	30-40 (98-131)
Loggerhead Turtle	91	30-40 (98-131)
Unidentified Hardshell Turtle	32	30-40 (98-131)
Unidentified Ray	1	30 (98)
Hammerhead Shark	2	40 (131)
Unidentified Shark	6	30-40 (98-131)

Behavior

No visible evidence of unusual behavior was observed during any of the monitoring surveys conducted before, during, or after the test events for the AN/AQS-20 sonar system (**Table 3**). The team was able to attempt 12 focal follows throughout the monitoring effort for the AN/AQS-20 sonar test events. The focal follows occurred for periods between a minimum of 8 min and a maximum of 31 min with groups of bottlenose dolphins, Atlantic spotted dolphins, and unidentified dolphins. **Table 5** provides a summary of the focal follows conducted. Detailed behavioral observations made during the focal follows are presented in **Appendix B**. Photographs and video of suitable quality for species identification purposes were collected during several sightings of dolphins.

Table 5. Summary of Focal Follows Conducted during Monitoring for AN/AQS-20 Sonar Test Events

Focal Follow	Sighting Number	Event Type	Species	Approximate Number of Individuals	Duration of Focal Follow
1	2	Before First Survey	TT	9	17
2	5	Before First Survey	TT	25	20
3	12	During First Survey	TT	2	9
4	18	During First Survey	TT	7	20
5	21	After First Survey/ Before Second Survey	SF	14	27
6	12	Before Second Survey	TT	1	8
7	16	Before Second Survey	Unid	8	20
8	23	Before Second Survey	TT	7	20
9	36	Before Second Survey	SF	60	22
10	1	After Second Survey	TT	20	22
11	7	After Second Survey	SF	18	20
12	24	After Second Survey	SF	9	31

Key: SF = Atlantic spotted dolphin (*Stenella frontalis*); TT = Bottlenose dolphin (*Tursiops truncatus*); Unid = Unidentified dolphin

Section 4 Acknowledgements

We would like to thank Orion Aviation's Director Ed Coffman and pilots Stan Huddle and Josh Clayton. These data were obtained under National Marine Fisheries Service permit No. 14451 issued to Joseph R. Mobley, Jr.

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Section 6 List of References

Buckland et al. 2001 — Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas. 2001. *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*. Oxford University Press, NY.

DON 2010 — Department of the Navy (DON). 2010. *Final Monitoring Plan for Marine Mammal Protection Act (MMPA) Authorization.* Naval Surface Warfare Center Panama City Division (NSWC PCD). Prepared for National Marine Fisheries Service, Silver Spring, Maryland. January 2010.

NMFS 2010 — National Marine Fisheries Service (NMFS). 2010. Final Rule: Taking and Importing Marine Mammals; U.S. Naval Surface Warfare Center Panama City Division Mission Activities. *Federal Register* 75: 3395-3416.

Smultea et al. 2009 — Smultea, M.A., J.R. Mobley, Jr., and K. Lomac-MacNair. 2009. *Aerial Survey Monitoring for Marine Mammals and Sea Turtles in Conjunction with U.S. Navy Major Training Events off San Diego, California, 15–21 October and 15–18 November 2008, Final Report.* Prepared by Marine Mammal Research Consultants, Honolulu, HI, and Smultea Environmental Sciences, LLC., Issaquah, WA, under Contract No. N62742-08-P-1936 and N62742-08-P-1938 for Naval Facilities Engineering Command Pacific, EV2 Environmental Planning, Pearl Harbor, HI.

U.S. Navy 2010 — U.S. Navy. 2010. *United States Navy Integrated Comprehensive Monitoring Program. 2010 update.*

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APPENDIX A

Environmental, Oceanographic, and Sighting Conditions

Table A-1 shows the environmental, oceanographic, and sighting conditions encountered before, during, and after the AN/AQS-20 sonar RDT&E test event.

Table A-1. Environmental, Oceanographic, and Sighting Conditions During Monitoring

Time	Beaufort Left MMO	Glare Left MMO (%)	Visibility Distance Left MMO km (nmi)	Beaufort Right MMO	Glare Right MMO (%)	Visibility Distance Right MMO km (nmi)	Cloud Cover (%)
Survey on 20 May 2012: Before First NSWC PCD AN/AQS-20 Test Event							
14:29:09	2	50	1.5 (1.2)	2	30	1.5 (1.2)	10
14:57:00	1	20	1.5 (1.2)	1	10	1.5 (1.2)	10
15:07:34	3	30	1.5 (1.2)	3	50	1.5 (1.2)	10
15:17:58	2	20	1.5 (1.2)	2	10	1.5 (1.2)	10
15:28:29	3	40	1.5 (1.2)	3	50	1.5 (1.2)	20
15:38:45	3	60	1.5 (1.2)	3	10	1.5 (1.2)	20
15:46:21	4	60	1.5 (1.2)	4	10	1.5 (1.2)	20
15:48:36	4	60	1 (0.8)	4	70	1 (0.8)	20
15:58:05	4	20	1 (0.8)	4	5	1.5 (1.2)	20
16:08:27	4	30	1 (0.8)	4	70	0.5 (0.27)	20
16:18:01	3	30	1 (0.8)	3	20	1.5 (1.2)	20
16:28:25	4	30	1 (0.8)	4	80	0.5 (0.27)	20
16:38:27	3	70	1 (0.8)	3	20	1.5 (1.2)	20
Survey on 21 May 2012: Before First NSWC PCD AN/AQS-20 Test Event							
9:27:00	2	30	1 (0.8)	2	40	1 (0.8)	0
9:37:33	2	10	1.5 (1.2)	2	70	0.5 (0.27)	0
9:47:27	2	50	1 (0.8)	2	50	1 (0.8)	0
9:50:06	3	50	1 (0.8)	3	50	1 (0.8)	0
9:56:47	3	10	1.5 (1.2)	3	50	0.5 (0.27)	0
10:07:14	3	50	1 (0.8)	3	20	1.5 (1.2)	0
10:16:48	3	10	1.5 (1.2)	3	50	0.5 (0.27)	0
10:49:22	3	10	1.5 (1.2)	3	50	0.5 (0.27)	0
10:51:19	3	60	0.5 (0.27)	3	40	0.5 (0.27)	0
11:00:53	3	20	1.5 (1.2)	3	30	1 (0.8)	0
11:11:40	3	60	0.5 (0.27)	3	20	1.5 (1.2)	0

Time	Beaufort Left MMO	Glare Left MMO (%)	Visibility Distance Left MMO km (nmi)	Beaufort Right MMO	Glare Right MMO (%)	Visibility Distance Right MMO km (nmi)	Cloud Cover (%)
Survey on 21 May 2012: Before First NSWC PCD AN/AQS-20 Test Event (continued)							
11:21:43	3	15	0.5 (0.27)	3	30	1 (0.8)	0
11:31:40	3	60	0.5 (0.27)	3	30	1 (0.8)	0
11:41:19	3	20	0.5 (0.27)	3	20	1.5 (1.2)	0
Survey on 22 May 2012: During First NSWC PCD AN/AQS-20 Test Event							
11:16:11	2	10	1.5 (1.2)	2	10	1.5 (1.2)	20
11:25:54	2	10	1.5 (1.2)	2	75	0.5 (0.27)	20
11:36:15	2	40	1 (0.8)	2	15	1.5 (1.2)	20
11:46:35	2	30	1 (0.8)	2	70	0.5 (0.27)	20
11:56:45	2	50	1 (0.8)	2	5	1.5 (1.2)	20
12:18:51	2	30	1 (0.8)	2	70	0.5 (0.27)	20
12:23:59	2	30	1 (0.8)	2	50	0.5 (0.27)	20
12:29:19	2	30	1 (0.8)	2	5	1.5 (1.2)	20
13:00:54	2	10	1.5 (1.2)	2	60	0.5 (0.27)	20
13:10:30	2	20	1.5 (1.2)	2	25	1.5 (1.2)	20
13:21:04	2	40	1 (0.8)	2	50	1 (0.8)	20
13:28:55	2	40	1 (0.8)	2	30	1 (0.8)	20
13:30:32	2	40	1 (0.8)	2	40	1 (0.8)	20
13:44:28	2	30	1 (0.8)	2	40	1 (0.8)	20
Survey on 23 May 2012: After First NSWC PCD AN/AQS-20 Test Event / Before Second NSWC PCD AN/AQS-20 Test Event							
9:02:06	2	50	1 (0.8)	2	80	0.5 (0.27)	Hazy
9:12:46	2	60	0.5 (0.27)	2	80	0.5 (0.27)	Hazy
9:21:58	2	60	0.5 (0.27)	2	80	0.5 (0.27)	Hazy
9:32:25	2	50	1 (0.8)	2	60	1 (0.8)	Hazy
9:41:55	2	75	0.5 (0.27)	2	70	0.5 (0.27)	Hazy
9:52:30	2	60	1 (0.8)	2	60	0.5 (0.27)	Hazy
10:01:35	2	60	1 (0.8)	2	60	0.5 (0.27)	Hazy
10:05:57	3	60	1 (0.8)	3	60	0.5 (0.27)	Hazy
10:11:30	2	60	1 (0.8)	2	60	0.5 (0.27)	Hazy
10:16:48	2	60	1 (0.8)	2	70	0.5 (0.27)	Hazy
10:25:53	2	70	0.5 (0.27)	2	60	0.5 (0.27)	Hazy
10:36:16	2	60	0.5 (0.27)	2	60	0.5 (0.27)	Hazy
10:45:36	2	60	0.5 (0.27)	2	60	0.5 (0.27)	Hazy

Time	Beaufort Left MMO	Glare Left MMO (%)	Visibility Distance Left MMO km (nmi)	Beaufort Right MMO	Glare Right MMO (%)	Visibility Distance Right MMO km (nmi)	Cloud Cover (%)
Survey on 23 May 2012: After First NSWC PCD AN/AQS-20 Test Event / Before Second NSWC PCD AN/AQS-20 Test Event (continued)							
10:55:57	2	60	0.5 (0.27)	2	60	0.5 (0.27)	Hazy
11:32:03	2	60	0.5 (0.27)	2	60	0.5 (0.27)	Hazy
Survey on 24 May 2012: Before Second NSWC PCD AN/AQS-20 Test Event							
8:57:16	2	40	1 (0.8)	2	60	0.5 (0.27)	30
9:07:29	2	40	1 (0.8)	2	80	0.5 (0.27)	3
9:30:15	2	70	1 (0.8)	2	40	1 (0.8)	40
9:51:15	2	40	1 (0.8)	2	85	0.5 (0.27)	40
10:23:52	2	70	1 (0.8)	2	40	1 (0.8)	40
10:27:45	2	70	1 (0.8)	2	30	1 (0.8)	40
10:34:15	2	60	1 (0.8)	2	65	0.5 (0.27)	40
11:07:04	1	40	1 (0.8)	1 (0.8)	25	1.5 (1.2)	30
11:17:15	1	40	1 (0.8)	1 (0.8)	50	1 (0.8)	30
11:27:18	1	60	0.5 (0.27)	1 (0.8)	40	1 (0.8)	20
12:02:05	1	40	1 (0.8)	1 (0.8)	20	1.5 (1.2)	20
12:12:15	1	40	1 (0.8)	1 (0.8)	20	1.5 (1.2)	20
12:22:17	1	40	1 (0.8)	1 (0.8)	30	1 (0.8)	20
Survey on 25 May 2012: During Second NSWC PCD AN/AQS-20 Test Event							
8:10:15	3	70	0.5 (0.27)	3	70	1 (0.8)	Hazy
8:13:16	4	70	0.5 (0.27)	4	70	1 (0.8)	Hazy
8:19:40	4	40	1 (0.8)	4	80	0.5 (0.27)	Hazy
8:30:14	4	70	0.5 (0.27)	4	50	1 (0.8)	Hazy
8:39:36	4	30	0.5 (0.27)	4	70	0.5 (0.27)	Hazy
8:50:44	4	70	0.5 (0.27)	4	40	0.5 (0.27)	Hazy
9:00:02	4	40	0.5 (0.27)	4	60	0.5 (0.27)	Hazy
9:13:13	4	40	0.5 (0.27)	4	60	0.5 (0.27)	Hazy
9:15:24	4	70	0.5 (0.27)	4	40	0.5 (0.27)	Hazy
9:25:01	4	40	0.5 (0.27)	4	80	0.5 (0.27)	Hazy
9:35:09	3	65	0.5 (0.27)	3	40	1 (0.8)	Hazy
9:45:35	3	40	1 (0.8)	3	60	1 (0.8)	Hazy
9:56:07	3	50	0.5 (0.27)	3	40	1 (0.8)	Hazy
10:06:04	3	30	1 (0.8)	3	60	0.5 (0.27)	Hazy
10:16:56	3	70	0.5 (0.27)	3	40	1 (0.8)	Hazy

Time	Beaufort Left MMO	Glare Left MMO (%)	Visibility Distance Left MMO km (nmi)	Beaufort Right MMO	Glare Right MMO (%)	Visibility Distance Right MMO km (nmi)	Cloud Cover (%)
Survey on 25 May 2012: During Second NSWC PCD AN/AQS-20 Test Event							
10:26:43	3	30	1 (0.8)	3	40	1 (0.8)	Hazy
10:37:15	3	65	0.5 (0.27)	3	40	1 (0.8)	Hazy
10:46:55	3	55	0.5 (0.27)	3	50	0.5 (0.27)	Hazy
10:55:53	2	30	1 (0.8)	2	50	0.5 (0.27)	Hazy
10:58:24	2	55	0.5 (0.27)	2	40	1 (0.8)	Hazy
11:07:30	2	55	0.5 (0.27)	2	40	1 (0.8)	Hazy
11:08:45	3	65	0.5 (0.27)	3	40	1 (0.8)	Hazy
11:11:57	3	50	1 (0.8)	2	60	0.5 (0.27)	Hazy
11:18:30	2	50	1 (0.8)	2	60	0.5 (0.27)	Hazy
11:22:59	1	60	1 (0.8)	2	40	1 (0.8)	Hazy
11:25:57	2	60	1 (0.8)	2	50	0.5 (0.27)	Hazy
11:32:35	3	55	1 (0.8)	3	50	0.5 (0.27)	Hazy
11:41:46	2	55	1 (0.8)	2	50	0.5 (0.27)	Hazy
11:44:05	2	45	1 (0.8)	2	50	0.5 (0.27)	Hazy
11:57:15	2	45	1 (0.8)	2	60	0.5 (0.27)	Hazy
Survey on 26 May 2012: After Second NSWC PCD AN/AQS-20 Test Event							
8:02:56	2	50	1 (0.8)	2	40	1 (0.8)	75
8:32:05	1	50	1 (0.8)	1	40	0.5 (0.27)	60
8:35:57	1	60	0.5 (0.27)	1	75	0.5 (0.27)	60
9:11:56	1	60	0.5 (0.27)	1	25	1 (0.8)	60
9:23:09	1	60	0.5 (0.27)	1	50	0.75 (2.5)	60
9:33:32	1	40	1 (0.8)	1	15	1.5 (1.2)	40
9:43:54	2	60	0.5 (0.27)	1	80	0.5 (0.27)	40
9:54:19	1	40	1 (0.8)	1	15	1.5 (1.2)	40
10:04:49	1	40	1 (0.8)	1	80	0.5 (0.27)	40
10:21:22	1	40	1 (0.8)	1	20	1.5 (1.2)	40
10:32:07	1	40	1 (0.8)	1	60	0.5 (0.27)	40
11:16:42	1	30	1 (0.8)	1	25	1.5 (1.2)	40

APPENDIX B

Focal-Follow Data

Table B-1 shows focal-follow behavioral data from the 20 to 26 May 2012 monitoring efforts before, during, and after the AN/AQS-20 sonar system test events. Twelve focal-follow events were conducted throughout the monitoring effort for the AN/AQS-20 sonar test events. Two focal follows occurred on 20 May 2012 and 21 May 2012, which were part of the surveys conducted before the first NSWC PCD AN/AQS-20 test event; both were for groups of bottlenose dolphins. Two focal follows occurred on 22 May 2012, which was part of the survey conducted during the first NSWC PCD AN/AQS-20 test event; both were for groups of bottlenose dolphins within the AN/AQS-20 survey area. One focal follow occurred on 23 May 2012, which was part of the survey conducted after the first NSWC PCD AN/AQS-20 test event and before the second NSWC PCD AN/AQS-20 test event; it was for a group of Atlantic spotted dolphins within the AN/AQS-20 survey area. Four focal follows were conducted on 24 May 2012, which were part of the survey conducted before the second NSWC PCD AN/AQS-20 test event; two were for sightings of bottlenose dolphins (one of which was off-effort), another was for a group of Atlantic spotted dolphins, and one was for a group of unidentified dolphins within the AN/AQS-20 survey area. No focal follows were conducted on 25 May 2012, which was part of the survey conducted during the second NSWC PCD AN/AQS-20 test event within the AN/AQS-20 survey area. Three focal follows were conducted on 26 May 2012, which were part of the survey conducted after the second NSWC PCD AN/AQS-20 test event; two were for groups of Atlantic spotted dolphins and one was for a group of bottlenose dolphins within the AN/AQS-20 survey area.

Table B-1. Focal-Follow Behavioral Data Collected During Monitoring

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 2 from 20 May 2012					
Species: *Tursiops truncatus*. Group size: 9.					
1	14:32:22	5/20/2012	30.066	-86.05	Travel heading west. Minimum Dispersal = 1, Maximum Dispersal = 6. Diving. Original 3 individuals gone.
2	14:33:19	5/20/2012	30.069	-86.049	Travel heading west. Minimum Dispersal = 1, Maximum Dispersal = 2.
3	14:34:35	5/20/2012	30.061	-86.046	Travel heading west. Minimum Dispersal = 1, Maximum Dispersal = 2. Others are next to each other. 7 individuals together; dove again.
4	14:35:47	5/20/2012	30.069	-86.049	Travel heading west. Minimum Dispersal = 1, Maximum Dispersal = 2. 4 individuals.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 2 from 20 May 2012 (continued)					
5	14:36:33	5/20/2012	30.067	-86.052	Travel heading west. Minimum Dispersal = 2, Maximum Dispersal = 2. 2 in back have moved forward and 2 in front still separated; rolling around together.
6	14:37:18	5/20/2012	30.061	-86.048	Travel heading west. Minimum Dispersal = NA, Maximum Dispersal = NA. No change from before; dove.
7	14:38:20	5/20/2012	30.061	-86.051	Travel heading west-southwest. Minimum Dispersal = 1, Maximum Dispersal = 1. All close together about 1 body length apart; more underwater travel.
8	14:40:15	5/20/2012	30.064	-86.054	Travel heading west-southwest. Minimum Dispersal = NA, Maximum Dispersal = NA. 1 animal – surface travel.
9	14:41:11	5/20/2012	30.065	-86.055	Travel heading west-southwest. Minimum Dispersal = 1, Maximum Dispersal = 2. 2 about 1 body length; 2
10	14:41:56	5/20/2012	30.067	-86.055	Travel heading west-southwest. Minimum Dispersal = 0.5, Maximum Dispersal = 0.5. Moving quickly - in a line; possible calf - large if so.
11	14:43:03	5/20/2012	30.071	-86.049	Travel heading west-southwest. Minimum Dispersal = 0.5, Maximum Dispersal = 1. Travel - surface just under water
12	14:44:04	5/20/2012	30.071	-86.051	Travel heading west-southwest. Minimum Dispersal = 0.5, Maximum Dispersal = 1. Surface travel.
13	14:45:12	5/20/2012	30.065	-86.049	Group not seen - but same as previous.
14	14:45:46	5/20/2012	30.068	-86.061	Travel heading west-southwest. Minimum Dispersal = 1, Maximum Dispersal = 5.
15	14:46:42	5/20/2012	30.067	-86.061	Travel heading west-southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. 1 animal about 0.25 miles from the rest of the individuals; 3 groups; 9 total animals.
16	14:47:48	5/20/2012	30.07	-86.054	Travel heading west-southwest. Minimum Dispersal = 1, Maximum Dispersal = 2. 3 groups of 3; about 1 body length apart; 3 groups following each other; one group is 2 body lengths apart
17	14:48:31	5/20/2012	30.065	-86.065	Travel heading west-southwest. Minimum Dispersal = 1, Maximum Dispersal = 2. Same.
18	14:49:03	5/20/2012	30.064	-86.055	Travel heading west-southwest. Minimum Dispersal = NA, Maximum Dispersal = NA.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 5 from 21 May 2012					
Species: *Tursiops truncatus*. Group size: 25.					
1	10:27:17	5/21/2012	26.997	-85.893	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 2.
2	10:28:52	5/21/2012	29.989	-85.897	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 6. Split into 3 groups.
3	10:30:04	5/21/2012	29.993	-85.888	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 6. 3 front, 2 middle; 4 groups.
4	10:31:17	5/21/2012	29.987	-85.894	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 6. Five groups traveling, groups tightening up a bit.
5	10:32:52	5/21/2012	29.994	-85.885	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 3. Tighter groups.
6	10:33:40	5/21/2012	29.996	-85.884	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 3. Five groups still, still just moving.
7	10:34:16	5/21/2012	29.993	-85.893	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 3. Surface travel, still moving.
8	10:36:01	5/21/2012	29.993	-85.892	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Body length dispersal is within individual groups.
9	10:37:32	5/21/2012	29.991	-85.889	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Some splashing but still traveling.
10	10:39:16	5/21/2012	29.994	-85.893	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Still 5 groups traveling at surface.
11	10:40:29	5/21/2012	30.000	-85.889	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Traveling some splashing, not much activity.
12	10:41:15	5/21/2012	29.994	-85.893	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Traveling.
13	10:42:07	5/21/2012	29.999	-85.892	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Traveling, splashing some underwater.
14	10:44:00	5/21/2012	30.001	-85.884	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 6. Traveling.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 5 from 21 May 2012 (continued)					
15	10:45:30	5/21/2012	30.003	-85.886	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 3. Traveling no splashing.
16	10:46:55	5/21/2012	30.001	-85.889	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 3. Traveling.
17	10:47:37	5/21/2012	30.003	-85.888	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 3. Traveling underwater.
Sighting Number 12 from 22 May 2012					
Species: *Tursiops truncatus*. Group size: 2.					
1	12:03:26	5/22/2012	29.945	-85.994	Travel heading northeast. Minimum Dispersal = 4, Maximum Dispersal = 4. 2 individuals traveling, now under.
2	12:04:28	5/22/2012	29.948	-85.997	Underwater. Dove, circling.
3	12:05:16	5/22/2012	29.945	-85.992	Travel heading south. Minimum Dispersal = 0.5, Maximum Dispersal = 0.5. Switch directions, still 2 animals.
4	12:06:21	5/22/2012	29.946	-85.998	Travel heading south. Minimum Dispersal = 0.5, Maximum Dispersal = 0.5. Brief surfacing.
5	12:07:09	5/22/2012	29.944	-85.991	Travel heading east. Now only one individual at surface.
6	12:08:06	5/22/2012	29.945	-85.989	Milling heading south. Lurking just under the water; not traveling; still only seeing one individual.
7	12:09:37	5/22/2012	29.951	-86.000	Milling heading south. Lurking just under the water; not traveling; still only seeing one individual.
8	12:10:07	5/22/2012	29.947	-85.991	Playing. Now seen playing with something on surface of water.
9	12:10:37	5/22/2012	29.955	-85.994	Playing. Second individual coming over and now together.
10	12:11:20	5/22/2012	29.946	-85.990	Both dove under the water.
11	12:12:22	5/22/2012	29.943	-85.996	Both still down under the water.
Sighting Number 18 from 22 May 2012					
Species: *Tursiops truncatus*. Group size: 7.					
1	12:35:45	5/22/2012	29.879	-85.979	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 3. Diving down.
2	12:36:15	5/22/2012	29.873	-85.972	One off by itself - 5 individuals best count now.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 18 from 22 May 2012 (continued)					
3	12:36:37	5/22/2012	29.882	-85.975	Loggerhead turtle sighted under the plane as well.
4	12:37:15	5/22/2012	29.872	-85.971	Milling heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 2. Some are close to each other and others a little more dispersed; the couple stragglers have not been sighted in awhile.
5	12:38:30	5/22/2012	29.877	-85.983	Milling heading east. Minimum Dispersal = 0, Maximum Dispersal = 2. Underwater.
6	12:39:36	5/22/2012	29.877	-85.980	Milling heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 2. Three individuals together; 2 were side by side.
7	12:40:31	5/22/2012	29.880	-85.979	Milling heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 2. Staying underwater; one may be a calf - confirm front one a calf.
8	12:41:15	5/22/2012	29.875	-85.981	4 individuals in group + stragglers = 7.
9	12:42:10	5/22/2012	29.880	-85.980	Underwater.
10	12:43:17	5/22/2012	29.880	-85.976	Milling/slow travel heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 2. Slowly moving and milling around
11	12:44:59	5/22/2012	29.880	-85.978	Milling/slow travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 1. Collecting video; now underwater close to surface; grouped up in chorus line.
12	12:46:25	5/22/2012	29.877	-85.984	Milling/slow travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 1.
13	12:47:27	5/22/2012	29.881	-85.981	Milling/slow travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 1. Still lined up.
14	12:48:17	5/22/2012	29.881	-85.980	Milling/slow travel heading south. Minimum Dispersal = 1, Maximum Dispersal = 1.
15	12:49:15	5/22/2012	29.877	-85.976	Milling/slow travel heading south. Minimum Dispersal = 1, Maximum Dispersal = 1.
16	12:50:03	5/22/2012	29.875	-85.977	Milling/slow travel heading south. Minimum Dispersal = 1, Maximum Dispersal = 1. For 3 individuals.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 18 from 22 May 2012 (continued)					
17	12:50:35	5/22/2012	29.880	-85.982	Minimum Dispersal = 2, Maximum Dispersal = 2. Spreading out and going underwater.
18	12:53:33	5/22/2012	29.874	-85.980	Dove.
19	12:54:43	5/22/2012	29.875	-85.983	Milling/slow travel heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 2. More animals - 5 definitely calf - focal group.
20	12:55:55	5/22/2012	29.881	-85.979	Milling/slow travel heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 2.
Sighting Number 21 from 23 May 2012					
Species: *Stenella frontalis*. Group size: 14.					
1	11:04:12	5/23/2012	29.762	-85.855	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5.
2	11:06:02	5/23/2012	29.767	-85.851	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5.
3	11:07:45	5/23/2012	29.763	-85.850	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. One swimming upside down in the middle of the group in a leisurely pace.
4	11:08:33	5/23/2012	29.767	-85.854	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. Travel just below surface following *Sargassum* line.
5	11:09:47	5/23/2012	29.761	-85.850	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. Same travel but a couple more are on their backs.
6	11:10:41	5/23/2012	29.758	-85.852	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. One splashing, all still traveling.
7	11:11:50	5/23/2012	29.759	-85.861	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. All dove a bit deeper, we can still see them.
8	11:12:38	5/23/2012	29.758	-85.861	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. Still underwater.
9	11:13:58	5/23/2012	29.762	-85.854	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. Still underwater, might be feeding in *Sargassum* line.
10	11:15:43	5/23/2012	29.758	-85.853	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. Might have 14 or so.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 21 from 23 May 2012 (continued)					
11	11:16:15	5/23/2012	29.759	-85.863	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. Still under.
12	11:17:27	5/23/2012	29.758	-85.855	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 8. Seem to be dividing into 2 groups; front and back.
13	11:18:35	5/23/2012	29.752	-85.861	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 8. Still traveling underwater and seem to be joining up together into one large group.
14	11:19:45	5/23/2012	29.760	-85.862	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 8. Same travel but a couple more are on their backs again.
15	11:20:22	5/23/2012	29.754	-85.864	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 8.
16	11:21:17	5/23/2012	29.753	-85.863	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 8. Same leisurely travel just under the surface.
17	11:22:08	5/23/2012	29.752	-85.863	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 8.
18	11:23:29	5/23/2012	29.755	-85.856	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 8. Same behavior, starting video.
19	11:24:37	5/23/2012	29.749	-85.861	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 8. Same behavior.
20	11:26:15	5/23/2012	29.752	-85.856	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 8. One splashing, all still traveling.
21	11:27:50	5/23/2012	29.757	-85.861	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 7. A bit closer together, possible calf.
22	11:29:09	5/23/2012	29.748	-85.859	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 7. Same travel, 3 of them dove.
23	11:30:01	5/23/2012	29.749	-85.864	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 7. Still traveling, making 3 smaller inline groups, 5 in front, 8 in middle, and 2 in back.
24	11:31:41	5/23/2012	29.746	-85.862	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 7. Same behavior, end of filming.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 12 from 24 May 2012					
Species: *Tursiops truncatus*. Group size: 1.					
1	9:37:33	5/24/2012	29.949	-86.078	Diving/fast travel heading south. One individual.
2	9:38:23	5/24/2012	29.950	-86.075	Diving/fast travel heading east. Changed direction.
3	9:39:26	5/24/2012	29.946	-86.070	Diving/fast travel heading southeast. Changed direction.
4	9:40:32	5/24/2012	29.942	-86.078	Lost sighting of individual.
5	9:41:57	5/24/2012	29.939	-86.073	Resighted individual heading toward charter headboat that is traveling away from AN/AQS-20 Study Area.
6	9:43:05	5/24/2012	29.941	-86.073	Still heading toward boat.
7	9:44:17	5/24/2012	29.934	-86.072	Individual jumped by the headboat vessel; approaching vessel.
8	9:45:13	5/24/2012	29.934	-86.073	Lost sighting of individual.
Sighting Number 16 from 24 May 2012					
Species: Unidentified Dolphin. Group size: 8.					
1	9:57:41	5/24/2012	29.979	-85.992	Slow Travel heading east. Minimum Dispersal = 4, Maximum Dispersal = 5. Best count 4, wide dispersal.
2	9:59:09	5/24/2012	29.974	-85.994	Slow Travel heading east. Minimum Dispersal 3, Maximum Dispersal = 6. Getting closer together and grouping up.
3	10:00:32	5/24/2012	29.972	-85.986	Slow Travel heading east. Minimum Dispersal 3, Maximum Dispersal = 6. Another dolphin sighted so now 5 individuals; swimming in a chorus line.
4	10:01:34	5/24/2012	29.972	-85.991	Slow Travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 3. Diving now a little.
5	10:02:28	5/24/2012	29.971	-85.989	Slow Travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 3. Same behaviors seen; traveling right under the surface.
6	10:04:19	5/24/2012	29.978	-85.984	Slow Travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 3. All five together in group.
7	10:05:26	5/24/2012	-29.972	-85.981	Slow Travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 3. Collecting video; end of camera photographs; all went down; one more individual sighted bringing total to 6.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 16 from 24 May 2012 (continued)					
8	10:06:38	5/24/2012	29.976	-85.986	Slow Travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 15. Greater dispersal now; scattered; cannot get video because they dispersed.
9	10:07:37	5/24/2012	29.975	-85.980	Slow Travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 15. Three below the plane now and grouping back up; back to traveling and seems to be moving faster now.
10	10:08:11	5/24/2012	29.978	-85.980	Slow Travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 15. Whole group is joining back together - 5.
11	10:09:16	5/24/2012	29.971	-85.979	Slow Travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 6. Some individuals are about 6 body lengths apart.
12	10:10:07	5/24/2012	29.972	-85.977	Slow travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 6. No changes in behavior state.
13	10:11:05	5/24/2012	29.969	-85.981	Slow travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 6. No changes in behavior state.
14	10:12:07	5/24/2012	29.970	-85.984	Slow travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 6. Two groups of 3 animals and one individual off to right for a total of 7 animals.
15	10:13:07	5/24/2012	29.974	-85.985	Slow travel heading east. Minimum Dispersal = 0.5, Maximum Dispersal = 6. Two animals instead of just one off by itself to total 8 animals.
16	10:14:00	5/24/2012	29.976	-85.980	Slow travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Joining as one group now; one individual is off by itself.
17	10:15:12	5/24/2012	29.967	-85.978	Slow travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Same behavior states.
18	10:16:20	5/24/2012	29.974	-85.981	Slow travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Underwater; all in one group.
19	10:17:49	5/24/2012	29.966	-85.977	Dove heading east. Minimum Dispersal = 2, Maximum Dispersal = 4. All spooked and dove.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 23 from 24 May 2012					
Species: *Tursiops truncatus*. Group size: 7.					
1	10:40:45	5/24/2012	29.926	-85.949	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 4. Following group sighted while off-effort. Two are keeping something between, perhaps the calf. Confirmed, the baby is playing between two adults. The group has 6 individuals with a seventh lone individual off behind group.
2	10:42:34	5/24/2012	29.924	-85.956	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 4. Some dove down under the water.
3	10:43:43	5/24/2012	29.929	-85.958	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 4. One individual goes under the other individual where the calf is.
4	10:44:43	5/24/2012	29.929	-85.958	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 4. Same behavioral state.
5	10:45:50	5/24/2012	29.932	-85.954	Travel heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 4. Animals are traveling slowly.
6	10:47:02	5/24/2012	29.931	-85.949	Travel heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 4. Confirmed bottlenose dolphins; end photos and start video.
7	10:48:16	5/24/2012	29.928	-85.947	Travel heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 4. No change in behavioral state.
8	10:49:37	5/24/2012	29.926	-85.957	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 4. No change in behavioral state.
9	10:51:13	5/24/2012	29.926	-85.949	Dove heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 4. Dove; seen underwater with at least one individual's white of belly.
10	10:52:11	5/24/2012	29.927	-85.954	Dove heading southwest, still down.
11	10:53:20	5/24/2012	29.926	-85.956	Travel heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 6. Surfaced; traveling in circles because plane's circles are not moving and keeping them on the wing.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 23 from 24 May 2012 (continued)					
12	10:54:53	5/24/2012	29.926	-85.947	Travel heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 6. Same behavioral state.
13	10:55:40	5/24/2012	29.928	-85.946	Diving heading southwest, all animals dove down; can see underwater.
14	10:56:41	5/24/2012	29.925	-85.947	Travel heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 6. Diving down and swimming around and then re-surfacing.
15	10:57:31	5/24/2012	29.927	-85.946	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 6. Five surfaced in same area and simultaneously.
16	10:57:56	5/24/2012	29.923	-85.954	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 6. Mom and calf are farther away; individuals that are about 6 body lengths from the group.
17	10:58:54	5/24/2012	29.925	-85.956	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 10. One individual is leaving group and swimming away - about 10 body lengths away now.
18	10:59:39	5/24/2012	29.922	-85.953	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 10. Same behavioral state.
19	10:59:54	5/24/2012	29.925	-85.956	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 6. Two are in the front; 3 in the back where calf is; distribution of 2 groups is 6 body lengths and within each group they are right next to one another.
20	11:00:53	5/24/2012	29.925	-85.957	Travel/diving heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 6.
Sighting Number 36 from 24 May 2012					
Species: *Stenella frontalis*. Group size: 60.					
1	11:36:00	5/24/2012	29.818	-85.957	Travel heading east. Minimum Dispersal = 0, Maximum Dispersal = 20. Traveling/milling splashing and playing. Lots of splashing.
2	11:37:45	5/24/2012	29.809	-85.951	Travel heading east. Minimum Dispersal = 0, Maximum Dispersal = 20. Some are jumping straight up and straight down. Initial estimate was 40 - pilot seeing 41.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 36 from 24 May 2012 (continued)					
3	11:39:06	5/24/2012	29.818	-85.958	Travel heading east. Minimum Dispersal = 0, Maximum Dispersal = 20. Some are milling; some are at surface; some of them are underwater; jumping.
4	11:40:06	5/24/2012	29.817	-85.959	Travel heading east. Minimum Dispersal = 0, Maximum Dispersal = 20. Lots of jumping in back of group. One individual cleared the water.
5	11:40:52	5/24/2012	29.813	-85.956	Travel heading west. Minimum Dispersal = 0, Maximum Dispersal = 20. Pointed west. Airplane circles are not moving so milling about, playing, splashing, and slow travel. Tail slapping.
6	11:42:19	5/24/2012	29.822	-85.953	Travel heading west. Minimum Dispersal = 0, Maximum Dispersal = 20. Same behaviors. Milling.
7	11:43:12	5/24/2012	29.82	-85.960	Travel heading west. Minimum Dispersal = 0, Maximum Dispersal = 20. Four groups following each other.
8	11:44:07	5/24/2012	29.814	-85.959	Minimum Dispersal = 0, Maximum Dispersal = 20. A few individuals are swimming with bellies to surface of water. Animals turned to the south and they all did so at once.
9	11:45:28	5/24/2012	29.823	-85.955	Travel heading southwest. Minimum Dispersal = 0, Maximum Dispersal = 20. Milling about still. More lined up side by side in a chorus line instead of in front of each other.
10	11:46:59	5/24/2012	29.814	-85.953	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. End photos; start videotaping. Groups are looking tighter bunched and dispersed among them.
11	11:48:27	5/24/2012	29.816	-85.964	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. Individuals jumping out of the water.
12	11:48:53	5/24/2012	29.817	-85.954	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. Play behavior observed. Whipping around underwater.
13	11:50:07	5/24/2012	29.812	-85.959	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. Play/milling/travel. Some individuals traveling with bellies to the surface. A large group is bunched up together, 4 smaller groups to middle, and another larger, tightly bunched group at the back.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 36 from 24 May 2012 (continued)					
14	11:51:18	5/24/2012	29.817	-85.968	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. Same behaviors.
15	11:52:24	5/24/2012	29.815	-85.969	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. Broken up into three groups
16	11:53:23	5/24/2012	29.815	-85.969	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. Lots of underwater play - twists.
17	11:54:37	5/24/2012	29.820	-85.962	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. Five calves and approximately 60 total individuals.
18	11:55:28	5/24/2012	29.820	-85.966	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. Spending more time under surface. 3-6 groups.
19	11:56:25	5/24/2012	29.820	-85.965	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. Same behaviors.
20	11:57:35	5/24/2012	29.820	-85.962	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. All animals coming together into one big group again
21	11:58:26	5/24/2012	29.820	-85.968	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 20. End of focal follow.
Sighting Number 1 from 26 May 2012					
Species: *Tursiops truncatus*. Group size: 22.					
1	8:08:48	5/26/2012	30.026	-86.088	Travel heading northeast. Minimum Dispersal = 1, Maximum Dispersal = 15. Underwater; a couple at surface; 16 individuals in 3 or 4 groups.
2	8:10:05	5/26/2012	30.022	-86.095	Travel heading northeast. Minimum Dispersal = 1, Maximum Dispersal = 15. Fifteen body lengths between the groups; still staying underwater.
3	8:11:11	5/26/2012	30.027	-86.094	Travel heading northeast. Minimum Dispersal = 1, Maximum Dispersal = 15. Slow travel; come up for air and then go down again.
4	8:12:21	5/26/2012	30.027	-86.086	Travel heading northeast. Minimum Dispersal = 1, Maximum Dispersal = 15. Dispersal is same but seem like 2 groups instead of 4; within groups 1-2 body lengths; some individuals swimming above other individuals; switch to video.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 1 from 26 May 2012 (continued)					
5	8:13:20	5/26/2012	30.024	-86.086	Tail slap.
6	8:14:22	5/26/2012	30.023	-86.086	Travel heading northeast. Minimum Dispersal = 1, Maximum Dispersal = 15. Dispersal within group is 1-5 body lengths; starting to line up in a chorus line instead of front to back.
7	8:15:23	5/26/2012	30.023	-86.093	Travel heading northwest. Minimum Dispersal = 1, Maximum Dispersal = 15. Direction of travel slightly changed to NW from NE.
8	8:15:51	5/26/2012	30.031	-86.093	Traveling. All dove down at the same time
9	8:16:30	5/26/2012	30.025	-86.094	One group lining up.
10	8:17:16	5/26/2012	30.023	-86.091	Travel heading northwest. Minimum Dispersal = 1, Maximum Dispersal = 15. Big blow.
11	8:18:23	5/26/2012	30.027	-86.094	Travel heading northwest. Minimum Dispersal = 1, Maximum Dispersal = 15. Some rings from diving; 2 main groups.
12	8:19:22	5/26/2012	30.028	-86.093	Travel heading northwest. Minimum Dispersal = 1, Maximum Dispersal = 15. Consistent travel to NW.
13	8:20:30	5/26/2012	30.033	-86.088	Travel heading northwest. Minimum Dispersal = 1, Maximum Dispersal = 15. Juvenile sighted in group.
14	8:21:04	5/26/2012	30.027	-86.092	Travel heading northwest. Minimum Dispersal = 1, Maximum Dispersal = 15. Two groups are merging together; 22 individuals counted.
15	8:21:33	5/26/2012	30.034	-86.086	Milling. Minimum Dispersal = 1, Maximum Dispersal = 18. Now one large group.
16	8:22:12	5/26/2012	30.033	-86.089	Milling. Minimum Dispersal = 1, Maximum Dispersal = 8. One calf sighted in addition to juvenile.
17	8:23:06	5/26/2012	30.032	-86.091	Milling. Minimum Dispersal = 1, Maximum Dispersal = 8. Three are swimming exact distance apart; leisure swim.
18	8:24:08	5/26/2012	30.034	-86.089	Traveling. Minimum Dispersal = 1, Maximum Dispersal = 8. Cruising through the water.
19	8:25:14	5/26/2012	30.030	-86.081	Traveling. Front group did 180 degree turn and came to back group; piled on top of each other.
20	8:25:38	5/26/2012	30.026	-86.089	Splashing.
21	8:25:45	5/26/2012	30.030	-86.092	Diving deeper now.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 1 from 26 May 2012 (continued)					
22	8:26:20	5/26/2012	30.030	-86.082	Can only see a couple; most are deep.
23	8:26:52	5/26/2012	30.035	-86.088	Individual animal straggling below us.
24	8:27:04	5/26/2012	30.029	-86.083	Deep; tight non-uniform group under the water.
25	8:28:10	5/26/2012	30.032	-86.090	Travel heading northwest. Minimum Dispersal = 1, Maximum Dispersal = 4. At surface, anywhere from touching to 4 body lengths; all traveling same direction.
26	8:29:10	5/26/2012	30.035	-86.090	Travel heading northwest. Minimum Dispersal = 1, Maximum Dispersal = 4. Spreading out a little more; now diving back down; perhaps responding to the aircraft; will go back on line.
Sighting Number 7 from 26 May 2012					
Species: *Stenella frontalis*. Group size: 18.					
1	8:45:24	5/26/2012	30.027	-86.027	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 3. One group traveling.
2	8:46:13	5/26/2012	30.026	-86.030	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 3. Splashing, but mostly surface travel.
3	8:47:01	5/26/2012	30.025	-86.030	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 8. Breaking off into two groups; within the groups 0 to 3 body lengths; 7 in front and 8 in back.
4	8:47:51	5/26/2012	30.020	-86.029	Play activity seen.
5	8:48:46	5/26/2012	30.023	-86.031	Travel heading south. Minimum Dispersal = 1, Maximum Dispersal = 6. Groups merging back up.
6	8:49:20	5/26/2012	30.021	-86.023	Traveling, almost all are down now.
7	8:50:19	5/26/2012	30.020	-86.028	Starting to come to the surface.
8	8:51:07	5/26/2012	30.020	-86.027	Travel heading south. Minimum Dispersal = 1, Maximum Dispersal = 5. Five body lengths; 4-5 in first group and the rest are in back; the groups are merging and swimming side-by-side.
9	8:52:54	5/26/2012	30.020	-86.028	Traveling, all are dispersed farther apart.
10	8:53:56	5/26/2012	30.020	-86.033	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 4. Eighteen individuals counted; all in one group; look like they are tightening up; splashing at surface and coming up to surface from a dive.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 7 from 26 May 2012 (continued)					
11	8:55:14	5/26/2012	30.027	-86.033	Travel heading south. Minimum Dispersal = 0, Maximum Dispersal = 4. Coming up a little bit to surface; keeping dispersal, come up breath and dive again.
12	8:56:14	5/26/2012	30.027	-86.031	Seems there are more frequent surfacings.
13	8:56:29	5/26/2012	30.023	-86.030	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 5. Forming more of a line front to back than side-to-side.
14	8:57:22	5/26/2012	30.023	-86.031	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 6. Group is more dispersed; all are 1-2 body lengths.
15	8:58:31	5/26/2012	30.021	-86.039	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 6. Same behavioral state.
16	8:59:17	5/26/2012	30.019	-86.038	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 6. Lining up, almost in a chorus line; the front 2 were and now they are back in a pack.
17	9:00:14	5/26/2012	30.018	-86.040	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 6. Same behavioral state; one juvenile sighted; no calves sighted.
18	9:01:02	5/26/2012	30.019	-86.036	Surface-active travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 6. Splashing and twisting while they are traveling; have traveled several miles since started tracking.
19	9:02:00	5/26/2012	30.019	-86.036	Surface-active travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 6. Upside-down swimming by a couple individuals.
20	9:04:09	5/26/2012	30.020	-86.038	Surface-active travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 6. Same behavior state.
21	9:05:14	5/26/2012	30.016	-86.041	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 6. Moving faster now.
22	9:05:33	5/26/2012	30.016	-86.051	Surface-active travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 6. Some exhibiting play, others just traveling.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 24 from 26 May 2012					
Species: *Stenella frontalis*. Group size: 9.					
1	10:35:41	5/26/2012	29.803	-85.899	Travel heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Initial count is 4 individuals. Traveling at surface and then diving. Collect photos.
2	10:36:41	5/26/2012	29.800	-85.897	Travel/feeding heading east. Minimum Dispersal = 1, Maximum Dispersal = 4. Moving around a lot.
3	10:37:45	5/26/2012	29.797	-85.900	Travel/feeding underwater.
4	10:38:52	5/26/2012	48.239	-85.901	Travel/feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 4. All surfaced together; 5 individuals counted now.
5	10:39:55	5/26/2012	29.804	-85.900	Splashing on side; clearing water.
6	10:40:25	5/26/2012	29.796	-85.906	Travel/feeding, play activity seen.
7	10:41:23	5/26/2012	29.796	-85.907	Travel/feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 2. Getting closer together to one another. Activity underwater.
8	10:42:56	5/26/2012	29.801	-85.901	Travel/feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 6. Behavior is same although individuals are getting more dispersed.
9	10:43:47	5/26/2012	29.803	-85.903	Travel/feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 6. Now behavior is more travel, less play.
10	10:44:00	5/26/2012	29.797	-85.908	Feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 2. Upside down swimming; photograph shows animals feeding - individual with fish in mouth.
11	10:45:14	5/26/2012	29.804	-85.911	Feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 4. Same behavior.
12	10:46:17	5/26/2012	29.806	-85.911	Feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 4. Same behavior; 2 separated from group.
13	10:47:02	5/26/2012	29.805	-85.913	Feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 4. One calf and there are 6 individuals including the calf; second group showed up with 4 individuals.
14	10:48:57	5/26/2012	29.803	-85.917	Travel/feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 4. Calf right below plane.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 24 from 26 May 2012 (continued)					
15	10:49:31	5/26/2012	29.799	-85.913	Travel/feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 4. Moving toward recreational boat; animals seem to be moving more quickly.
16	10:51:28	5/26/2012	29.799	-85.913	Travel/feeding heading west. Minimum Dispersal = 1, Maximum Dispersal = 4. Three or 4 are just below the plane.
17	10:52:10	5/26/2012	29.802	-85.911	Travel/milling heading W. Minimum Dispersal = 1, Maximum Dispersal = >20. Dispersed; some are over 20 body lengths away. No activity with the fish now. Seems like they are joining back up.
18	10:53:36	5/26/2012	29.804	-85.922	Travel/milling heading west. Minimum Dispersal = 1, Maximum Dispersal = >20. Five to six are 10 body lengths apart.
19	10:54:03	5/26/2012	29.807	-85.911	Dive heading west. Minimum Dispersal = 1, Maximum Dispersal = >20. All down.
20	10:54:07	5/26/2012	29.807	-85.911	Minimum Dispersal = 1, Maximum Dispersal = >20. Resurfaced.
21	10:54:44	5/26/2012	29.809	-85.914	Minimum Dispersal = 1, Maximum Dispersal = >20. Group of 5 has gone back together; 1-4 body lengths within that group.
22	10:55:30	5/26/2012	29.800	-85.920	All animals are grouping up together.
23	10:55:38	5/26/2012	29.804	-85.923	Travel heading southwest. New count is 9; in a tight pack and under the surface.
24	10:56:33	5/26/2012	29.805	-85.924	Travel heading southwest. Upside down swim; lined up front to back.
25	10:57:23	5/26/2012	29.804	-85.924	Travel heading southwest. Under the surface of the water.
26	10:58:22	5/26/2012	29.806	-85.925	Travel heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 4. Grouped up tight.
27	10:59:29	5/26/2012	29.809	-85.925	Potential foraging. Likely still foraging, just not as aggressively as they were earlier. Some are diving deeper than the others.
28	11:00:48	5/26/2012	29.805	-85.918	Dove heading southwest. Minimum Dispersal = 1, Maximum Dispersal = 4. All below water.
29	11:01:12	5/26/2012	29.809	-85.928	Initial group was 4 and 5 joined up (group with the calf); 2 up front leading group.
30	11:01:52	5/26/2012	29.804	-85.926	Individuals at back of pack caught up and are now tightly grouped.
31	11:02:46	5/26/2012	29.803	-85.925	Same behavior state. Surfacing at intervals with deep diving.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 24 from 26 May 2012 (continued)					
32	11:03:09	5/26/2012	29.811	-85.928	Dispersing - most are 3 body lengths apart.
33	11:04:57	5/26/2012	29.810	-85.932	Traveling and swimming together synchronized.
34	11:05:16	5/26/2012	29.810	-85.922	One individual is swimming upside down behind the other individuals.
35	11:06:07	5/26/2012	29.813	-85.925	Grouped up tight and in ball. Dove deep.
36	11:06:28	5/26/2012	29.804	-85.927	Resurfaced.
37	11:07:22	5/26/2012	29.805	-85.925	End of focal follow.

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Appendix D – October 2011 Aerial Monitoring Survey Trip Report

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Naval Surface Warfare Center
Panama City Division (NSWC PCD)

Marine Species Monitoring

AERIAL MONITORING SURVEYS
TRIP REPORT

February 2012

ACRONYMS AND ABBREVIATIONS

AMNS	Airborne Mine Neutralization System
DON	Department of the Navy
ft	feet
GOM	Gulf of Mexico
h	hour(s)
HDR EOC	HDR Environmental, Operations and Construction, Inc.
ICMP	Integrated Comprehensive Monitoring Program
km	kilometer(s)
kn	knot(s)
m	meter(s)
min	minute(s)
nmi	nautical mile(s)
NSWC PCD	Naval Surface Warfare Center Panama City Division
OPAREA	Operating Area
RDT&E	Research, Development, Test, and Evaluation
SPUE	Sightings Per Unit Effort
U.S.	United States

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Section 1 Introduction

Aerial marine species monitoring surveys occurred during 19 through 22 October 2011 for an Airborne Mine Neutralization System (AMNS) live-inert explosive research, development, test, and evaluation (RDT&E) event. These surveys were conducted off the west coast of Florida in the Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area in the Gulf of Mexico (GOM). The AMNS is a mine countermeasures device that includes an explosive charge.

As part of the requirements for compliance with the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, the United States (U.S.) Navy developed the Integrated Comprehensive Monitoring Program (ICMP). The ICMP applies by regulation to those activities on U.S. Navy training ranges and operating areas (OPAREAs) for which the U.S. Navy has sought and received incidental take authorizations. To support the U.S. Navy in meeting regulatory requirements for monitoring established under the NSWC PCD Final Rule, and to provide a mechanism to assist with coordination of program objectives under the ICMP, monitoring of marine mammals and sea turtles (protected marine species) during this test event included visual surveys from a fixed-wing aircraft.

Section 2 Methods

Study Area

The NSWC PCD Study Area includes both territorial (waters that are between 0 and 22 kilometers [km] (0 and 12 nautical miles [nmi]) and non-territorial (waters that are beyond the 22 km [12 nmi] limit) waters. Monitoring conducted for protected marine species during the AMNS test event was focused within the Panama City OPAREA of the NSWC PCD Study Area (**Figure 1**). The test area for the AMNS system is approximately 22 km (12 nmi) offshore, covers an area approximately 21 square kilometers (km^2) (6 square nautical miles [nmi^2]) in size, and ranges in bottom depth from 28 to 35 meters (m) (92 to 115 feet [ft]).

Aerial-Based Monitoring

Aerial-based monitoring was performed over a four-day period from 19 through 22 October 2011 (**Table 1**). Survey methods were generally consistent with currently accepted Distance Sampling theory (Buckland et al. 2001) and followed a well-established protocol used for aerial surveys throughout all U.S. Navy range complexes (e.g., Smultea et al., 2009). A survey altitude and speed of approximately 305 m (1,000 ft) and 185 km/h (100 knots) was maintained while on-effort, but might have varied slightly based on weather conditions in the area. Once a marine mammal sighting was made, a focal-follow circling session was attempted at 305 m (1,000 ft) or higher if conditions were appropriate (Smultea et al. 2009; refer to the survey methods on page 4 of this document). A lower altitude of approximately 210 to 250 m (700 to 800 ft) was established after focal-follow sessions for photographic purposes to provide sharper images required for species identification.

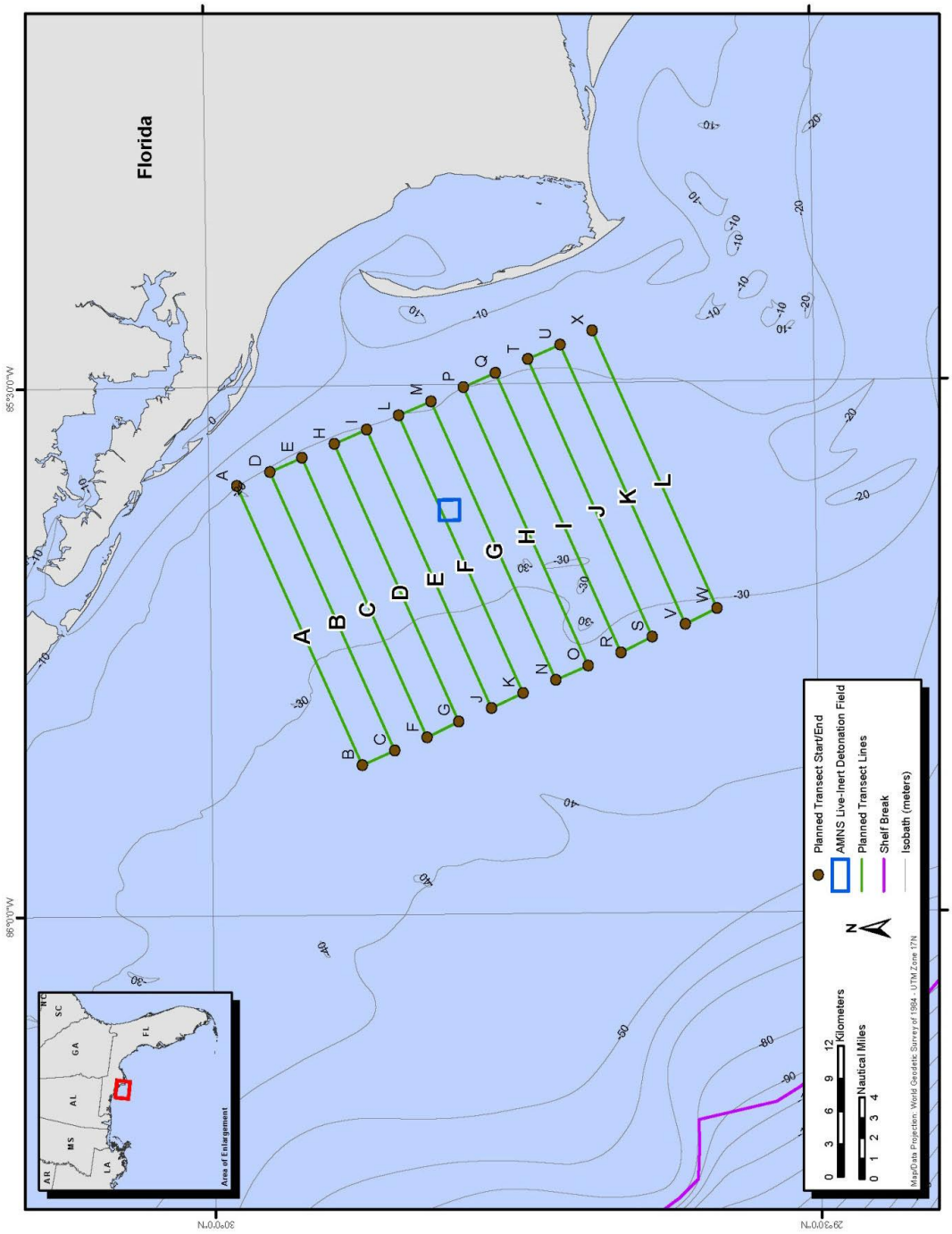

Figure 1. Pre-planned Track Lines for the Monitoring Effort for the AMNS Live-inert Explosives Test Event for 19-22 October 2011 in the NSWC PCD Study Area

Table 1. Summary of NSWC PCD Monitoring Effort

Date	Description	Start Time	Stop Time	Total Survey Minutes*	Total On-Effort Minutes	Trackline On-Effort Distance (km)	Trackline On-Effort Distance (nmi)
19 October	Transect Survey (Pre-Event)	15:03	16:53	110	90	314	170
20 October	Transect Survey (Pre-Event)	7:47	9:41	114	98	335	181
21 October	Transect Survey (During Event)	11:06	16:12	305	197	621	335
22 October	Transect Survey (Post-Event)	8:48	11:58	190	151	498	269
Total				**719 (≈12.0 hours)**	**536 (≈8.9 hours)**	**1,768**	**955**

Note: *Total Survey Minutes reflect minutes expended in the range/area of interest and include both on-effort (systematic) and off-effort (cross-legs between transects, and circling for focal follows or species ID) total minutes. Total Survey Minutes may not match the difference between Start Time and Stop Time in the table due to differences in rounding.

The observation platform was a Cessna T337H Turbo Skymaster aircraft operating out of Northwest Florida Beaches International Airport, Panama City Beach, Florida. Four surveys were conducted following pre-planned transect lines covering the entire AMNS test area. The lines were defined by waypoints designed to extend beyond the entire range (if permitted by U.S. Navy and U.S. Air Force flight operations) during each survey day for a total flight-time window over 5 hours (h) (**Table 1, Figure 1**). Aerial observers (**Table 2**) were experienced with line-transect survey methodology, had experience in identification of Atlantic marine mammal and sea turtle species, were knowledgeable of marine mammal biology and behavior, and had previous experience conducting marine mammal and sea turtle observations.

Table 2. Observers and Roles

Observer	Role(s)	Dates of Participation
Lenisa Blair	Observer	19-21 Oct
Dana Spontak	Observer	19-22 Oct
Jennifer Latusek-Nabholz	Chief Scientist/Observer	22-Oct

Survey effort was designed to include the entirety of the AMNS test area. Twelve parallel tracklines running approximately east-south-east to west-north-west, measuring 27.8 km (15 nmi) in length, and spaced approximately 3.7 km (2 nmi) apart were flown during

"systematic" efforts throughout the surveys. The lines provided a total survey coverage area (hereinafter referred to as the survey area) of approximately 986 km^2 (287 nmi^2) (**Figure 1**). Planned lines were followed when possible, but exact lines followed for each survey day were subject to modifications as a result of range exclusion by unfavorable weather conditions in the Panama City OPAREA of the NSWC PCD Study Area (**Table 1, Figures 2 through 6**).

The following describe the general survey approach:

1. Followed pre-planned transect lines and waypoints using methods described by Smultea et al. (2009) until a sighting occurred. Variables such as sea state, glare, and visibility were recorded for each transect flown.
2. Upon sighting a marine mammal/sea turtle group, recorded basic sighting information per established protocol (Smultea et al. 2009). As outlined in the NSWC PCD Study Area Monitoring Plan (DON 2010), information included: (1) species identification and group size; (2) location (relative to observation platform); (3) the behavior of marine mammals and sea turtles; (4) date, time, and environmental and oceanographic conditions associated with each observation; (5) direction of travel relative to true North; and (6) duration of the observation.
3. If the species appeared suitable for a focal follow, the aircraft increased altitude to approximately 365 to 455 m (1,200 to 1,500 ft) and radial distance increased approximately 0.5 to 1.0 km (0.3 to 0.5 nmi). Then, the aircraft circled the sighting to obtain detailed behavioral information as long as possible and logistically feasible (i.e., Beaufort sea state, visibility, group size, behavior, dive times, aircraft considerations [e.g., fuel], etc.). Focal follows occurred for a minimum of 5 minutes (min) and included an observer taking digital photographs of the group when possible.
4. If the sighting was not selected for a focal follow, and species and group size were unknown, the aircraft circled the sighting to obtain digital photographs for confirmation of species identification and to estimate group size/composition.

Section 3 Results

Survey Effort

Observers visually surveyed 1,768 km (955 nmi) of on-effort tracklines and 2,390 km (1,290 nmi) of total trackline (including the systematic transects, cross-legs between transects, and circling for focal follows or species ID) during four days for 8.9 h of on-effort status (**Table 1**). Trackline distance was estimated based on pre-planned lines when the global positioning system (GPS) lost signal for the entire duration of the fourth line and first portion of the fifth line conducted during the pre-AMNS event survey on 19 October. Beaufort sea state ranged from 3 to 6, and all sightings were made in Beaufort sea states between 3 and 4 (**Table 3**). **Appendix A** contains a detailed description of environmental, oceanographic, and sighting conditions.

Sightings

Four sightings of cetaceans and 25 sightings of sea turtles were recorded during times of both on-effort and off-effort, which encompassed approximately 12 h of total survey flight time within the survey area (**Figure 2, Table 3**).

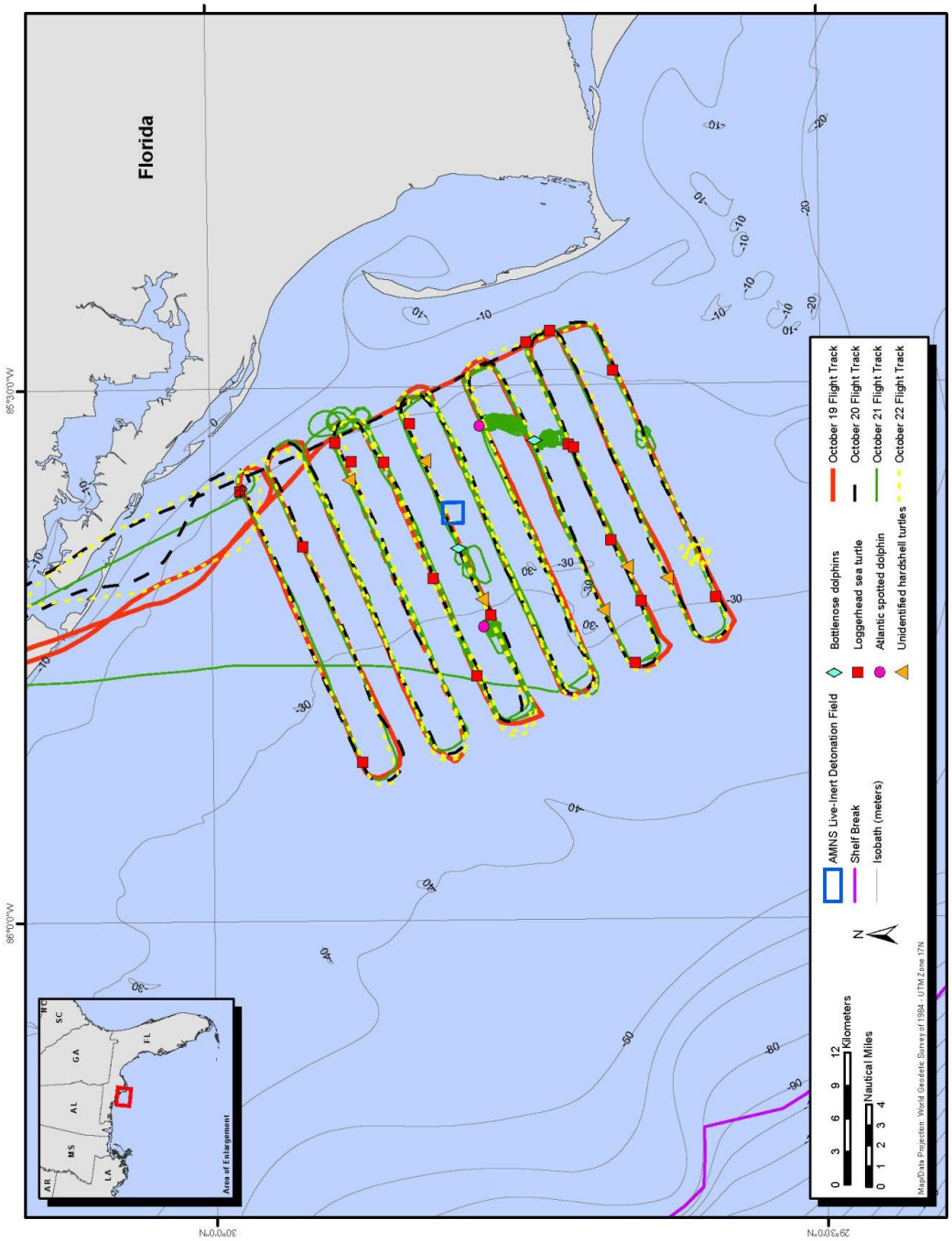

Figure 2. Location of All Cetacean and Sea Turtle Sightings Recorded Throughout the AMNS Survey Period (19-22 October 2011)

Dashed lines indicate route followed for pre-planned lines when GPS lost signal.

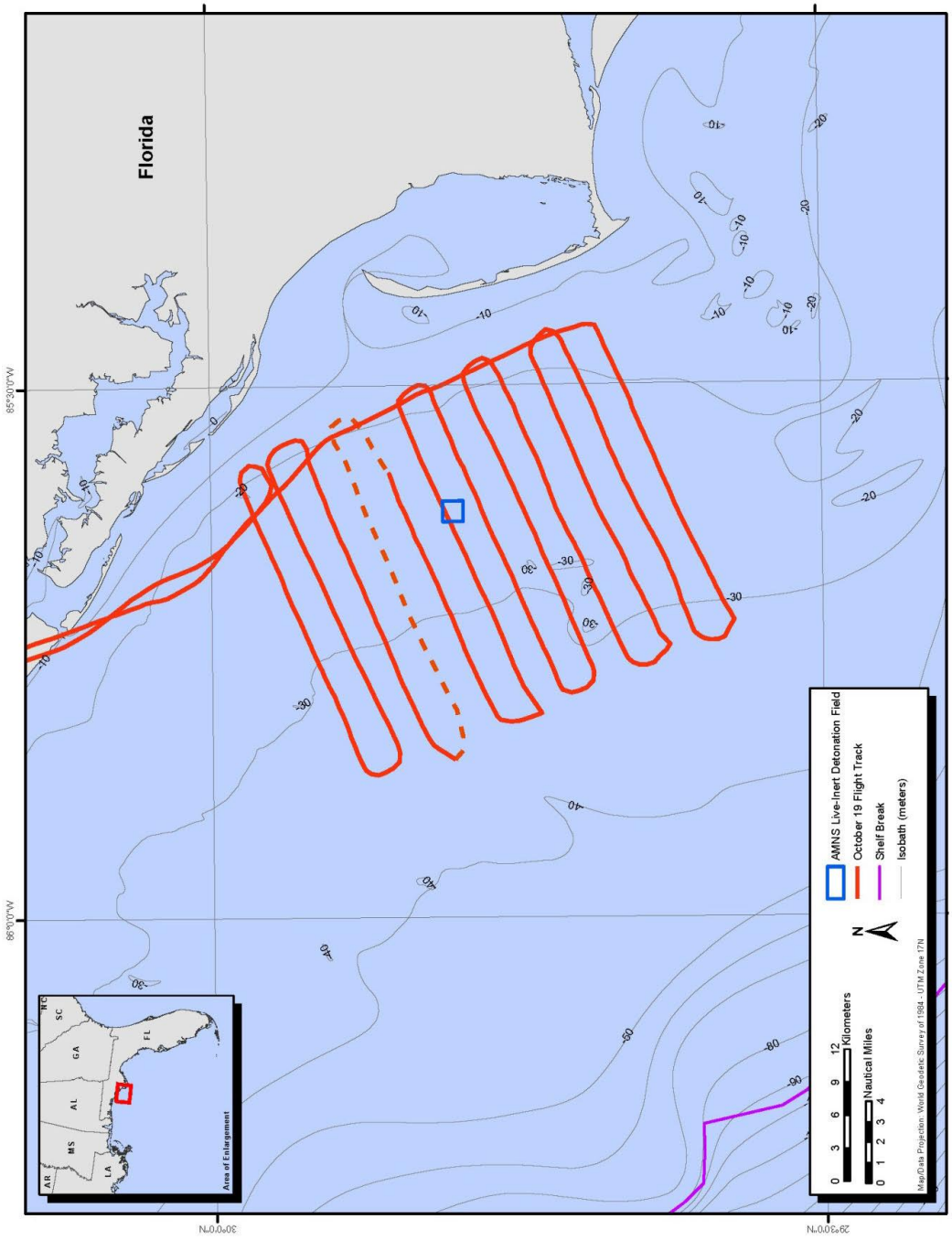

Figure 3. Survey Flight Track Conducted Before the AMNS Test Event (19 October 2011)

Red dashed lines indicate route followed for pre-planned lines when GPS lost signal. No cetacean or sea turtle sightings were made on 19 October.

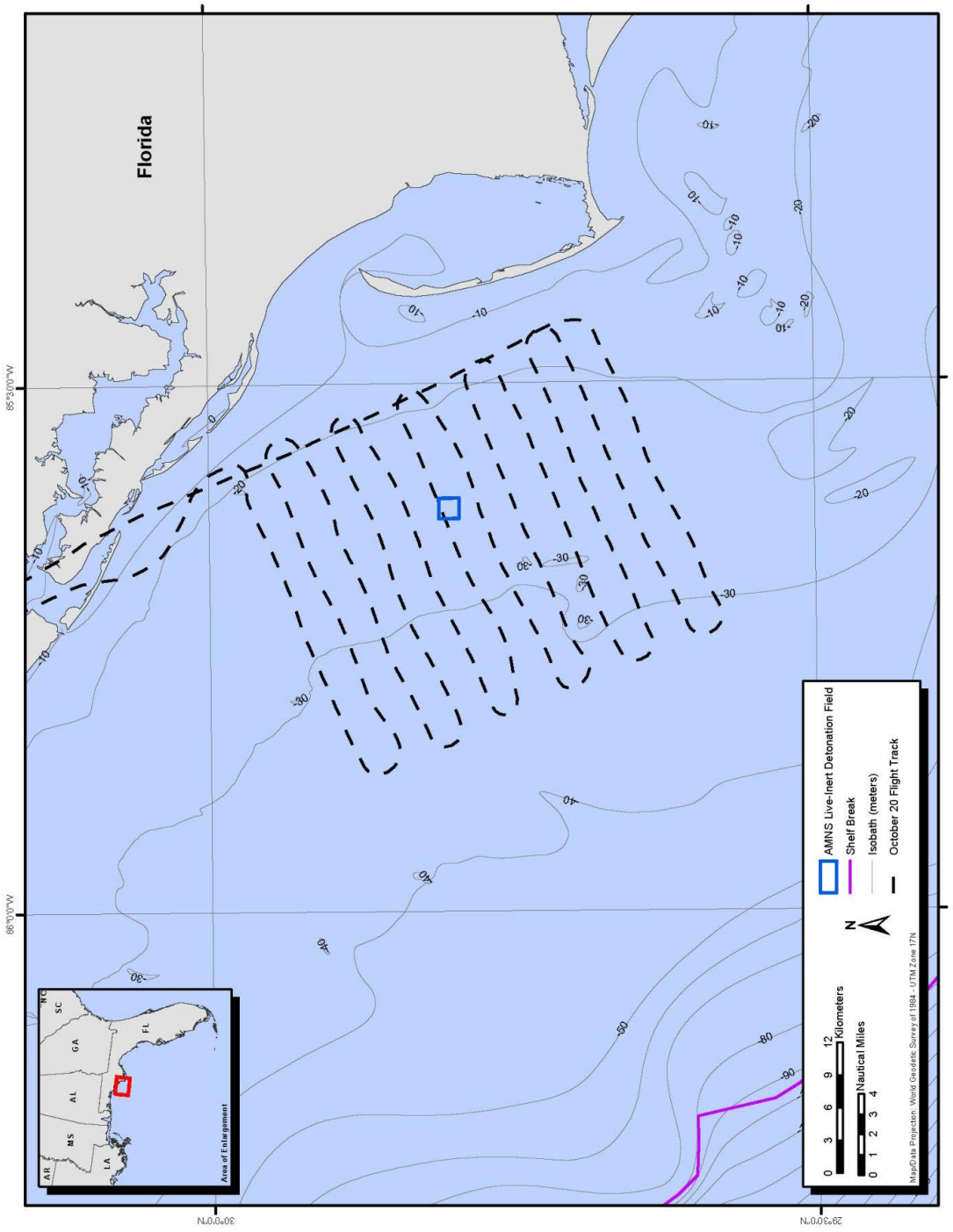

Figure 4. Survey Flight Track Conducted Before the AMNS Test Event (20 October 2011)

No cetacean or sea turtle sightings were made on 20 October.

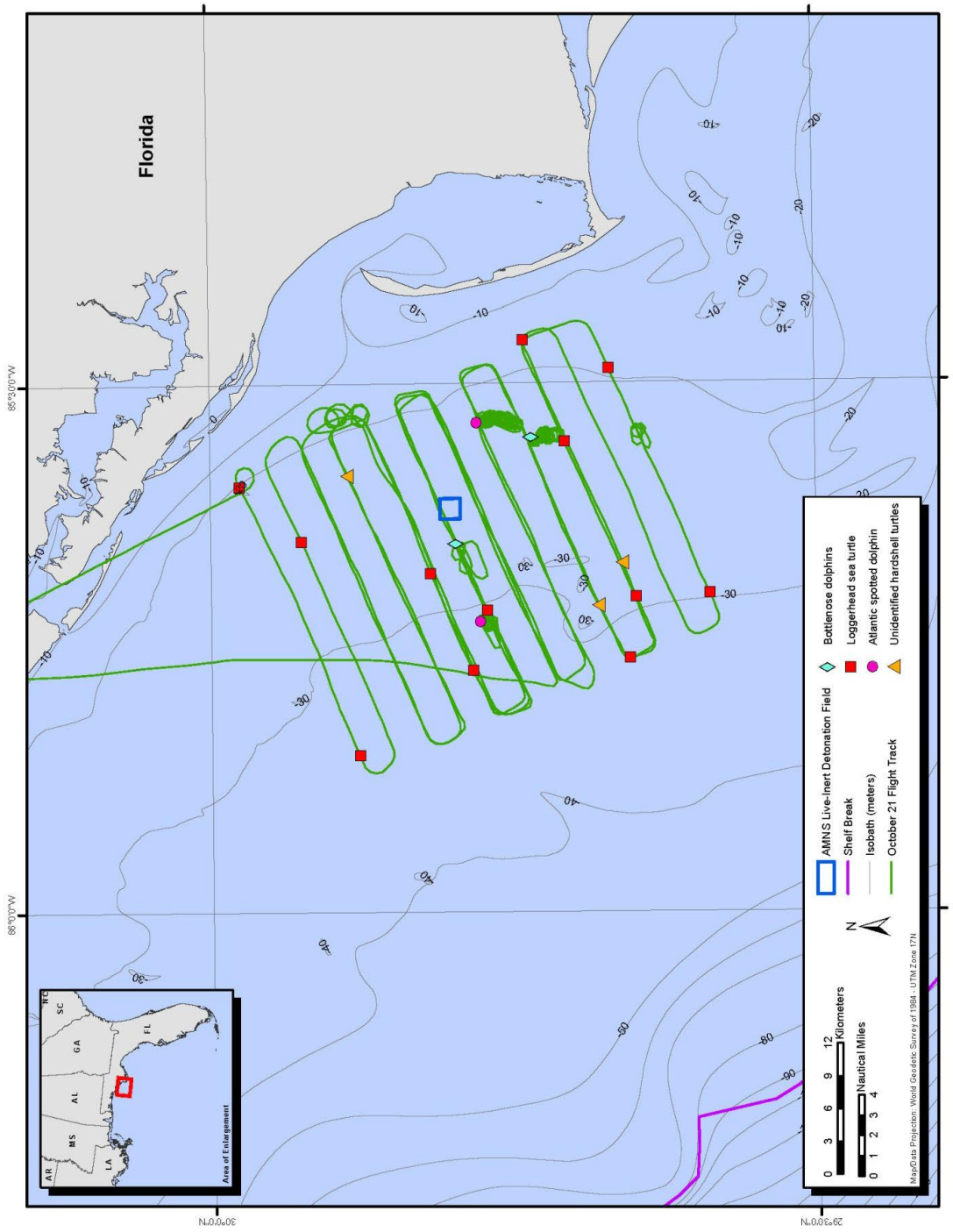

Figure 5. Location of Cetacean and Sea Turtle Sightings Recorded During the AMNS Test Event (21 October 2011)

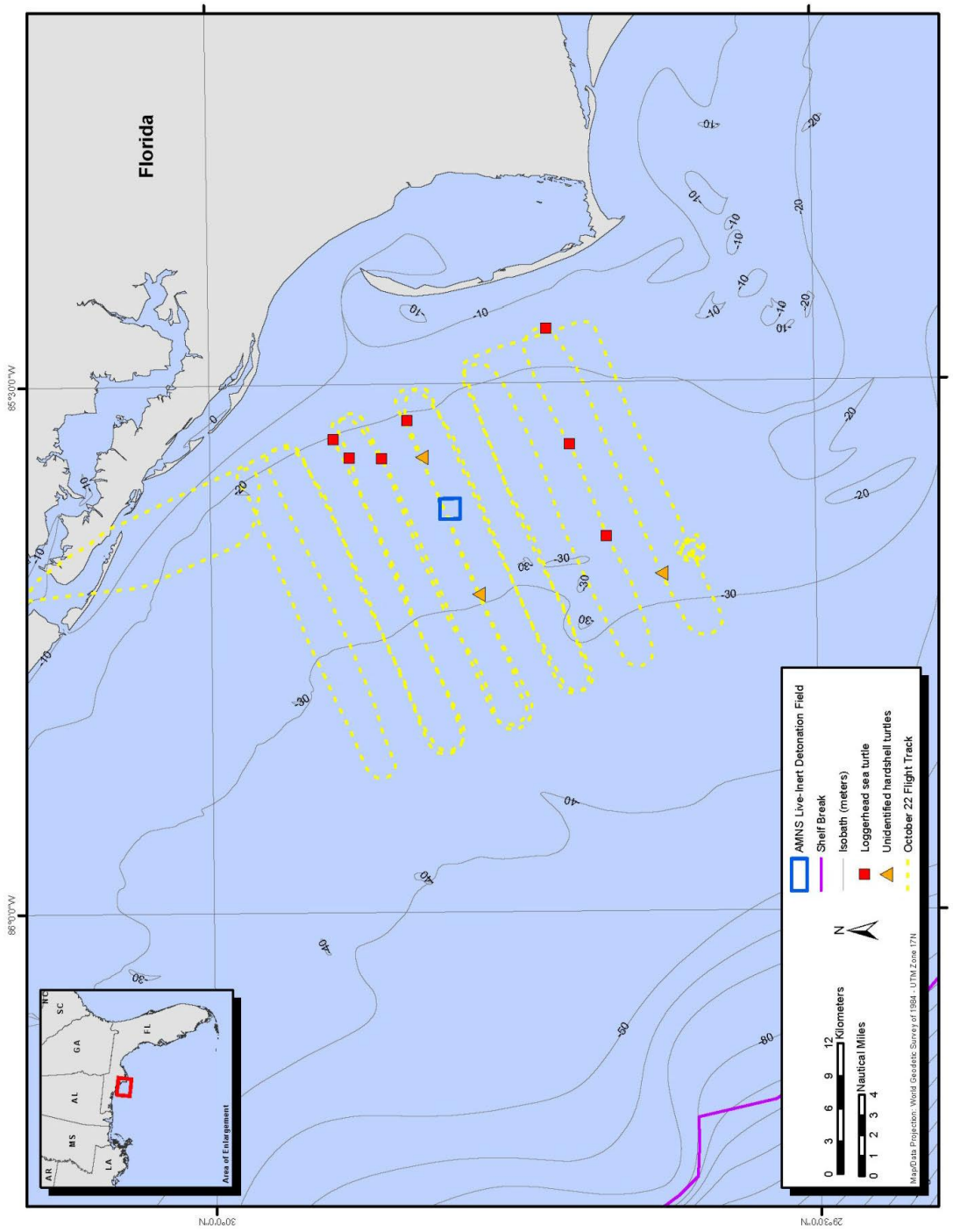

Figure 6. Location of Sea Turtle Sightings Recorded After the AMNS Test Event (22 October 2011)

Table 3. Summary of Sightings

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
During NSWC PCD AMNS Test Event Sightings – 21 October 2011*																
1	10/21/11	CC	1	1	1	-	11:06	-	3	29.976	-85.597	034	0.5	225	20	Loggerhead turtle resting at the surface. No disturbance detected.
2	10/21/11	CC	1	1		-	11:14	-	3	29.878	-85.852	045	0.3	180	30	Loggerhead turtle resting at the surface. No disturbance detected.
3	10/21/11	CC	1	1	1	-	11:22	-	3	29.925	-85.649	032	0.5	180	20	Loggerhead turtle resting at the surface. No disturbance detected.
4	10/21/11	Unid HST	2	2	2	-	11:44	-	3	29.887	-85.587	055	0.2	135	20	Unidentified hardshell turtles resting at the surface. No disturbance detected.
5	10/21/11	SF	55	55	46	0	12:25	12:46	3	29.780	-85.538	050	0.3	135	30	Group of approximately 55 Atlantic spotted dolphins travelling southeast, in the opposite direction of the test area. See Appendix B for focal follow data.
6	10/21/11	CC	1	1	1	-	13:01	-	3	29.654	-85.761	030	0.5	135	30	Loggerhead turtle resting at the surface. No disturbance detected.
7	10/21/11	CC	1	1	1	-	13:08	-	3	29.707	-85.556	020	0.8	000	10	Loggerhead turtle resting at the surface. No disturbance detected.
8	10/21/11	CC	1	1	1	-	13:11	-	3	29.741	-85.460	035	0.4	Unk.	20	Loggerhead turtle resting at the surface. No disturbance detected.
9	10/21/11	CC	1	1	1	-	13:23	-	3	29.588	-85.700	045	0.3	180	10	Loggerhead turtle resting at the surface. No disturbance detected.
10	10/21/11	CC	1	1	1	-	13:34	-	3	29.670	-85.487	035	0.4	315	20	Loggerhead turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
During NSWC PCD AMNS Test Event Sightings – 21 October 2011 (continued)																
11	10/21/11	Unid HST	1	1	1	-	13:44	-	3	29.660	-85.671	018	0.9	Unk.	20	Unidentified hardshell turtle resting at the surface. No disturbance detected.
12	10/21/11	CC	1	1	1	-	13:45	-	3	29.649	-85.703	018	0.9	180	20	Loggerhead turtle resting at the surface. No disturbance detected.
13	10/21/11	Unid HST	1	1	1	-	13:49	-	3	29.680	-85.711	038	0.4	Unk.	20	Unidentified hardshell turtle resting at the surface. No disturbance detected.
14	10/21/11	TT	14	15	11	2	13:54	14:13	3	29.735	-85.552	035	0.4	Various	20	Group of approximately 14 bottlenose dolphins travelling at various speeds east, then south. See Appendix B for focal follow data.
15	10/21/11	SF	4	8	3	0	14:49	-	3	29.778	-85.726	035	0.4	270	20	Small group of Atlantic spotted dolphins travelling west.
16	10/21/11	CC	1	1	1	-	15:43	-	3	29.819	-85.680	020	0.8	000	20	Loggerhead turtle resting at the surface. No disturbance detected.
17	10/21/11	CC	1	1	1	-	15:46	-	3	29.784	-85.772	033	0.5	000	30	Loggerhead turtle resting at the surface. No disturbance detected.
18	10/21/11	CC	1	1	1	-	15:51	-	3	29.772	-85.715	032	0.5	045	20	Loggerhead turtle resting at the surface. No disturbance detected.
19	10/21/11	TT	3	3	3	0	15:53	-	3	29.798	-85.652	035	0.4	225	20	Small group of bottlenose dolphins travelling southwest in "V" formation, away from test area.
After NSWC PCD AMNS Test Event Sightings – 22 October 2011																
1	10/22/11	CC	1	1	1	-	9:26	-	4	29.898	-85.552	035	0.4	135	20	Loggerhead turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
After NSWC PCD AMNS Test Event Sightings – 22 October 2011 (continued)																
2	10/22/11	Unid HST	1	1	1	-	9:40	-	4	29.779	-85.700	028	0.6	000	20	Unidentified hardshell turtle resting at the surface. No disturbance detected.
3	10/22/11	CC	1	1	1	-	10:20	-	3	29.673	-85.646	030	0.5	135	20	Loggerhead turtle resting at the surface. No disturbance detected.
4	10/22/11	CC	1	1	1	-	10:23	-	3	29.703	-85.559	033	0.5	315	20	Loggerhead turtle resting at the surface. No disturbance detected.
5	10/22/11	CC	1	1	1	-	10:27	-	3	29.721	-85.449	020	0.8	Unk.	10	Loggerhead turtle resting at the surface. No disturbance detected. Sighting made off-effort.
6	10/22/11	Unid HST	1	1	1	-	10:34	-	3	29.628	-85.682	022	0.8	Unk.	20	Unidentified hardshell turtle resting at the surface. No disturbance detected.
7	10/22/11	CC	1	1	1	-	11:18	-	3	29.837	-85.535	025	0.7	000	20	Loggerhead turtle resting at the surface. No disturbance detected. Sighting made off-effort.
8	10/22/11	Unid HST	1	1	1	-	11:19	-	3	29.825	-85.570	030	0.5	045	20	Unidentified hardshell turtle resting at the surface. No disturbance detected.
9	10/22/11	CC	1	1	1	-	11:36	-	3	29.858	-85.571	027	0.6	315	20	Loggerhead turtle resting at the surface. No disturbance detected.
10	10/22/11	CC	1	1	1	-	11:39	-	3	29.885	-85.570	030	0.5	315	20	Loggerhead turtle resting at the surface. No disturbance detected. Sighting made off-effort.

Key:
CC = Loggerhead sea turtle (*Caretta caretta*)
SF = Atlantic spotted dolphin (*Stenella frontalis*)
TT = Bottlenose dolphin (*Tursiops truncatus*)
Unid HST = Unidentified hardshell turtle
***No sightings were made during either pre-event survey on 19 or 20 October 2011.**

Sightings per unit effort (SPUE) was calculated as the total number of cetacean (n=4) or sea turtle (n=22) sightings made on-effort divided by total survey on-effort (t=8.9 h and d=1,768 km [1,290 nmi]), resulting in an estimate for the number of sightings per h and number of sightings per km (number of sightings per nmi). For this monitoring event, the SPUE for cetaceans was equal to 0.45 sightings per h or 0.002 sightings per km (0.004 sightings per nmi) and the SPUE for sea turtles was equal to 2.5 sightings per h or 0.012 sightings per km (0.02 sightings per nmi). No sightings of cetaceans and sea turtles were made prior to the test event on either 19 or 20 October 2011 (**Figures 3-4, Table 3**). Four sightings of cetaceans and 15 sightings of sea turtles were made during the test event on 21 October 2011 (**Figure 5, Table 3**). Ten sightings of sea turtles were made after the test event on 22 October 2011 (**Figure 6, Table 3**). No cetaceans were seen during the post-test survey.

Sightings were comprised of two groups of bottlenose dolphins (*Tursiops truncatus*); two groups of Atlantic spotted dolphins (*Stenella frontalis*); 19 loggerhead sea turtles (*Caretta caretta*); and six unidentified hardshell turtles (**Figure 2, Table 3**). **Table 4** provides a summary of the sightings recorded, which includes group information and environmental data. Bottom depth for each sighting was estimated in 10-m (30-ft) ranges from the maps from Geographic Information System plots of latitude and longitude for sightings.

Table 4. Summary of Sightings Recorded during Monitoring for AMNS Test Event

Species	Number of sightings	Bottom Depth
Bottlenose dolphin	2	20 m (66 ft)
Atlantic spotted dolphin	2	20-30 m (66-98 ft)
Loggerhead turtle	19	10-30 m (33–98 ft)
Unidentified hardshell turtle	6	20 m (66 ft)

Behavior

No visible evidence of unusual behavior was observed during surveys before, during, or after the test event for the AMNS (**Table 3**). During the test event, two groups of bottlenose dolphins and one group of Atlantic spotted dolphins were seen travelling in the opposite direction of the test area (**Table 3, Appendix B**). The team was able to attempt two focal follows on 21 October 2011 during the test event. The first focal follow occurred for a period of 21 min, and was spent with a group of about 55 Atlantic spotted dolphins. The second focal follow occurred for a period of 19 min, and was spent with a group of approximately 14 bottlenose dolphins. Detailed behavioral observations made during the focal follows are presented in **Appendix B**. Photographs of suitable quality for species identification purposes were collected during several sightings of dolphins and sea turtles. No video was collected during the focal follows.

Section 4 Acknowledgements

We would like to thank Orion Aviation's Director Ed Coffman and pilots Stan Huddle and Dave Huddle. These data were obtained under National Marine Fisheries Service permit No. 14451 issued to Joseph R. Mobley, Jr.

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Section 6 List of References

Buckland et al. 2001 — Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas. 2001. *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*. Oxford University Press, NY.

DON 2010 — Department of the Navy (DON). 2010. *Final Monitoring Plan for Marine Mammal Protection Act (MMPA) Authorization.* Naval Surface Warfare Center Panama City Division (NSWC PCD). Prepared for National Marine Fisheries Service, Silver Spring, Maryland. January 2010.

Smultea et al. 2009 — Smultea, M.A., J.R. Mobley, Jr., and K. Lomac-MacNair. 2009. *Aerial Survey Monitoring for Marine Mammals and Sea Turtles in Conjunction with U.S. Navy Major Training Events off San Diego, California, 15–21 October and 15–18*

November 2008, Final Report. Prepared by Marine Mammal Research Consultants, Honolulu, HI, and Smultea Environmental Sciences, LLC., Issaquah, WA, under Contract No. N62742-08-P-1936 and N62742-08-P-1938 for Naval Facilities Engineering Command Pacific, EV2 Environmental Planning, Pearl Harbor, HI.

APPENDIX A

Environmental, Oceanographic, and Sighting Conditions

Table A-1 shows the environmental, oceanographic, and sighting conditions encountered throughout the pre-AMNS, during AMNS, and post-AMNS monitoring efforts.

Table A-1. Environmental, Oceanographic, and Sighting Conditions During Monitoring.

Time	Beaufort Left MMO	Glare Left MMO (%)	Visibility Distance Left MMO (km)	Beaufort Right MMO	Glare Right MMO (%)	Visibility Distance Right MMO (km)	Cloud Cover (%)
Survey Before NSWC PCD AMNS Test Event on 19 October 2011							
15:03	5	30	1	5	10	1	45
15:10	6	30	1	6	10	1	45
15:13	6	25	1	6	15	1	40
15:21	6	60	1	6	15	1	40
15:32	6	30	1	6	5	1	55
15:40	6	40	1	6	25	1	55
15:50	6	25	1	6	25	1	50
15:59	6	55	1	6	15	1	55
16:09	6	15	1	6	5	1	65
16:17	5	20	1	5	15	1	65
16:23	6	20	1	6	5	1	65
16:27	6	15	1	6	5	1	65
16:36	6	15	1	6	10	1	65
16:46	5	25	1	5	10	1	65
Survey Before NSWC PCD AMNS Test Event on 20 October 2011							
7:47	4	45	1	4	90	1	15
7:55	5	45	1	5	90	1	15
7:57	5	30	1	5	95	1	15
8:07	5	85	1	5	90	1	15
8:16	6	85	1	6	90	1	15
8:17	6	45	1	6	95	1	15
8:21	5	45	1	5	95	1	15
8:27	5	85	1	5	90	1	20
8:32	6	85	1	5	90	1	20
8:37	5	45	1	5	95	1	20

Time	Beaufort Left MMO	Glare Left MMO (%)	Visibility Distance Left MMO (km)	Beaufort Right MMO	Glare Right MMO (%)	Visibility Distance Right MMO (km)	Cloud Cover (%)
Survey Before NSWC PCD AMNS Test Event on 20 October 2011 (continued)							
8:46	5	60	1	5	85	1	25
8:56	5	35	1	5	93	1	25
9:04	5	80	1	5	80	1	25
9:14	5	40	1	5	90	1	25
9:23	5	55	1	5	75	1	25
9:34	5	30	1	5	90	1	20
9:38	5	30	1	5	90	1	20
Survey During NSWC PCD AMNS Test Event on 21 October							
11:07	3	80	1.5	3	30	1.5	0
11:16	3	35	1.5	3	90	1.5	0
11:27	3	85	1.5	3	20	1.5	0
11:37	3	95	1.5	3	20	1.5	0
11:47	3	85	1.5	3	15	1.5	0
11:57	3	15	1.5	3	95	1.5	0
12:07	3	85	1.5	3	10	1.5	0
12:17	3	10	1.5	3	75	1.5	0
12:51	3	10	1.5	3	75	1.5	0
12:53	3	75	1.5	3	75	1.5	0
13:03	3	15	1.5	3	10	1.5	0
13:13	3	50	1.5	3	20	1.5	0
13:23	3	15	1.5	3	75	1.5	0
13:32	3	15	1.5	3	75	1.5	0
13:38	3	75	1.5	3	20	1.5	0
13:48	3	10	1.5	3	60	1.5	0
14:16	3	10	1.5	3	60	1.5	0
14:20	3	60	1.5	3	15	1.5	0
14:31	3	15	1.5	3	35	1.5	0
14:41	3	65	1.5	3	40	1.5	0
14:57	3	65	1.5	3	40	1.5	0
15:01	3	30	1.5	3	30	1.5	0
15:19	3	30	1.5	3	30	1.5	0
15:28	3	30	1.5	3	40	1.5	0
15:39	3	55	1.5	3	20	1.5	0

Time	Beaufort Left MMO	Glare Left MMO (%)	Visibility Distance Left MMO (km)	Beaufort Right MMO	Glare Right MMO (%)	Visibility Distance Right MMO (km)	Cloud Cover (%)
Survey During NSWC PCD AMNS Test Event on 21 October (continued)							
15:49	3	20	1.5	3	45	1.5	0
16:00	3	20	1.5	3	45	1.5	0
16:04	3	20	1.5	3	50	1.5	0
Survey After NSWC PCD AMNS Test Event on 22 October 2011							
8:48	4	50	1.5	4	30	1.5	0
8:58	4	50	1.5	4	90	1.5	0
9:08	4	50	1.5	4	30	1.5	0
9:18	4	70	1.5	4	30	1.5	0
9:28	4	70	1.5	4	30	1.5	0
9:38	4	50	1.5	4	90	1.5	0
9:48	4	90	1.5	4	3	1.5	0
9:58	4	70	1.5	4	90	1.5	0
10:08	3	70	1.5	3	30	1.5	5
10:17	3	50	1.5	3	90	1.5	5
10:28	3	70	2	3	30	1.5	5
10:38	3	50	2	3	90	1.5	5
10:58	3	70	2	3	50	1.5	5
11:08	3	50	2	3	50	1.5	5
11:18	3	50	2	3	90	1.5	5
11:29	3	50	2	3	90	1.5	5
11:39	3	70	2	3	50	1.5	5
11:49	3	50	2	3	90	1.5	5

APPENDIX B

Focal Follow Data

Table B-1 shows focal follow behavioral data from the 19-22 October 2011 monitoring efforts before, during, and after the NSWC PCD AMNS test event. Two focal follow events were conducted on 21 October 2011, which was part of the survey conducted during the NSWC PCD AMNS test event; one was for a group of Atlantic spotted dolphins and another for a group of bottlenose dolphins within the survey area.

Table B-1. Focal Follow Behavioral Data Collected During Monitoring.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 5					
Species: *Stenella frontalis.* Group size: 55.					
1	12:25	10/21/11	29.780	-85.538	Travel heading 135. Min Dispersal = 1, Max Dispersal = 6.
2	12:32	10/21/11	29.766	-85.527	Travel heading 135. Min Dispersal = 1, Max Dispersal = 6.
3	12:33	10/21/11	29.768	-85.526	Travel heading 135. Min Dispersal = 1, Max Dispersal = 6.
4	12:36	10/21/11	29.765	-85.529	Travel heading 135. Min Dispersal = 1, Max Dispersal = 6.
5	12:37	10/21/11	29.766	-85.533	Travel heading 135. Min Dispersal = 1, Max Dispersal = 6.
6	12:38	10/21/11	29.765	-85.531	Travel heading 135. Min Dispersal = 1, Max Dispersal = 6.
7	12:42	10/21/11	29.761	-85.534	Travel heading 135. Min Dispersal = 1, Max Dispersal = 6.
8	12:44	10/21/11	29.750	-85.543	Fast travel heading 135. Min Dispersal = 1, Max Dispersal = 6.
9	12:46	10/21/11	29.751	-85.544	Fast travel heading 135. Min Dispersal = 1, Max Dispersal = 6. Merged into one group.
Sighting Number 14					
Species: *Tursiops truncatus.* Group size: 14.					
1	13:54	10/21/11	29.735	-85.552	Travel heading 090. Min Dispersal = 1, Max Dispersal = 3.
2	13:57	10/21/11	29.729	-85.558	Travel heading 090. Min Dispersal = 1, Max Dispersal = 5.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 14 (continued)					
3	13:58	10/21/11	29.734	-85.555	Travel heading 090. Min Dispersal = 1, Max Dispersal = 5.
Species: *Tursiops truncatus*. Group size: 14. (continued)					
4	13:59	10/21/11	29.729	-85.550	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 5.
5	14:00	10/21/11	29.725	-85.554	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 6. One cow/calf pair away from other dolphins.
6	14:02	10/21/11	29.728	-85.548	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 6. One cow/calf pair away from other dolphins.
7	14:03	10/21/11	29.723	-85.552	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 4. One cow/calf pair away from other dolphins. Main group in subgroups of 2.
8	14:05	10/21/11	29.725	-85.556	Travel heading 180. Min Dispersal = 1, Max Dispersal = 4. Subgroups are pretty tight together.
9	14:06	10/21/11	29.721	-85.553	Group dove, and then re-surfaced.
10	14:07	10/21/11	29.718	-85.551	Travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Group is super tight; appears that they have picked up travel speed.
11	14:09	10/21/11	29.717	-85.548	Fast travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Re-sighted cow/calf pair still traveling with group but keeping same distance.
12	14:10	10/21/11	29.718	-85.546	Travel heading 180. Min Dispersal = 2, Max Dispersal = 6. Slowed down their travel.
13	14:11	10/21/11	29.717	-85.545	Travel heading 180. Min Dispersal = 2, Max Dispersal = 6. Another cow/calf pair about 0.25 miles away from others (2 cow/calf pairs).
14	14:12	10/21/11	29.718	-85.544	Travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Really tight; 1st cow/calf about 1 body length away; 2nd is still pretty far way (0.25 miles).
15	14:13	10/21/11	29.718	-85.547	Travel heading 180. Min Dispersal = 1, Max Dispersal = 4. Two cow/calf pairs still located away from the main group, which is best estimated at 12 individuals with a low estimate of 11 and a high estimate of 15.

Appendix E – December 2011 Vessel Monitoring and PAM Survey Trip Report

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Naval Surface Warfare Center
Panama City Division (NSWC PCD)

Marine Species Monitoring

VESSEL MONITORING SURVEY
TRIP REPORT

June 2012

ACRONYMS AND ABBREVIATIONS

AMNS	Airborne Mine Neutralization System
dB re 1 µPa	decibel(s) referenced to 1 microPascal
DoN	Department of the Navy
ft	foot/feet
GOM	Gulf of Mexico
h	hour(s)
ICMP	Integrated Comprehensive Monitoring Program
kHz	kilohertz
km	kilometer(s)
km^2	square kilometer(s)
m	meter(s)
nmi	nautical mile(s)
nmi^2	square nautical mile(s)
NSWC PCD	Naval Surface Warfare Center Panama City Division
OPAREA	Operating Area
PAM	passive acoustic monitoring
RDT&E	Research, Development, Test, and Evaluation
R/V	Research Vessel
sec	second(s)
SPL	Sound pressure level
SPUE	Sightings Per Unit Effort
U.S.	United States

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Section 1 Introduction

Vessel-based marine species monitoring occurred during 5 through 10 December 2011 for an Airborne Mine Neutralization System (AMNS) live-inert explosives research, development, test, and evaluation (RDT&E) event. These surveys were conducted off the west coast of Florida in the Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area in the Gulf of Mexico (GOM). The AMNS is a mine countermeasures device that includes an explosive charge.

As part of the compliance requirements of the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, the United States (U.S.) Navy developed the Integrated Comprehensive Monitoring Program (ICMP; DoN 2010a). The ICMP applies by regulation to those activities on U.S. Navy training ranges and operating areas (OPAREAs) for which the U.S. Navy has sought and received incidental take authorizations. To support the U.S. Navy in meeting regulatory requirements for monitoring established under the NSWC PCD Final Rule (NMFS 2010), and to provide a mechanism to assist with coordination of program objectives under the ICMP, monitoring of marine mammals and sea turtles (protected marine species) during this test event included visual and acoustic surveys from a 50.3-meter (m) (165-foot [ft]) research vessel.

Section 2 Methods

Study Area

The NSWC PCD Study Area includes both territorial (waters that are between 0 and 22 kilometers [(km)] [0 and 12 nautical miles [nmi]]) and non-territorial (waters that are beyond the 22-km [12-nmi] limit) waters. Monitoring conducted for protected marine species during the AMNS test event was focused within the Panama City OPAREA of the NSWC PCD Study Area (**Figure 1**). The test area for the AMNS system is approximately 309 square kilometers (km^2) (90 square nautical miles [nmi^2]), 12 nmi offshore of Panama City Beach, Florida and ranges in bottom depth from 20 to 40 m (66 to 131 ft).

Vessel-Based Monitoring

Vessel-based monitoring, including visual observations and acoustic detections, was performed over a 6-day period from 5 through 10 December 2011 (**Tables 1, 2, and 3**). Monitoring did not occur on 7 December because the test director required all the U.S. Navy vessels (including the research vessel) participating in the AMNS test event to return to port due to poor weather conditions. Survey methods were generally consistent with currently accepted Distance Sampling theory (Buckland et al. 2001) and generally followed a well-established protocol used for vessel surveys throughout all U.S. Navy range complexes (e.g., HDR 2010). A survey speed of approximately 15 km/hour (h) (8 knots) was maintained while on-effort, but might have varied slightly based on weather conditions experienced throughout the area. Once a marine mammal sighting was visually detected, a slower speed was established in an attempt to conduct a focal follow from a distance at least 500 meters away from the sighting so as not to alter the animals' natural behavior by the presence of the survey vessel.

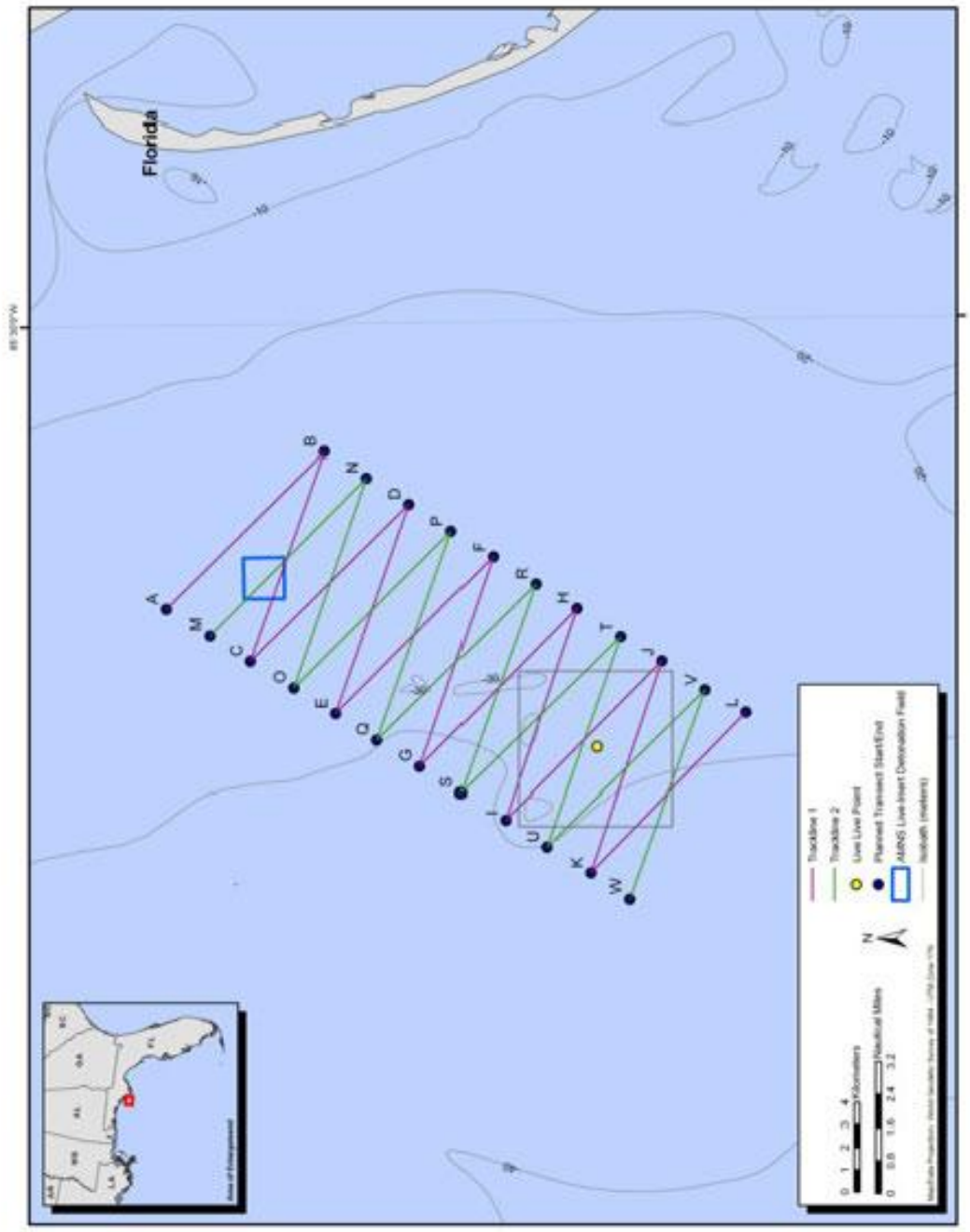

Figure 1. Pre-planned Track Lines for the Monitoring Effort for AMNS Test Event for 5–10 December 2011 in the NSWC PCD AMNS Survey Area.

Table 1. Summary of NSWC PCD AMNS Visual Monitoring Effort

Date	Description	Start Time	Stop Time	Total Survey Minutes*	Total On-Effort Minutes
5 December	Transect survey (Pre-Event)	11:40	16:48	308	304
6 December	Transect survey (Pre-Event)	6:29	16:32	603	603
7 December	Poor weather conditions required R/V *Athena II* to return to port.				
8 December	Transect survey (Pre-Event)	13:21	16:39	198	162
9 December	Transect survey (During Event)	8:32	16:30	478	478
10 December	Transect survey (Post-Event)	6:21	11:28	306	0
Total				**1895 (≈31.6 h)**	**1549 (≈25.8 h)**

Note: * Total Survey Minutes reflect minutes occupied in the range/area of interest and include both on-effort (systematic) and off-effort (connector and circling) total minutes.

Table 2. Summary of NSWC PCD AMNS Monitoring Effort by Trackline Coverage

Date	Description	On-Effort km (nmi)	Off-Effort km (nmi)	Total Daily Effort km (nmi)
5 December	Transect survey (Pre-Event)	72.95 (39.37)	0.56 (0.30)	73.51 (39.67)
6 December	Transect survey (Pre-Event)	158.35 (85.44)	0 (0)	158.35 (85.44)
7 December	Poor weather conditions required R/V *Athena II* to return to port.			
8 December	Transect survey (Pre-Event)	38.51 (20.78)	7.43 (4.00)	45.94 (24.78)
9 December	Transect survey (During Event)	115.98 (62.58)	0 (0)	115.98 (62.58)
10 December	Transect survey (Post-Event)	0 (0)	76.81 (41.45)	76.81 (41.45)
Total		**385.79 (208.17)**	**84.80 (45.75)**	**470.59 (253.92)**

Table 3. Summary of NSWC PCD AMNS Acoustic Monitoring Effort

Date	Description	Start Time	Stop Time	Total Survey Minutes[1]	Total Distance km (nmi)[2]
5 December	Transect Survey (Pre-Event)	11:50	13:27	97	23.9 (12.9)
		13:35	14:16	41	9.6 (5.2)
		14:27	16:45	138	34.0 (18.4)
6 December	Transect Survey (Pre-Event)	06:30	06:55	25	6.1 (3.3)
		07:00	09:55	175	43.2 (23.3)
		10:03	12:03	120	29.6 (16.0)
		12:33	16:30	237	58.5 (31.6)
8 December	Transect Survey (Pre-Event)	13:20	14:51	91	22.4 (12.1)
		14:57	16:40	103	25.4 (13.7)
9 December	Transect Survey (Event Day)	08:30	12:00	210	51.8 (28.0)
		12:30	16:31	241	59.5 (32.1)
10 December	Transect Survey (Post-Event)	06:35	11:30	295	72.8 (39.3)
Total				**1,773 (29.55 h)**	**436.8 (235.9)**

Notes:

1. Total Survey Minutes reflect all minutes within and outside of the AMNS survey area and include all minutes while the hydrophone array was monitored.
2. Transect lines were only 6-11 km (3-6 nmi) long. Therefore, these numbers reflect the vessel going back and forth in a small box. Average vessel speed was 15 km/h (8 knots). These numbers reflect that average.

The observation platform was a U.S. Navy Research Vessel (R/V) *Athena II*, a 50.3-m (165-ft) vessel based at NSWC PCD, Panama City, Florida. Five surveys (three pre-, one during, and one post-survey) were conducted following pre-planned transect lines covering the entire AMNS test area. The lines were defined by waypoints designed to extend beyond the entire range during each survey day for an average survey-time window of 6 h (**Tables 1 and 2;** and **Figure 1**).

- Visual marine mammal and sea turtle observations were conducted using 7x50 hand-held reticled binoculars, and unaided eyes. Use of "Big Eye" binoculars was planned; however, no suitable area was available on the ship to mount the stands where observer viewing would be unobstructed. Given the small size of the survey area and the ability to adequately pre-plan transect lines, the Chief Scientist in coordination with the Project Manager concluded that hand-held binoculars would be appropriate for use in this survey. Data were recorded on sighting sheets and using the VisVessel application of the VisSurvey software package. During focal follows, images were collected by digital photography and video cameras to allow the team to confirm species identification and group size, and gather additional behavioral information, as needed.

- Digital acoustic recordings and information logs were gathered for acoustic detections of marine mammals using a towed hydrophone array built by Seiche Measurements Limited and leased to HDR through E&P Environmental Services - RPS. PAMGUARD software was used during the collection and initial classification process. The array of hydrophones was calibrated and all measurements are expressed in decibels referenced to 1 microPascal (dB re 1 µPa).

All observers (**Table 4**) were experienced with line-transect survey methodology. Each participant also had experience in identification of Atlantic marine mammal and sea turtle species, had knowledge of marine mammal biology and behavior, and had previous experience conducting marine mammal and sea turtle observations from vessels. The passive acoustic monitoring (PAM) operator was extensively trained in the detection of marine mammals using the towed Seiche hydrophone array.

Table 4. Observers and Roles

Observer	Role(s)	Company	Dates of Participation
Michael Richlen	Chief Scientist/Cruise Leader	HDR	5-10 Dec
Keri Lestyk	Senior Observer	HDR	5-10 Dec
Mari Smultea	Senior Observer	HDR	5-10 Dec
Paula von Weller	Visual Observer	HDR	5-10 Dec
Brad Dawe	Visual Observer	HDR	5-7 Dec
Mark Cotter	Visual Observer	HDR	5-10 Dec
Jennifer Latusek-Nabholz	Visual Observer	HDR	8 Dec
Cathy Bacon	Visual Observer	HDR	9-10 Dec
James Doom	PAM Operator	RPS	5-10 Dec

Visual survey effort was designed to include the entirety of the AMNS test area. Eleven tracklines running in a sawtooth pattern were designed for "systematic" efforts throughout the surveys. The lines provided a targeted total survey coverage area (hereinafter referred to as "the survey area") 928 square kilometers [km^2] (271 nmi^2) (**Figure 1**). Planned lines were followed when possible, but exact lines followed for each survey day were subject to modifications resulting from unfavorable weather conditions including high Beaufort sea states and from U.S. Navy restrictions around the AMNS detonation site during testing (**Tables 1** and **2,** and **Figures 2 through** 7).

The following describe the general survey approach:

1. Vessel operator followed pre-determined transect lines and waypoints using methods described in the cruise plan until a visual sighting occurred. Variables such as Beaufort sea state, glare, and visibility were recorded throughout the survey.

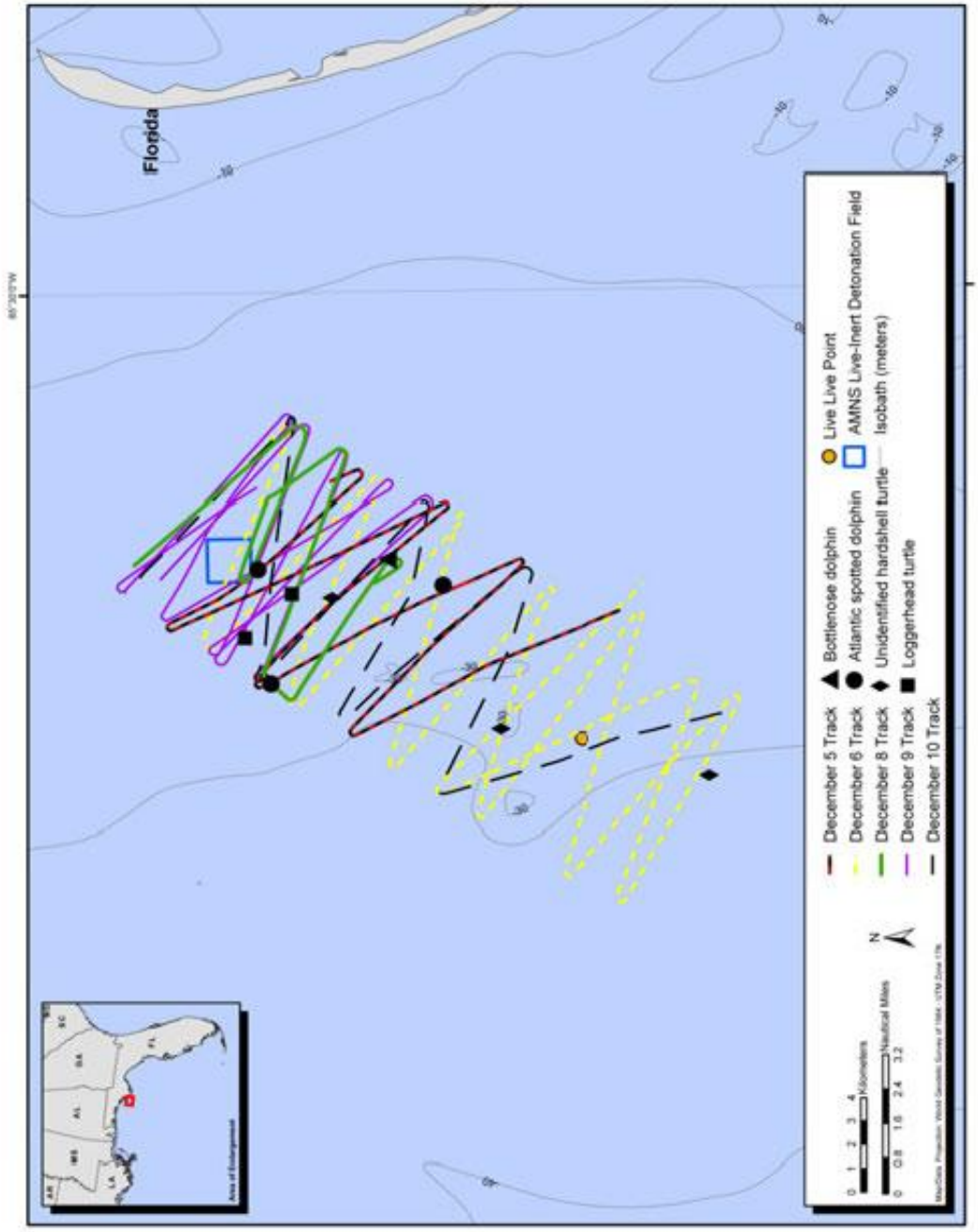

Figure 2. Location of All Cetacean and Sea Turtle Sightings Recorded Throughout the AMNS Survey Period (5-10 December).

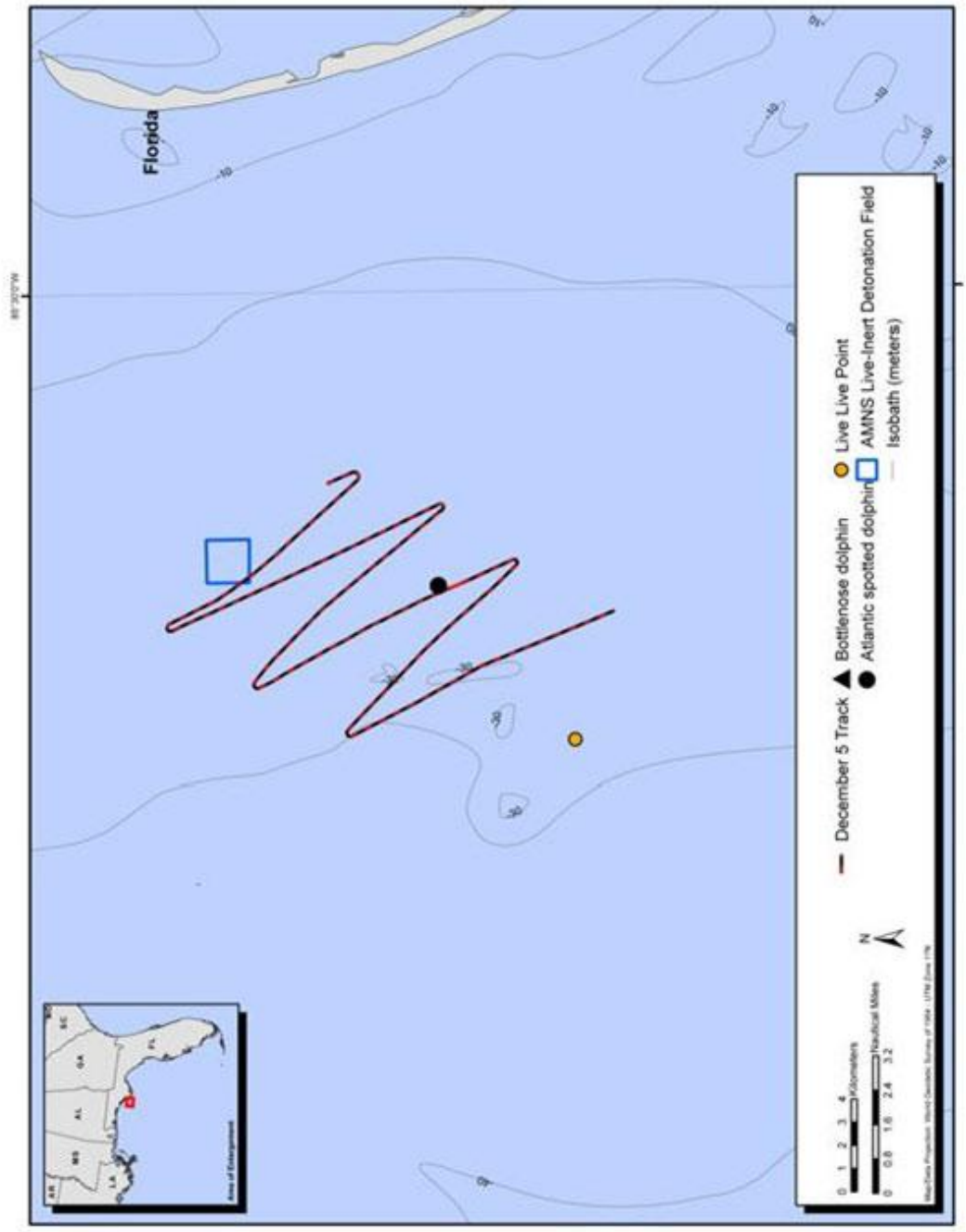

Figure 3. Location of the Cetacean Sighting Recorded Before the AMNS Test Event (5 December 2011)

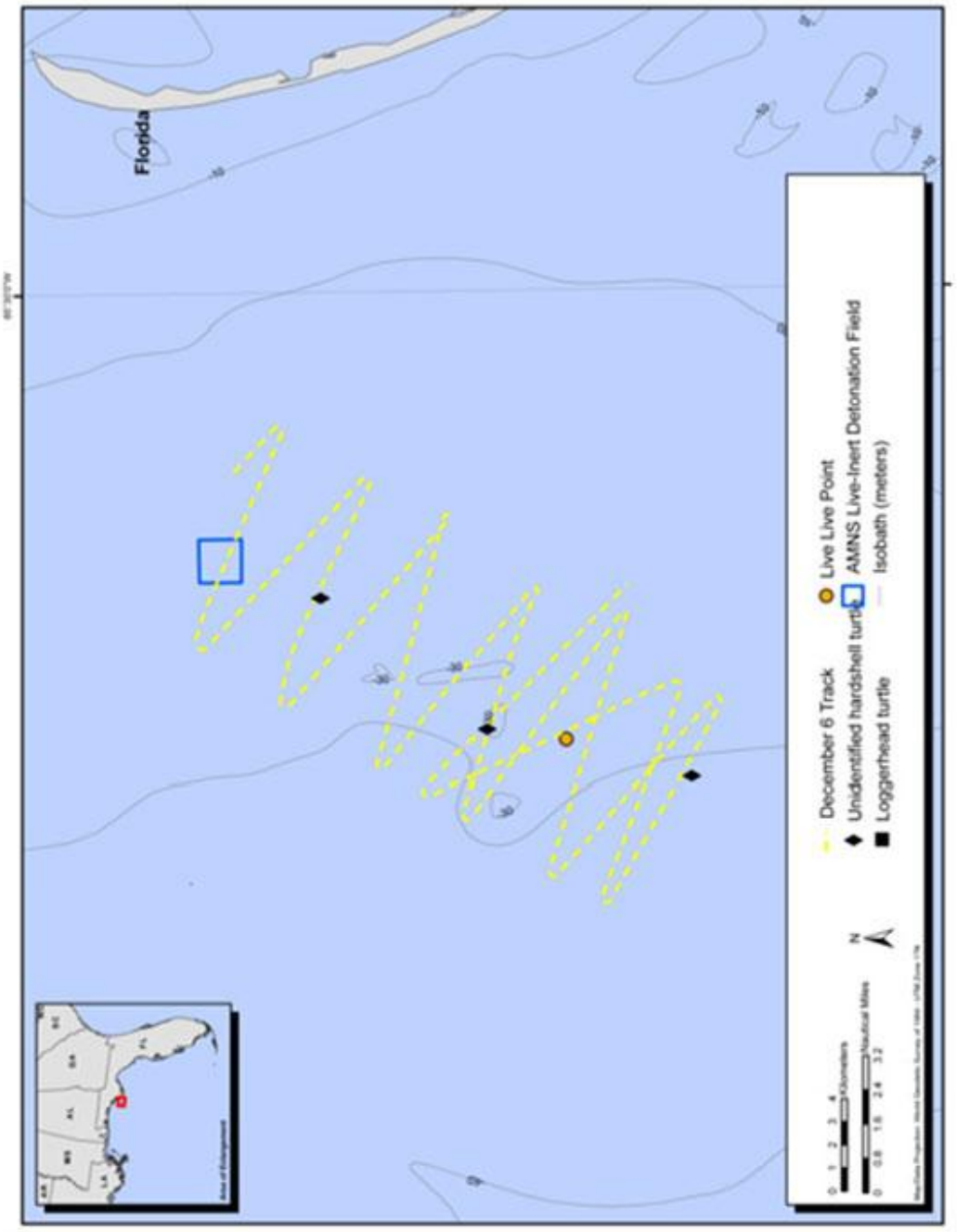

Figure 4. Location of Sea Turtle Sightings Recorded Before the AMNS Test Event (6 December 2011)

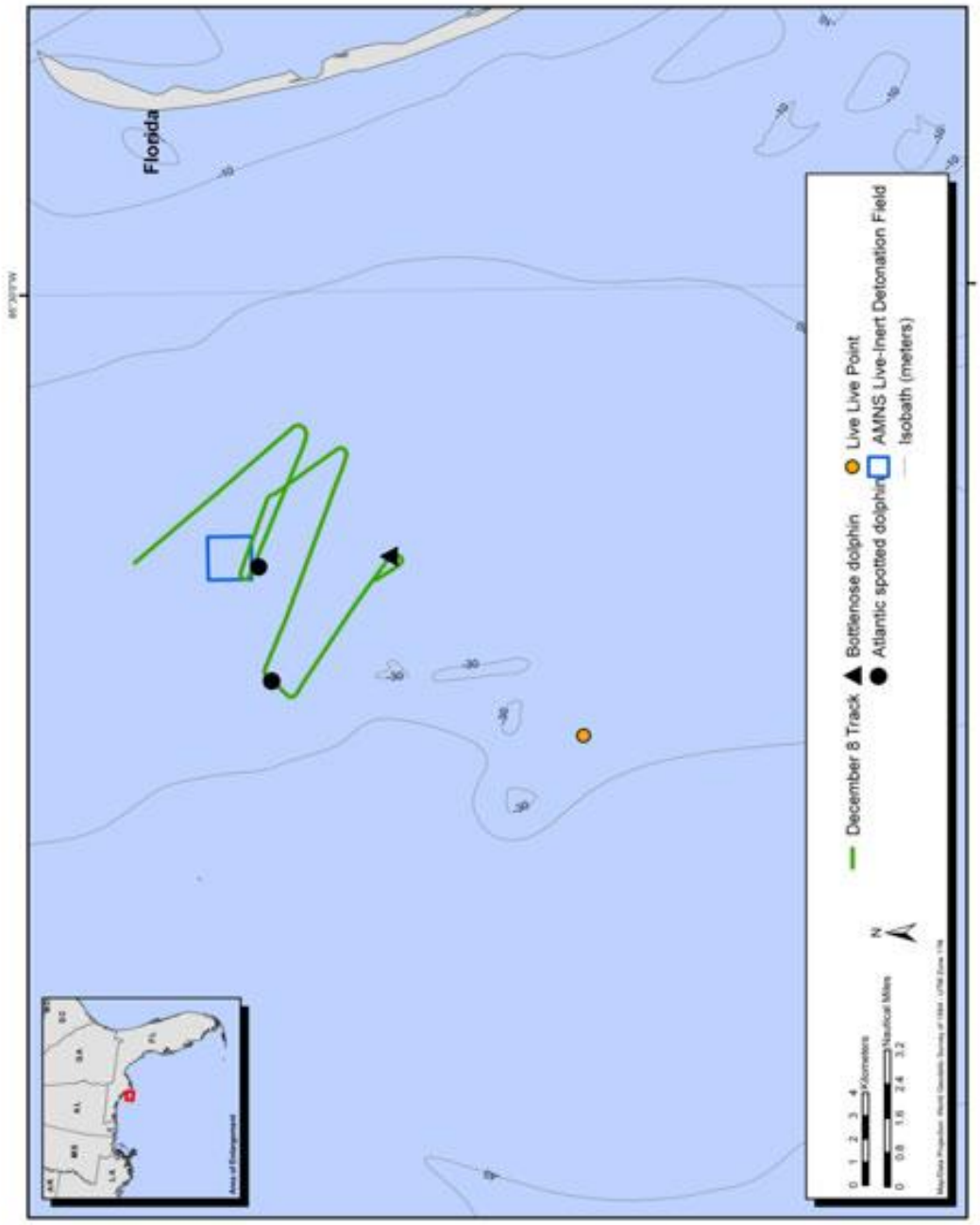

Figure 5. Location of Cetacean Sightings Recorded Before the AMNS Test Event (8 December 2011)

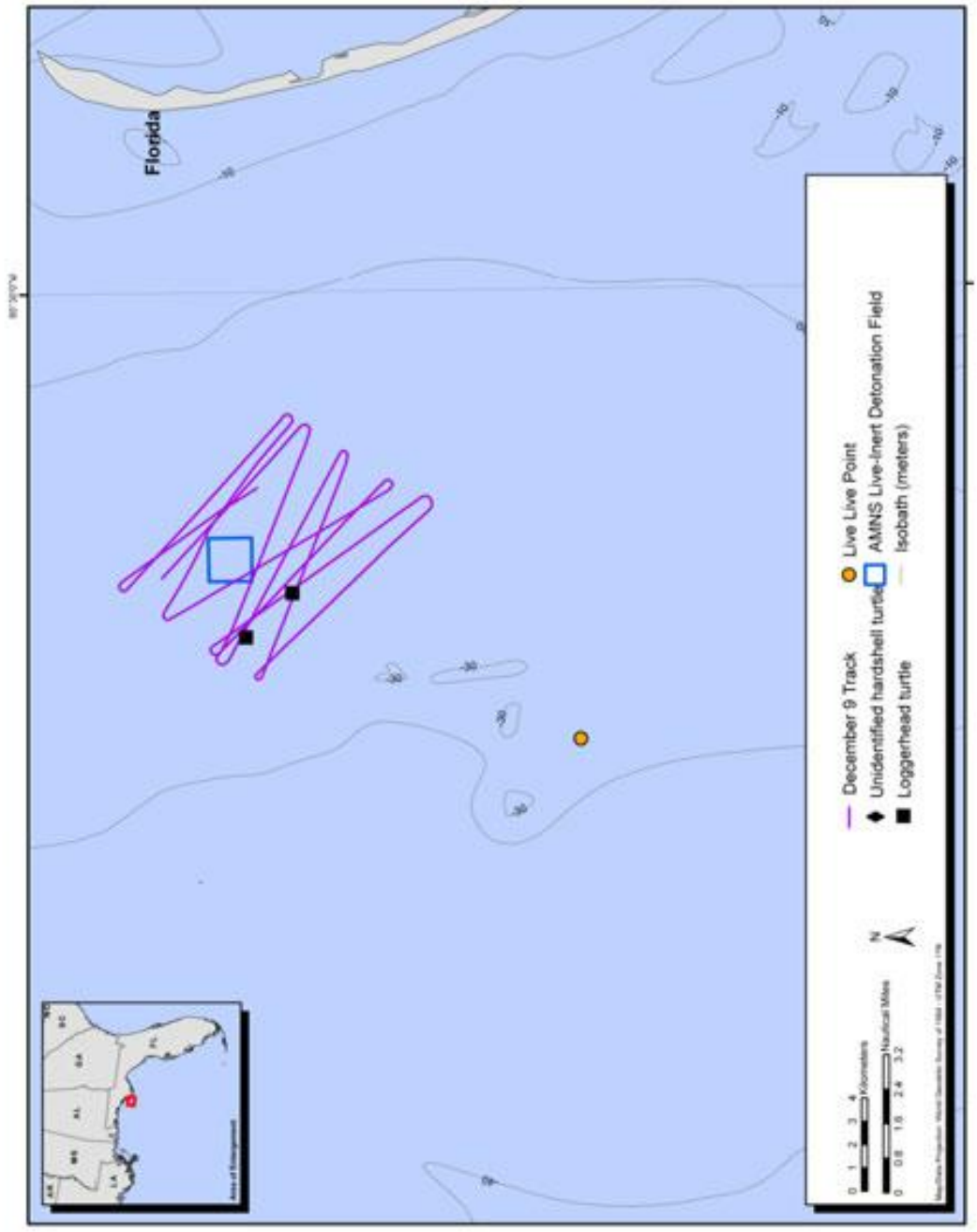

Figure 6. Locations of Sea Turtle Sightings Recorded During the AMNS Test Event (9 December 2011)

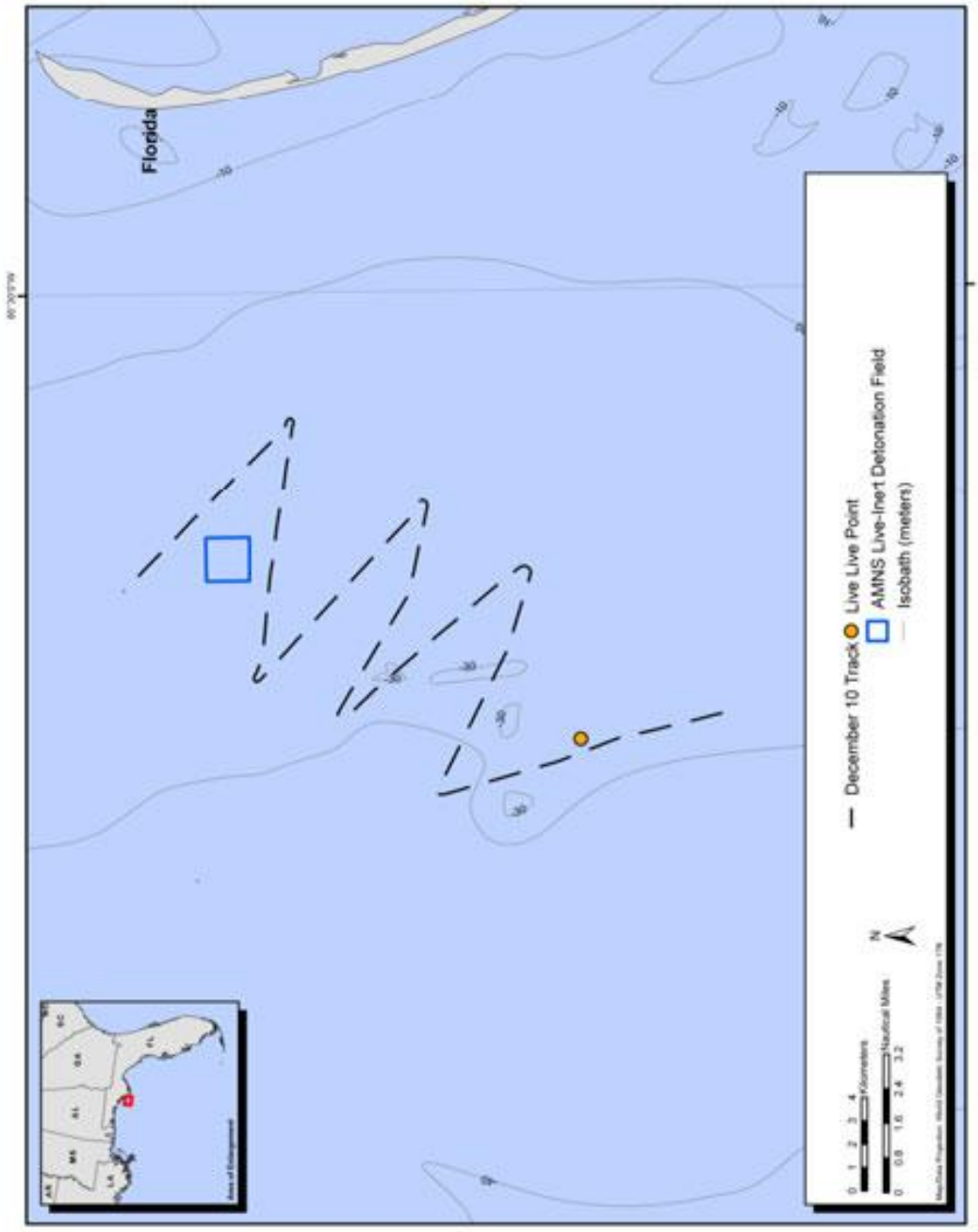

Figure 7. Survey Vessel Track Conducted After the AMNS Test Event (10 December 2011)

2. Upon sighting a marine mammal/sea turtle group, data recorder entered basic sighting information per established protocol (e.g., HDR 2010) using the VisVessel application of the VisSurvey software package. As outlined in the NSWC PCD Study Area Monitoring Plan (DoN 2010b), information included: (1) species identification and group size; (2) location (relative to observation platform and also AMNS detonation site, if available); (3) the behavior of marine mammal(s); (4) date, time, and visual conditions associated with each observation; (5) direction of travel relative to true North; and (6) duration of the observation.
3. If the species appeared suitable for a focal follow, the vessel slowed to a suitable speed and maintained a safe distance as required to obtain detailed behavior information when possible. Focal follows occurred for a minimum of 5 minutes and included one observer taking digital photographs and one observer capturing digital video of the group, when possible.
4. If the sighting was not selected for a focal follow, and species and group size were unknown, the vessel attempted to remain with the sighting to obtain digital photographs for confirmation of species identification and to estimate group size/composition.

Section 3 Results

Survey Effort

Observers visually surveyed 386 km (208 nmi) of on-effort tracklines and 471 km (254 nmi) of total trackline (including systematic transects, transits between tracklines, and chase distances for focal follows or species identification) during five days for 25.8 h of total on-effort status (**Tables 1 and 2**). Acoustic monitoring effort lasted for approximately 29.6 total hours (**Table 3**). Beaufort sea state ranged from 1 to 5, and all visual sightings and acoustic detections were made in Beaufort sea states ranging between 1 and 4 (**Tables 5** and **6**). **Appendix A** contains a detailed description of environmental, oceanographic, and sighting conditions that were collected using the VisVessel application of the VisSurvey software package.

Visual Sightings

Four sightings of cetaceans and five sightings of sea turtles were recorded during 31.6 h of total survey time within the survey area (**Figure 2, Table 5**). Four sightings of cetaceans and three sightings of sea turtles were made during monitoring efforts on the 5, 6, and 8 December 2011 surveys before the test event (**Figures 3–5, Table 5**). Two sightings of sea turtles were made during the test event on the 9 December 2011 survey (**Figure 6, Table 5**). No cetaceans or sea turtles were seen after the test event on the 10 December 2011 survey (**Figure 7**).

Sightings per unit effort (SPUE) was calculated as the total number of cetacean (n=4) or sea turtle (n=5) sightings made on-effort, divided by total survey on-effort (t=25.8 h and d=385.8 km [208.2 nmi]), resulting in an estimate for the number of sightings per h and number of sightings per km (number of sightings per nmi). For this monitoring event, the SPUE for cetaceans was equal to 0.16 sighting per h or 0.010 sighting per km (0.019 sighting per nmi) and the SPUE for sea turtles was equal to 0.19 sighting per h or 0.013 sighting per km (0.024 sighting per nmi).

Table 5. Summary of Sightings for AMNS Test Event

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle (ret.)	Distance off Track km (nmi)	Bearing (Relative to Bow)	Bottom Depth m (ft)	Behavioral Summary
Before NSWC PCD AMNS Test Event Sightings – 5 December 2011																
1	12/5/11	SF	4	4	4	2	14:58	15:05	4	29.720	-85.631	4	0.5 (0.3)	315	20-30 (66-98)	Four Atlantic spotted dolphins were seen travelling slowly initially, and then riding the bow only briefly before falling behind the vessel.
Before NSWC PCD AMNS Test Event Sightings – 6 December 2011																
1	12/6/11	Unid HST	1	1	1	-	7:05	-	2	29.698	-85.695	4	0.5 (0.3)	020	20-30 (66-98)	Unidentified hardshell turtle sighted at the surface. The individual was likely a loggerhead turtle.
2	12/6/11	Unid HST	1	1	1	-	9:09	-	2	29.617	-85.717	5	0.4 (0.2)	270	20-30 (66-98)	Unidentified hardshell turtle sighted at the surface.
3	12/6/11	Unid HST	1	1	1	-	14:42	-	3	29.763	-85.636	2	0.9 (0.5)	330	20-30 (66-98)	Unidentified hardshell turtle sighted at the surface.
Before NSWC PCD AMNS Test Event – AMNS Sightings – 8 December 2011																
1	12/8/11	SF	8	10	5	1	14:28	14:50	1	29.791	-85.623	-	0.2 (0.1)	090	20-30 (66-98)	Group of approximately 8 Atlantic spotted dolphins sighted milling and travelling, then approached bow of vessel and rode the bow. See **Appendix B** for focal follow data.
2	12/8/11	SF	6	10	5	0	15:49	15:50	2	29.787	-85.674	2.5	0.8 (0.4)	320	20-30 (66-98)	Two subgroups of Atlantic spotted dolphins were sighted milling 100 to 300 m (984 ft) behind the vessel. Unable to maneuver vessel for focal follow, no disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle (ret.)	Distance off Track km (nmi)	Bearing (Relative to Bow)	Bottom Depth m (ft)	Behavioral Summary
Before NSWC PCD AMNS Test Event – AMNS Sightings – 8 December 2011 (continued)																
3	12/8/11	TT	15	20	15	1	16:26	16:41	2	29.741	-85.619	-	0.2 (0.1)	320	20-30 (66-98)	Three subgroups of bottlenose dolphins sighted travelling slowly. See **Appendix B** for focal follow data.
During NSWC PCD AMNS Test Event Sightings – 9 December 2011																
1	12/9/11	CC	1	1	1	-	9:59	-	4	29.796	-85.653	3.5	0.6 (0.3)	332	20-30 (66-98)	Loggerhead sea turtle sighted briefly at the surface.
2	12/9/11	CC	1	1	1	-	12:37	-	4	29.778	-85.634	-	0.1 (0.1)	090	20-30 (66-98)	Loggerhead sea turtle sighted briefly at the surface.
After NSWC PCD AMNS Test Event Sightings – 10 December 2011																
No sightings were made during the survey after the NSWC PCD AMNS test event on 10 December 2011.																

Key:
CC = Loggerhead sea turtle (*Caretta caretta*)
SF = Atlantic spotted dolphin (*Stenella frontalis*)
TT = Bottlenose dolphin (*Tursiops truncatus*)
Unid HST = Unidentified hardshell turtle

Table 6. Summary of Sightings Recorded during Monitoring for AMNS Test Event

Species	Number of sightings	Bottom Depth
Bottlenose dolphin	1	20-30 m (66-98 ft)
Atlantic spotted dolphin	3	20-30 m (66-98 ft)
Loggerhead turtle	2	20-30 m (66–98 ft)
Unidentified hardshell turtle	3	20-30 m (66-98 ft)

Four sightings of cetaceans and three sightings of sea turtles were made on 5, 6, and 8 December 2011 before the test event (**Figure 3, Table 5**). Two sightings of sea turtles were made during the test event on 9 December 2011 (**Figure 4, Table 5**). No cetaceans or sea turtles were seen after the test event on 10 December 2011.

Sightings included one group of bottlenose dolphins (*Tursiops truncatus*); three groups of Atlantic spotted dolphins (*Stenella frontalis*); two sightings of loggerhead sea turtle (*Caretta caretta*); and three sightings of unidentified hardshell turtles (**Figure 2, Table 5**). **Table 5** provides a summary of the sightings recorded, which includes group information and environmental data. Bottom depths for each sighting were estimated visually by eye in 20 to 30 m (65 to 98 ft) ranges from the maps from Geographic Information System plots of latitude and longitude for sightings and were not estimated more precisely for individual sightings (**Table 6**).

Acoustic Detections

Three acoustic detections during the nearly 29.5 h of acoustic survey time were recorded by E&P Environmental Services - RPS throughout the monitoring efforts (**Table 7**). The post-monitoring analyses determined that all three detections contained sounds produced by marine mammals (**Table 7**).

Two types of marine mammal sounds were identified using the following criteria:

1. Delphinid whistles: narrow-band, frequency-modulated sounds (5 to 18 kilohertz [kHz]) (**Figure 8a**); and
2. Delphinid clicks: broadband high-frequency clicks with short (< 1 second [sec]) inter-click intervals (**Figure 8b**).

Three detections of marine mammals were made on the pre-AMNS event survey day of 8 December 2011 (**Table 7**). No marine mammals were acoustically detected either during or after the AMNS test event. All three acoustic detections were associated with visual sighting events and included one group of bottlenose dolphins and two groups of Atlantic spotted dolphins in waters with bottom depths less than 30 m (98 ft) (**Figure 5, Table 7**).

Marine mammal acoustic SPUE was calculated as the total number of marine mammal acoustic detections (n=3) made divided by total acoustic survey (t=29.6 h and d=436.8 km [235.9 nmi]). The SPUE for cetaceans detected acoustically was equal to 0.10 detection per h or 0.0069 detection per km (0.013 detection per nmi).

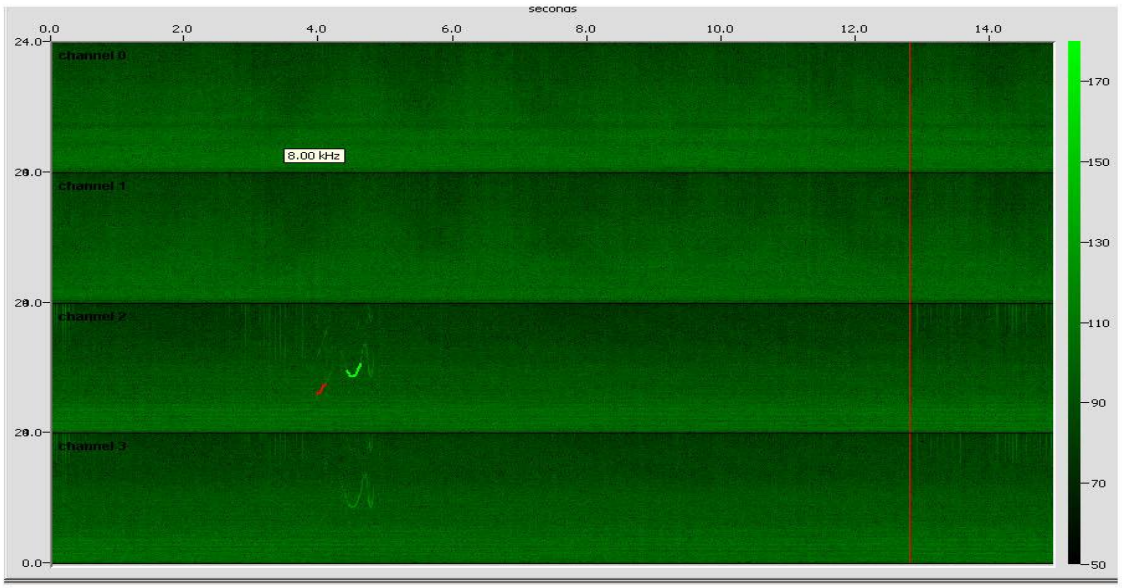

Figure 8a. Spectrograms of detected delphinid whistles. The x-axis is time in sec; y-axis, frequency in kHz. The scale on the right hand side indicates the received sound pressure level (SPL) at the hydrophone in dB re 1 µPa. Brighter green color indicates a louder sound (greater amplitude/intensity in dB) received at the hydrophone. The vertical red line indicates where newer data is scrolling over older data.

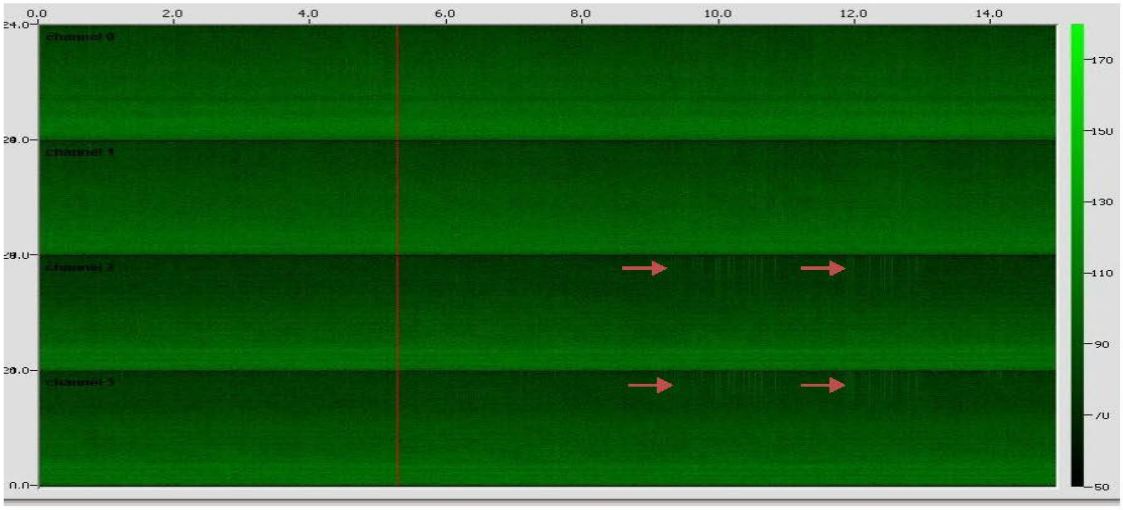

Figure 8b. Spectrograms of detected delphinid clicks (indicated by red arrows). The x-axis is time in sec; y-axis, frequency in kHz. The scale on the right indicates SPL received in dB re 1 µPa, where brighter green color indicates a louder sound (greater amplitude/intensity in dB) received at the hydrophone. The vertical red line indicates where newer data is scrolling over older data.

Table 7. Summary of Acoustic Detections for AMNS Test Event.

Detection No.	Date	Species (if known)	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Bottom Depth m (ft)	Certainty of Detection	Comments
1	8 December	Bottlenose Dolphin	14:41	14:43	2	29.94805°N	85.76944°W	<30 (<98)	Definite	Upsweep Whistle (12.5-14.5 kHz), Clicks (11.7-24 kHz)
2	8 December	Atlantic Spotted Dolphin	15:53	15:55	2	29.98861°N	85.91250°W	<30 (<98)	Definite	Sinusoidal Whistles (8-22 kHz), Clicks (16-24 kHz)
3	8 December	Atlantic Spotted Dolphin	16:25	16:39	3	29.85305°N	85.84333°W	<30 (<98)	Definite	Sweeping Whistles (6-22 kHz), Clicks (18-24 kHz)

Noise interference may have masked some acoustic detections, especially on the first day (5 December) where only 110 m (361 ft) of cable (two hydrophones) was deployed. Noise interference such as propeller wash (0-4.17 kHz measured at 110 to 130 dB); electronic pulses from the equipment (14 kHz); and wave/sea noise depending on Beaufort sea state (3 to 24 kHz up to 160 dB) were noted during the measurements. These noises potentially masked mid-frequency signals, such as whistles. Additionally, shallow water environments can limit the propagation of sound due to scattering, surface reflection and absorption. These effects can be even more accentuated with rough surface conditions (i.e., high Beaufort sea state) and the type of seabed substrate.

Behavior

No visible evidence of unusual behavior was observed during surveys before, during, or after the test event for the AMNS (**Table 5**). The team was able to attempt two focal follows during the pre-test monitoring on 8 December 2011. The first focal follow occurred for a period of 20 minutes and was spent with a group of eight Atlantic spotted dolphins. The second focal follow occurred for a period of 12 minutes, and was spent with a group of 15 bottlenose dolphins. Detailed behavioral observations made during the focal follows are presented in **Appendix B**. Photographs of suitable quality for species identification purposes were collected during several sightings of dolphins and sea turtles. Video was also collected during focal follows.

Section 4 Acknowledgements

We would like to thank Captain Marvin Rowe and the crew of the R/V *Athena II*. These data were obtained under National Marine Fisheries Service permit No. 14451 issued to Joseph R. Mobley, Jr.

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Section 6 List of References

Buckland et al. 2001 — Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas. 2001. *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*. Oxford University Press, NY.

DoN 2010a — Department of the Navy (DoN). 2010. *Navy Integrated Comprehensive Monitoring Program (ICMP), 2010 Update*. Chief of Naval Operations (CNO) Energy and Environmental Readiness Division (N45). 20 December.

DoN 2010b — DoN. 2010. *Final Monitoring Plan for Marine Mammal Protection Act (MMPA) Authorization.* Naval Surface Warfare Center Panama City Division (NSWC PCD). Prepared for National Marine Fisheries Service, Silver Spring, Maryland. January 2010.

HDR 2010 — HDR. 2010. *RIMPAC 2010. Marine Species Monitoring. Passive Acoustic Monitor Deployment and Small Vessel-based Monitoring Surveys, 17-15 July 2010.* Final field summary report. Submitted to NAVFAC Pacific, EV2 Environmental Planning under contract # N62470-10-D-3011 by HDR Environmental Operations & Construction. 15 pp.

NMFS 2010 — National Marine Fisheries Service (NMFS). 2010. Final Rule: Taking and Importing Marine Mammals; U.S. Naval Surface Warfare Center Panama City Division Mission Activities. *Federal Register* 75: 3395-3416.

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APPENDIX A
Environmental, Oceanographic, and Sighting Conditions

Table A-1 shows the environmental, oceanographic, and sighting conditions encountered throughout the pre-AMNS, during-AMNS and post-AMNS monitoring efforts.

Time	Beaufort	Swell Height m (ft)	Port Side Glare	Starboard Side Glare	Trackline Glare
Survey Before NSWC PCD AMNS Test Event on 5 December 2011					
11:44	4	3-4 (10-13)	Yes	No	No
12:22	4	3-4 (10-13)	No	No	Yes
12:32	4	2-3 (7-10)	No	No	No
13:32	4	2-3 (7-10)	No	No	Yes
14:03	4	2-3 (7-10)	No	No	No
14:22	4	2-3 (7-10)	No	No	Yes
15:12	4	3-4 (10-13)	Yes	No	No
15:18	4	3-4 (10-13)	No	No	No
15:43	3	3-4 (10-13)	No	No	No
15:59	3	3-4 (10-13)	Yes	No	No
16:21	3	2-3 (7-10)	No	No	Yes
Survey Before NSWC PCD AMNS Test Event on 6 December 2011					
7:34	2	0-1 (0-3)	No	No	No
7:41	2	1-2 (3-7)	No	No	No
7:48	3	1-2 (3-7)	No	No	No
8:09	3	1-2 (3-7)	No	No	Yes
8:34	2	1-2 (3-7)	No	No	Yes
9:06	2	1-2 (3-7)	Yes	No	No
9:15	2	1-2 (3-7)	No	No	Yes
10:06	2	1-2 (3-7)	Yes	No	No
10:07	3	1-2 (3-7)	Yes	No	No
10:26	3	1-2 (3-7)	No	No	Yes
11:28	2	1-2 (3-7)	No	No	Yes
11:58	3	1-2 (3-7)	Yes	No	No
12:14	3	1-2 (3-7)	Yes	No	No
12:15	3	0-1 (0-3)	No	No	Yes
12:54	3	0-1 (0-3)	Yes	No	No
13:57	2	0-1 (0-3)	No	No	Yes
14:22	3	0-1 (0-3)	No	No	Yes
15:32	2	0-1 (0-3)	No	No	Yes
16:01	3	0-1 (0-3)	No	No	Yes
Survey Before NSWC PCD AMNS Test Event on 8 December 2011					
13:22	1	0-1 (0-3)	Yes	No	No
14:03	1	0-1 (0-3)	No	No	No

Time	Beaufort	Swell Height m (ft)	Port Side Glare	Starboard Side Glare	Trackline Glare
Survey Before NSWC PCD AMNS Test Event on 8 December 2011 (continued)					
15:40	2	0-1 (0-3)	No	No	No
16:04	2	0-1 (0-3)	Yes	No	No
16:05	2	0-1 (0-3)	No	No	Yes
Survey During NSWC PCD AMNS Test Event on 9 December 2011					
8:32	2	0-1 (0-3)	No	Yes	No
8:34	3	0-1 (0-3)	No	Yes	No
8:44	3	0-1 (0-3)	Yes	No	No
9:02	3	0-1 (0-3)	No	No	No
9:04	3	0-1 (0-3)	No	No	Yes
9:43	4	0-1 (0-3)	No	No	Yes
9:52	4	0-1 (0-3)	Yes	No	No
10:46	4	0-1 (0-3)	No	No	Yes
11:21	4	0-1 (0-3)	Yes	No	No
11:41	3	0-1 (0-3)	Yes	No	No
12:11	3	0-1 (0-3)	No	No	Yes
12:12	4	0-1 (0-3)	No	No	Yes
13:00	4	0-1 (0-3)	Yes	No	No
13:12	3	0-1 (0-3)	Yes	No	No
13:42	3	0-1 (0-3)	No	No	No
13:44	3	0-1 (0-3)	No	No	Yes
13:58	4	0-1 (0-3)	No	No	Yes
14:21	4	0-1 (0-3)	No	No	No
14:38	3	0-1 (0-3)	Yes	No	No
15:18	3	0-1 (0-3)	No	No	No
15:41	4	0-1 (0-3)	No	No	No
16:04	4	0-1 (0-3)	No	No	Yes
16:05	3	0-1 (0-3)	No	No	Yes
Survey After NSWC PCD AMNS Test Event on 10 December 2011					
6:22	5	2-3 (7-10)	No	No	Yes
7:16	5	2-3 (7-10)	Yes	No	No
7:42	5	2-3 (7-10)	No	No	Yes
8:39	5	2-3 (7-10)	Yes	No	No
8:45	5	2-3 (7-10)	No	No	Yes
9:01	5	2-3 (7-10)	No	No	Yes
9:26	5	2-3 (7-10)	No	No	Yes
9:42	4	2-3 (7-10)	No	No	Yes
10:07	5	2-3 (7-10)	Yes	No	No
10:50	5	2-3 (7-10)	No	No	Yes
11:06	5	1-2 (3-7)	No	No	Yes

APPENDIX B
Focal Follow Data

Table B-1 shows focal follow behavioral data from the 5–10 December 2011 monitoring efforts before, during, and after the NSWC PCD AMNS test event. Two focal follow events were conducted on 8 December 2011, before the NSWC PCD AMNS test event – one for a group of Atlantic spotted dolphins and another for a group of bottlenose dolphins.

Table B-1. Focal Follow Behavioral Data Collected During Monitoring.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 1 from Survey Before AMNS Test Event on 8 December 2011					
Species: *Stenella frontalis*. Group size: 8.					
1	14:30:23	12/8/11	29.794	-85.626	Too far away to discern dispersal, group size is 5-10. Milling when first seen briefly, turning vessel to attempt follow. Sighting at bearing 90 degrees right relative to bow.
2	14:33:08	12/8/11	29.798	-85.627	Vessel still turning, group out of sight.
3	14:33:24	12/8/11	29.798	-85.626	Seen surfacing briefly. Sighting at reticle 1.2 and bearing 20 degrees.
4	14:37:04	12/8/11	29.796	-85.618	Surface active travel heading 90 degrees relative to bow.
5	14:37:17	12/8/11	29.796	-85.618	Slow travel 200 m (656 ft) from vessel, some fluke out and tail swish. Minimum Dispersal = 1 body length, Maximum Dispersal = 1 body length. Spots on body visually confirmed by visual observer.
6	14:38:37	12/8/11	29.795	-85.616	Milling, possible foraging - gull dove near dolphins.
7	14:39:20	12/8/11	29.794	-85.615	Two individuals bowriding, four more coming toward bow. All bowrode briefly, but only three stayed to bowride.
8	14:39:49	12/8/11	29.795	-85.615	Three individuals bowriding now, another dolphin is behind the stern, subgroups separated by 20 body lengths, bowriding individuals separated by 1 to 7 body lengths, which varies as they move back and forth across bow.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 1 from Survey Before AMNS Test Event on 8 December 2011					
9	14:41:38	12/8/11	29.794	-85.611	Same three individuals still bowriding, while three others are directly above the array slowly traveling behind vessel. Focal follows focusing on three bowriding individuals. Minimum Dispersal = 1 body length, Maximum Dispersal = 7 body lengths.
10	14:42:17	12/8/11	29.793	-85.609	Others are milling above PAM array; same three are still bowriding.
11	14:42:59	12/8/11	29.793	-85.793	One juvenile and two adults are bowriding. Minimum Dispersal = 1, Maximum Dispersal = 7.
12	14:43:58	12/8/11	29.792	-85.606	Bowriding, dispersal of bowriders varies from 1 to 7 body lengths as they move back and forth in front of the bow.
13	14:45:29	12/8/11	29.791	-85.603	Difficult for observers to see bowriders from the flying bridge. Minimum Dispersal = 1 body length, Maximum Dispersal = 7 body lengths.
14	14:46:30	12/8/11	29.790	-85.601	Bowriding, one dolphin just swam under boat. Minimum Dispersal = 1 body length, Maximum Dispersal = 7 body lengths.
15	14:47:06	12/8/11	29.790	-85.600	Slow travel heading 270 degrees relative to bow, approximately 40 m (131 ft) from vessel. All dolphins left bow and are headed away from the vessel slowly. Minimum Dispersal = 2 body lengths, Maximum Dispersal = 2 body lengths.
16	14:48:12	12/8/11	29.789	-85.598	Slow travel heading 300 degrees relative to the bow, approximately 40 m (131 ft) from the vessel. All joined back together now for a total group size of 8. Minimum Dispersal = 1 body length, Maximum Dispersal = 6 body lengths.
17	14:50:24	12/8/11	29.788	-85.593	Slow travel heading 300 degrees relative to bow, approximately 50 m (164 ft) from vessel. Minimum Dispersal = 1 body length, Maximum Dispersal = 6 body lengths. Still moving slowly indirectly away we are going back on line effort, leaving dolphins ending focal follow.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 3 from Survey Before AMNS Test Event on 8 December 2011					
Species: *Tursiops truncatus*. Group size: 15.					
1	16:29:21	12/8/11	29.739	-85.619	Slow travel in 3 subgroups heading 40 degrees relative to bow. Minimum Dispersal = 1 body length (within subgroups), Maximum Dispersal = 6 body lengths (between subgroups). No change in behavior or heading since initially seen; no reaction to vessel entire time. Three juveniles are among the group
2	16:30:48	12/8/11	29.737	-85.619	Group underwater, bringing vessel speed back up to 15 km per h (8 knots), speed had been dropped to 11 km per h (6 knots). Visual sighting made before PAM operator detected acoustically via array.
3	16:33:38	12/8/11	29.737	-85.623	Slow travel heading 250 degrees relative to bow, 100 m (328 ft) from vessel. Minimum Dispersal = 1 body length, Maximum Dispersal = 1 body length. Still 3 subgroups.
4	16:35:17	12/8/11	29.741	-85.626	Slow travel heading 250 degrees relative to bow 70 m (230 ft) from vessel. Minimum Dispersal = 1 body length, Maximum Dispersal = 1 body length. Still three subgroups.
5	16:35:51	12/8/11	29.742	-85.626	Slow travel, front subgroup dove, flukes in air.
6	16:36:21	12/8/11	29.742	-85.626	Slow travel heading 250 degrees relative to bow 100 m (328 ft) from vessel. Location bearing 220 degrees relative to bow. Minimum Dispersal = 1 body length, Maximum Dispersal = 1 body length.
7	16:37:51	12/8/11	29.744	-85.628	Slow travel with sighting at bearing 250 degrees relative to bow and reticle 2. Location bearing 200 degrees relative to bow. Minimum Dispersal = 1 body length, Maximum Dispersal = 1 body length. Dolphins have passed vessel and are moving away from vessel; dolphins are headed in opposite direction.
8	16:39:38	12/8/11	29.746	-85.630	No longer seeing dolphins, breaking off line search effort for the day.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 3 from Survey Before AMNS Test Event on 8 December 2011					
9	16:41:00	12/8/11	29.746	-85.630	Slow travel with sighting of bearing 250 degrees relative to bow and reticle 2. Dispersal unknown. Can barely track them behind vessel and to port side.

APPENDIX C
Passive Acoustic Monitoring Data

Table C-1 shows daily passive acoustic monitoring forms, which include details on hydrophone array, methods of deployment, length of cable deployed, frequency and sampling range, as well as weather conditions and number of detections.

Table C-1. Daily Passive Acoustic Monitoring Form HDR Navy AMNS Program

December 5, 2011								
Project Details								
Date	12/5/2011		Project Number	UME04100		Permit Number	N/A	
Shift	Day		Vessel Name	Athena II		Client	Navy	
Acoustic Operator(s)	James Doom							
PAM Monitoring Details								
Detections (Y/N) and Number(s) if Y	N		Mitigation Actions	None		Seiche Serial Numbers for Hydrophone and Deck Cables in Use	SM. 1393, SM. 1810	
Hours of Operation (UTC; list all)	17:50-19:27, 19:37-20:16, 20:27-22:45		Total Acoustic Monitoring Time	04:34		Average Noise Score	5	
Monitoring Conditions								
Weather Conditions	Winds	10-15kts	Precipitation	None	Water Conditions	Swell Height	<2m	Sea State	Light Chop
PAM Deployment Details								
Hydrophone System Deployed	Specialized Towed Linear Array with Large Hydrophone Element Separation		Number of Functional Hydrophone Elements	2		Hydrophone Element Separation	1.2	
Monitoring Location	Technical Workshop		Length of Hydrophone Cable (meters)	400		Length of Hydrophone Cable Deployed (meters)	110	
Weight on Cable (kg)	0kg		Location of Weights Relative to First Hydrophone Element (x meters ahead of or behind)	None		Describe material used to Weigh Down Hydrophone Cable and How Attached	n/a	

December 5, 2011 (continued)							
PAM Deployment Details (continued)							
Hydrophone Towing Depth (meters)	3.5m	Hydrophone Tow Depth Variability (meters)	± 1.0m	Distance First Hydrophone Element from Airgun Array Center of Source (meters)	n/a		
Hydrophone Deployment Method	Two hydrophones deployed approximately 110 meters astern of the vessel. Limit length of cable deployed due to concerns about maneuvering ability and shallow water depth (100 ft) of the prospect. The hydrophone cable was deployed by hand from a wooden drum that was secured on a ground spooler secured to the vessel. The towed array was fed up to a tackle hanging from an A frame about 3 meters high off the stern of the vessel. A Chinese finger was attached to the array and secured to the A-frame. The spooler is secured using two snap tackles.						
Software Details							
Software	Pamguard	Frequency Range (kHz)	0-24kHz	Sampling Rate (kHz)	48KHz	Sound Card	ASIO Fireface
Software	Pamguard	Frequency Range (kHz)	0-96KHz	Sampling Rate (kHz)	192kHz	Sound Card	National Instruments DAQ Card
Detection Details							
No acoustic detections were made during the survey before the NSWC PCD AMNS test event on 5 December 2011.							
Additional Noise Characterization (Non-Biological)							
Source	Frequency Range (kHz)	Intensity (dB)	Occurrence	Recording Information	Details		
Prop Wash	0-4.17	110-130	continuous	HDR_NAV_LF_20111205_213735			
Electronic Pulse	14		continuous	HDR_NAV_LF_20111205_213735			
Wave/Sea Noise	3-24		every 3-10 sec	HDR_NAV_LF_20111205_213735			
Comments							
No detections. Shallow tow depth and proximity to the vessel generated high noise levels, effectively reducing detection range.							
December 6, 2011							
Project Details							
Date	12/6/2011	Project Number	UME04100	Permit Number	n/a		
Shift	Day	Vessel Name	Athena II	Client	Navy		
Acoustic Operator(s)	James Doom						
PAM Monitoring Details							
Detections (Y/N) and Number(s) if Y	N	Mitigation Actions	None	Seiche Serial Numbers for Hydrophone and Deck Cables in Use	SM. 1393, SM. 1810		
Hours of Operation (UTC; list all)	12:30-12:55, 13:00-15:55, 16:03-18:03, 18:33-22:30	Total Acoustic Monitoring Time	09:17	Average Noise Score	3		

December 6, 2011 (continued)									
Monitoring Conditions									
Weather Conditions	Winds	10-15kts	Precipitation	None	Water Conditions	Swell Height	<2m	Sea State	Slight
PAM Deployment Details									
Hydrophone System Deployed	Specialized Towed Linear Array with Large Hydrophone Element Separation		Number of Functional Hydrophone Elements	4		Hydrophone Element Separation		H1/H2: 1.2m; H2/H3: 194.6m; H3/H4: 1.2m	
Monitoring Location	Technical Workshop		Length of Hydrophone Cable (meters)	400		Length of Hydrophone Cable Deployed (meters)		320	
Weight on Cable (kg)	0kg		Location of Weights Relative to First Hydrophone Element (x meters ahead of or behind)	None		Describe material used to Weigh Down Hydrophone Cable and How Attached		n/a	
Hydrophone Towing Depth (meters)	14.5m		Hydrophone Tow Depth Variability (meters)	± 2.0m		Distance First Hydrophone Element from Airgun Array Center of Source (meters)		n/a	
Hydrophone Deployment Method	The hydrophone array was towed 320 meters astern of the vessel. Two hydrophones, 1.2 meters apart, were approximately 320 meters from the stern of the vessel. The second pair of hydrophones, also 1.2 meters apart, was towed 125.4 meters from the end of the vessel. The towed array was deployed by hand from a wooden drum secured on a ground spooling rack secured to the vessel. The towed array is fed up to a tackle hanging from an A frame about 3 meters above the stern of the vessel. A Chinese finger is attached to the array and secured to the A-frame. The spool is locked in place using two snap tackles.								
Software Details									
Software	Pamguard		Frequency Range (kHz)	0-24kHz	Sampling Rate (kHz)	48KHz	Sound Card	ASIO Fireface	
Software	Pamguard		Frequency Range (kHz)	0-96KHz	Sampling Rate (kHz)	192kHz	Sound Card	National Instruments DAQ Card	
Detection Details									
No acoustic detections were made during the survey before the NSWC PCD AMNS test event on 6 December 2011.									
Additional Noise Characterization (Non-Biological)									
Source	Frequency Range (kHz)		Intensity (dB)		Occurrence	Recording Information		Details	
Prop Wash	0-4.17		110-130		continuous	HDR_NAV_LF_20111206_133707			
Wave/Sea Noise	3-24		130-160		every 3-10 sec	HDR_NAV_LF_20111206_133707			
Comments									
The increased length of cable deployed from the vessel as reduced the noise levels and improved detection ranges. No detections were recorded.									

December 8, 2011									
Project Details									
Date	12/8/2011		Project Number		UME04100		Permit Number	n/a	
Shift	Day		Vessel Name		Athena II		Client	Navy	
Acoustic Operator(s)	James Doom								
PAM Monitoring Details									
Detections (Y/N) and Number(s) if Y	Y; 1-3		Mitigation Actions		None		Seiche Serial Numbers for Hydrophone and Deck Cables in Use	SM. 1393, SM. 1810	
Hours of Operation (UTC; list all)	19:20-20:51, 20:57-22:40		Total Acoustic Monitoring Time		03:14		Average Noise Score	3	
Monitoring Conditions									
Weather Conditions	Winds	0-5kts	Precipitation	None	Water Conditions		Swell Height	<2m	Sea State	Slight
PAM Deployment Details									
Hydrophone System Deployed	Specialized Towed Linear Array with Large Hydrophone Element Separation		Number of Functional Hydrophone Elements		4		Hydrophone Element Separation	H1/H2: 1.2m; H2/H3: 194.6m; H3/H4: 1.2m	
Monitoring Location	Technical Workshop		Length of Hydrophone Cable (meters)		400		Length of Hydrophone Cable Deployed (meters)	320	
Weight on Cable (kg)	0kg		Location of Weights Relative to First Hydrophone Element (x meters ahead of or behind)		None		Describe material used to Weigh Down Hydrophone Cable and How Attached	n/a	
Hydrophone Towing Depth (meters)	14.5m		Hydrophone Tow Depth Variability (meters)		± 2.0m		Distance First Hydrophone Element from Airgun Array Center of Source (meters)	n/a	
Hydrophone Deployment Method	The hydrophone array was towed 320 meters astern of the vessel. Two hydrophones, 1.2 meters apart, were approximately 320 meters from the stern of the vessel. The second pair of hydrophones, also 1.2 meters apart, was towed 125.4 meters from the end of the vessel. The towed array was deployed by hand from a wooden drum secured on a ground spooling rack secured to the vessel. The towed array is fed up to a tackle hanging from an A frame about 3 meters above the stern of the vessel. A Chinese finger is attached to the array and secured to the A-frame. The spool is locked in place using two snap tackles.								
Software Details									
Software	Pamguard		Frequency Range (kHz)	0-24kHz	Sampling Rate (kHz)	48KHz	Sound Card	ASIO Fireface	
Software	Pamguard		Frequency Range (kHz)	0-96KHz	Sampling Rate (kHz)	192kHz	Sound Card	National Instruments DAQ Card	

December 8, 2011 (continued)					
Detection Details					
Detection Number	1	2	3		
Time of First Detection (UTC)	20:41	21:53	22:25		
Time of Last Detection (UTC)	20:43	21:55	22:39		
Vessel Shooting Activity					
Noise Score	3	3	3		
Signal Detection Score	5	5	5		
Software Detected (list all)	Pamguard Spectrogram	Pamguard Spectrogram	Pamguard Spectrogram		
	Pamguard Low Frequency Click Detector	Pamguard High Frequency Click Detector	Pamguard High Frequency Click Detector		
		Pamguard Low Frequency Click Detector	Pamguard Low Frequency Click Detector		
Aurally Detected with Headphones	Yes	Yes	Yes		
Systems Detected if Multi-Vessel PAM Operation					
First Detected by	Visual Monitoring	Visual Monitoring	Acoustic Monitoring		
Correlated with Visual Detection	Yes	Yes	Yes		
Cetacean or Phocid Classification	Delphinid	Delphinid	Delphinid		
Species if Confirmed with Visual Detection	Common Bottlenose Dolphin	Atlantic Spotted Dolphin	Atlantic Spotted Dolphin		

December 8, 2011 (continued)					
Detection Details (continued)					
Estimated Range (meters)	100	100	10		
Localized via Triangulation (if detected on multiple arrays) or Built in Pamguard Function (Whistle-Moan Detector (specialized array with hydrophone separation) or Click Detector)					
Calculated Range if Localized via Method Above (meters)					
Recording Information (provide file name; all recordings should be sent in with the final report)	HDR_NAV_LF_20111208_202735, HDR_NAV_HF_20111208_204012	HDR_NAV_LF_20111208_213615, HDR_NAV_HF_20111208_214912	HDR_NAV_LF_20111208_221616, HDR_NAV_LF_20111208_222742, HDR_NAV_LF_20111208_222918, HDR_NAV_LF_20111208_223046, HDR_NAV_HF_20111208_221820, HDR_NAV_HF_20111208_222537, HDR_NAV_HF_20111208_223254,		
Additional Noise Characterization (Non-Biological)					
Source	Frequency Range (kHz)	Intensity (dB)	Occurrence	Recording Information	Details
Prop Wash	0-4.17	110-130	continuous	HDR_NAV_LF_20111208_193011	
Wave/Sea Noise	3-24	130-160	every 3-10 sec	HDR_NAV_LF_20111208_193011	
Comments					
Three detection events recorded, two of which were first detected visually by MSOs. The third detection event was also correlated with a visual observation but the operator detected the dolphins prior to the visual observers notifying the operator of the visual detection. See operator notes for additional details.					

December 9, 2011								
Project Details								
Date	12/9/2011	Project Number	UME04100	Permit Number	n/a			
Shift	Day	Vessel Name	Athena II	Client	Navy			
Acoustic Operator(s)	James Doom							
PAM Monitoring Details								
Detections (Y/N) and Number(s) if Y	N	Mitigation Actions	None	Seiche Serial Numbers for Hydrophone and Deck Cables in Use	*SM. 1393, SM. 1810*			
Hours of Operation (UTC; list all)	14:30-18:00,18:30-22:31	Total Acoustic Monitoring Time	07:31	Average Noise Score	3			
Monitoring Conditions								
Weather Conditions	Winds	5-10kts	Precipitation	None	Water Conditions	Swell Height	<2m	Sea State	Light Chop
PAM Deployment Details								
Hydrophone System Deployed	Specialized Towed Linear Array with Large Hydrophone Element Separation	Number of Functional Hydrophone Elements	4	Hydrophone Element Separation	H1/H2: 1.2m; H2/H3: 194.6m; H3/H4: 1.2m			
Monitoring Location	Technical Workshop	Length of Hydrophone Cable (meters)	400	Length of Hydrophone Cable Deployed (meters)	320			
Weight on Cable (kg)	0kg	Location of Weights Relative to First Hydrophone Element (x meters ahead of or behind)	None	Describe material used to Weigh Down Hydrophone Cable and How Attached	n/a			
Hydrophone Towing Depth (meters)	14.5m	Hydrophone Tow Depth Variability (meters)	± 2.0m	Distance First Hydrophone Element from Airgun Array Center of Source (meters)	n/a			
Hydrophone Deployment Method	The hydrophone array was towed 320 meters astern of the vessel. Two hydrophones, 1.2 meters apart, were approximately 320 meters from the stern of the vessel. The second pair of hydrophones, also 1.2 meters apart, was towed 125.4 meters from the end of the vessel. The towed array was deployed by hand from a wooden drum secured on a ground spooling rack secured to the vessel. The towed array is fed up to a tackle hanging from an A frame about 3 meters above the stern of the vessel. A Chinese finger is attached to the array and secured to the A-frame. The spool is locked in place using two snap tackles.							

December 9, 2011 (continued)							
Software Details							
Software	Pamguard	Frequency Range (kHz)	0-24kHz	Sampling Rate (kHz)	48KHz	Sound Card	ASIO Fireface
Software	Pamguard	Frequency Range (kHz)	0-96KHz	Sampling Rate (kHz)	192kHz	Sound Card	National Instruments DAQ Card
Detection Details							
No acoustic detections were made during the survey during the NSWC PCD AMNS test event on 9 December 2011.							
Additional Noise Characterization (Non-Biological)							
Source	Frequency Range (kHz)	Intensity (dB)	Occurrence	Recording Information	Details		
Prop Wash	0-4.17	110-130	continuous	HDR_NAV_LF_20111209_152615			
Wave/Sea Noise	3-24	130-160	every 3-10 sec	HDR_NAV_LF_20111209_152615			
Comments							
Navy conducted their scheduled detonation. No detections recorded.							

December 10, 2011									
Project Details									
Date	12/10/2011		Project Number		UME04100		Permit Number		n/a
Shift	Day		Vessel Name		Athena II		Client		HDR ARINC Navy
Acoustic Operator(s)	James Doom								
PAM Monitoring Details									
Detections (Y/N) and Number(s) if Y	N		Mitigation Actions		None		Seiche Serial Numbers for Hydrophone and Deck Cables in Use		SM. 1393, SM. 1810
Hours of Operation (UTC; list all)	12:35-17:30		Total Acoustic Monitoring Time		04:55		Average Noise Score		3
Monitoring Conditions									
Weather Conditions	Winds	20-25kts	Precipitation	None	Water Conditions		Swell Height	<2m	Sea State	Moderate Chop
PAM Deployment Details									
Hydrophone System Deployed	Specialized Towed Linear Array with Large Hydrophone Element Separation		Number of Functional Hydrophone Elements		4		Hydrophone Element Separation		H1/H2: 1.2m; H2/H3: 194.6m; H3/H4: 1.2m

December 10, 2011 (continued)							
PAM Deployment Details (continued)							
Monitoring Location	Technical Workshop	Length of Hydrophone Cable (meters)	400	Length of Hydrophone Cable Deployed (meters)	320		
Weight on Cable (kg)	0kg	Location of Weights Relative to First Hydrophone Element (x meters ahead of or behind)	None	Describe material used to Weigh Down Hydrophone Cable and How Attached	n/a		
Hydrophone Towing Depth (meters)	14.5m	Hydrophone Tow Depth Variability (meters)	± 2.0m	Distance First Hydrophone Element from Airgun Array Center of Source (meters)	n/a		
Hydrophone Deployment Method	The hydrophone array was towed 320 meters astern of the vessel. Two hydrophones, 1.2 meters apart, were approximately 320 meters from the stern of the vessel. The second pair of hydrophones, also 1.2 meters apart, was towed 125.4 meters from the end of the vessel. The towed array was deployed by hand from a wooden drum secured on a ground spooling rack secured to the vessel. The towed array is fed up to a tackle hanging from an A frame about 3 meters above the stern of the vessel. A Chinese finger is attached to the array and secured to the A-frame. The spool is locked in place using two snap tackles.						
Software Details							
Software	Pamguard	Frequency Range (kHz)	0-24kHz	Sampling Rate (kHz)	48KHz	Sound Card	ASIO Fireface
Software	Pamguard	Frequency Range (kHz)	0-96KHz	Sampling Rate (kHz)	192kHz	Sound Card	National Instruments DAQ Card
Detection Details							
No acoustic detections were made during the survey after the NSWC PCD AMNS test event on 9 December 2011.							
Additional Noise Characterization (Non-Biological)							
Source	Frequency Range (kHz)	Intensity (dB)	Occurrence	Recording Information	Details		
Prop Wash	0-4.17	110-130	continuous	HDR_NAV_LF_20111210_132825			
Wave/Sea Noise	3-24	130-160	every 3-10 sec	HDR_NAV_LF_20111210_132825			
Comments							
Seas increased considerably. Hydrophone 3 functioning well all day. No detections. Last day of watch.							

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Appendix F – Information on Sightings Recorded by U.S. Navy MMOs Onboard Vessels during Test Events Involving Sonar and Detonations in the NSWC PCD Study Area

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Table F-1. Information on Sightings Recorded by U.S. Navy MMOs Onboard Vessels during Sonar Test Events in the NSWC PCD Study Area.

	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5	Sighting 6	Sighting 7	Sighting 8
Map ID								
Sighting Information								
Date	1/14/12	2/5/12	2/5/12	2/8/12	2/13/12	2/13/12	2/22/12	3/10/12
Time	15:21	12:51	13:45	12:09	12:45	13:37	15:40	12:37
Location	6D	7A	7A	7A	7A	7A	7A	7A
Detection sensor	Visual	Visual	Visual	Visual	Visual	Visual	Visual	Visual
Species/group	CM	SD/SF	SD/SF	SD/SF	SD/SF	SD/SF	SD/SF	SD/SF
Group size	1	5	5	2	3	3	10	2
# calves	0	0	0	0	1	1	0	0
Behavior	Resting at surface	Bow riding	Bow riding	Bow riding	Bow riding	Bow riding	Bow riding	Traveling
Animal heading (true)	-	W	E	W	W	E	S	W
Animal motion relative to ship	-	-	-	-	-	-	-	-
Distance from ship	-	-	-	-	-	-	-	-
Length of contact	1-5 min	5-10 min	5-10 min	5-10 min	5-10 min	5-10 min	25 min	1-5 min
Environmental Information								
Wave height	2-3 ft	2-3 ft	2-3 ft	1-2 ft	2-3 ft	2-3 ft	0-1 ft	0-1 ft
Visibility	-	-	-	-	-	-	-	-
Beaufort Sea State (BSS)	-	-	-	-	-	-	-	-
Operational Information								
Active sonar in use?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Heading of ship	-	-	-	-	-	-	-	-
Mitigation implemented	Post-mission	During mission	During mission	During mission	During mission	During mission	During mission	During mission
Comments	No effect	No effect	No effect	No effect	No effect	No effect	No effect	Potential take

Table F-1. Information on Sightings Recorded by U.S. Navy MMOs Onboard Vessels during Sonar Test Events in the NSWC PCD Study Area (continued).

	Sighting 9	Sighting 10	Sighting 11	Sighting 12	Sighting 13	Sighting 14	Sighting 15	Sighting 16
Map ID								
Sighting Information								
Date	3/10/12	5/4/12	5/10/12	5/14/12	5/14/12	7/16/12	7/18/12	7/18/12
Time	16:58	18:35	12:00	11:01	12:52	13:54	9:40	10:25
Location	7A	W-151B-1	W-151B-1	W-151B-1	W-151B-1	W-151B-1	W-151B-1	W-151B-1
Detection sensor	Visual	Visual	Visual	Visual	Visual	Visual	Visual	Visual
Species/group	SD/SF	Unid ST	Unid ST	SD/TT	SD/SF	CC	CC	DC
Group size	1	1	1	20	12	1	1	1
# calves	0	0	0	0	0	0	0	0
Behavior	Bow riding	Resting at the surface	Resting at the surface	Traveling	Bow riding	Diving	Diving	Resting at the surface
Animal heading (true)	W	N	-	NW	W	NE	SW	E
Animal motion relative to ship	-	-	-	-	-	-	-	-
Distance from ship	-	-	-	-	-	-	-	-
Length of Contact	1 min	-	1-2 min	< 1 min	< 1 min	<1 min	< 1 min	< 1 min
Environmental Information								
Wave height	0-1 ft	2-3 ft	1-2 ft	3-5 ft	3-5 ft	1-2 ft	0-1 ft	0-1 ft
Visibility	-	-	-	-	-	-	-	-
BSS	-	-	-	-	-	-	-	-
Operational Information								
Active sonar in use?	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Heading of ship	-	-	-	-	-	-	-	-
Mitigation implemented	During mission	Post-mission	During mission	During mission	During mission	During mission	During mission	During mission
Comments	No effect	No effect	No effect	Possible take	No effect	No effect	No effect	No effect

Table F-1. Information on Sightings Recorded by U.S. Navy MMOs Onboard Vessels during Sonar Test Events in the NSWC PCD Study Area (continued).

	Sighting 17	Sighting 18	Sighting 19	Sighting 20
Map ID	**1**	**2**	**3**	**4**
Sighting Information				
Date	7/18/12	8/1/12	8/2/12	8/2/12
Time	13:20	10:09	9:11	11:23
Location	W-151B-1	W-151B-1	W-151B-1	W-151B-1
Detection sensor	Visual	Visual	Visual	Visual
Species/group	SD/SF	SD/TT	Unid SD	Unid ST
Group size	2	3	1	1
# calves	0	0	0	0
Behavior	Traveling	Traveling	Bow riding	Resting at the surface
Animal heading (true)	NE	SW	SE	-
Animal motion relative to ship	-	-	-	-
Distance from ship	-	-	-	-
Length of contact	2-3 min	< 1 min	< 1 min	< 1 min
Environmental Information				
Wave height	0-1 ft	2-3 ft	1-2 ft	1-2 ft
Visibility	-	-	-	-
BSS	-	-	-	-
Operational Information				
Active sonar in use?	No	No	Yes	Yes
Heading of ship	-	-	-	-
Mitigation implemented	Post-mission	Post-mission	During mission	During mission
Comments	No effect	Potential take	Potential take	Potential take

Key: - = Data not collected/available; ° = degrees; SD = Schooling dolphins; CC = Loggerhead turtle (*Caretta caretta*); CM = Green turtle (*Chelonia mydas*); DC = Leatherback turtle (*Dermochelys coriacea*); N/A=not applicable; Unid ST = Unidentified hard shell turtle; TT = Bottlenose dolphin (*Tursiops truncatus*); SF = Atlantic spotted dolphin (*Stenella frontalis*); Unid SD = unidentified schooling dolphins; min = minute(s); ft = feet; N = North; S = South; E = East; W = West; NW = Northwest; SW = Southwest; NE = Northeast; SE = Southeast

NOTE: MMO activities were conducted on the following dates, but no sightings occurred: 15 January 2012; 29 January 2012; 2 February, 2012; 18 May 2012; 22 May 2012; 25 May 2012; 30 May 2012; 5 June 2012.

Table F-2. Information on Sightings Recorded by U.S. Navy MMOs Onboard Vessels during AMNS Live-Inert Explosives Test Events in the NSWC PCD Study Area.

	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5	Sighting 6	Sighting 7
Map ID							
Sighting Information							
Date	10/21/11	10/28/11	10/28/11	10/28/11	10/28/11	10/28/11	10/28/11
Time	15:23	10:49	11:19	11:37	11:48	11:50	13:10
Location	-	-	-	-	-	-	-
Detection sensor	Visual	Visual	Visual	Visual	Visual	Visual	Visual
Species/group	Unid SD	Unid ST	Unid ST	Unid SD	Unid SD	Unid ST	Unid ST
Group size	1	1	1	2	1	1	1
# calves	0	0	0	0	0	0	0
Behavior	Traveling	Traveling	Resting at the surface	Traveling	Traveling	Traveling	Resting at the surface
Animal heading (true)	S	-	-	N	S	-	-
Animal motion relative to ship	-	-	-	-	-	-	-
Distance from ship	235 m	300 m	300 m	0 m	400 m	235 m	0 m
Length of Contact	15 min	1 – 5 min	< 1 min	1 – 5 min	15 min	<1 min	< 1 min
Environmental Information							
Wave height	< 3 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft
Visibility	-	-	-	-	-	-	-
BSS	-	-	-	-	-	-	-
Operational Information							
Detonation?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Heading of ship	NE	NW	NW	N	S	NNW	W
Mitigation implemented	During mission	Pre-mission	Pre-mission	During mission	During mission	During mission	Post mission
Comments	Mission delayed	No effect	No effect	No effect	Mission delayed	No effect	No effect

Table F-2. Information on Sightings Recorded by U.S. Navy MMOs Onboard Vessels during AMNS Live-Inert Explosives Test Events in the NSWC PCD Study Area (continued).

	Sighting 8	Sighting 9	Sighting 10	Sighting 11
Map ID				
Sighting Information				
Date	11/02/11	11/02/11	11/02/11	12/09/11
Time	12:15	13:36	14:00	10:15
Location	-	-	-	-
Detection sensor	Visual	Visual	Visual	Visual
Species/group	Unid ST	Unid SD	Unid SD	Unid ST
Group size	1	3	3	1
# calves	0	0	0	0
Behavior	Resting at the surface	Traveling	Traveling	Resting at the surface
Animal heading (true)	-	-	-	-
Animal motion relative to ship	-	-	-	-
Distance from ship	50 m	< 50 m	< 50 m	235 m
Length of contact	< 1 min	15 min	-	< 1 min
Environmental Information				
Wave height	2 ft	1-2 ft	1-2 ft	< 3 ft
Visibility	-	-	-	-
BSS	-	-	-	-
Operational Information				
Detonation?	Yes	Yes	Yes	Yes
Heading of ship	NW	NW	NNW	NE
Mitigation implemented	Pre-mission	Pre-mission	Pre-mission	Pre-mission
Comments	No effect	No effect	No effect	No effect

Key: - = Data not collected/available; Unid ST = Unidentified hard shell turtle; Unid SD = unidentified schooling dolphins; min = minute(s); ft = feet; m = meters: N = North; S = South; W = West; NW = Northwest; NE = Northeast: NNW = North-northwest.

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Appendix G – Navy Lookout Comparison Study Data Collection Protocol

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Last updated 3 Dec 2010

Calibrating US Navy lookout observer effectiveness

Information for Marine Mammal Observers

Version 2.1

ML BURT and L THOMAS

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Acknowledgements
Feedback on this document was provided by the marine mammal observers involved in the data collection and in the debriefing sessions that followed each of the cruises. These include Amy Farak, Sean Hanser, Anu Kumar, Toni Mizerek, Deanna Rees, Julie Rivers, Robert Uyeyama and Stephanie Watwood

1. INTRODUCTION

1.1 Aim of the project

The US Navy use lookouts (LO) to detect anything in the water, including marine mammals. Depending on the nature of the activity the vessel is engaged in, action may need to be taken if the animal is within certain ranges of the vessel. Therefore, it is important to be able to detect all animals that come within these ranges and also determine how far away the animals are with accuracy. Lookouts are positioned so that the waters all around the vessel can be searched. As well as dedicated lookouts, officers on the bridge may also be searching and acousticians may also be listening for vocalisations (although we assume that visual confirmation is required before the encounter is classed as a detection). We refer to all of these observers together as the "observation team" (OT). The aim of this project is to calibrate the OT effectiveness in terms of detecting and identifying marine mammals. Of particular interest is the probability of an animal getting within a defined range of the vessel without being sighted by the OT, as well as determining the accuracy of the OT (primarily the LO) in determining species group (whale, dolphin, etc.) group size and position. In order to achieve this, experienced marine mammal observers (MMO) are required to be searching and collecting information on marine mammals that both they and the OT detect.

1.2 Overview of analysis methods

Three statistical models are required to estimate the probability of an animal getting within a defined stand-off range without being detected by the OT: (1) a model of the probability that an animal, or group of animals, at the surface is detected by the OT as a function of the animal's position relative to the vessel; (2) a model of surfacing behaviour of the animal/group; and (3) a model of animal/group movement. The data collected during the survey described here will be used to parameterize the first model. The latter two models will be parameterized from literature sources. To obtain parameters for the first model, the data required will be information on every surfacing of an animal (or group) detected by the MMOs and whether or not the OT saw it.

Since the action taken by the vessel once a sighting has been made depends on the distance recorded by the OT, and to some extent the species, we will also make an assessment of the accuracy of distance and species (or species group) determination – although the only data we have to compare this with are the distances and species recorded by MMOs, which may also not be error free. Therefore, while we can estimate the magnitude of the differences between OT and MMO distances and species determinations, we cannot make statements about absolute accuracy of either.

1.3 Overview of survey methods

In order to obtain a realistic probability of detection of every surfacing for the OT, it is important that the OT search as usual. However, some additional information from the OT will be required: namely, information on every surfacing if possible. Since this is not typically recorded, and we do not wish to interfere with the normal operation of the OT, we designate one of the MMOs to ensure that this information is obtained (as detailed below). This MMO will be called the liaison MMO (LMMO) since they need to liaise with the OT. The other MMOs also search and record every surfacing, in such a way

that the OT do not know what they are doing. To distinguish them from the LMMO, we refer to them as surveying MMOs (SMMOs).

With the SMMOs searching and recording every surfacing, a combination of line transect distance sampling (DS) and mark-recapture (MR) methods can be used to estimate the required probability of detection for each surfacing. These methods are frequently used in surveys of marine mammal surveys, but generally without the complication of recording each surfacing. The idea is that when the SMMOs detect an animal surfacing, they are setting up a "trial" for the OT, which can either result in the OT detecting that surfacing or not. The model assumes that probability of detection is a function of distance (both ahead and abeam of the ship), whether that group was sighted by the OT before and potentially other variables. Animals (or groups) that are more-or-less continually at the surface (such as large groups of dolphins) can be analysed in a similar framework, but here the probability of detection is modelled as a continuous hazard rather than only when discrete surfacing occurs. The data required for continuously available animals is: when and where the SMMOs first detected them, regular updates on position, when and where the OT first detected them (if they did), when and where the OT lost contact with them and when and where the SMMOs lost contact with them.

The primary members of the OT are the dedicated LOs; however there are also observers on the bridge and possibly an acoustic 'observer', although the search effort for these observers will be variable depending on their other duties. Nevertheless, sightings information from these observers will also be required. We plan that the LMMO will be stationed next to the LO; hence it is important that other members of the OT communicate their detections to the LO so that the LMMO can record them. If this does not happen, it may be necessary to station an additional LMMO on the bridge, so they can record detections made by the bridge observers.

A key element of this method is that the OT must search as usual and search independently from the SMMOs. If the LO or other observers are aware of sightings made by the SMMOs, the premise of the analysis will break down.

Another key element is that the SMMOs must be able to determine if a detection of a surfacing they have made has been detected by the OT or not (i.e. was the trial a "success" or "failure"). The LMMO is responsible for communicating all OT detections to the SMMOs, who can then judge if this corresponds with to a detection they have made. Also, information about the timing and location of detections will be recorded (by the LMMO for OT detections and by the SMMO for SMMO detections) so that determination of which are duplicates can be refined offline, after the survey.

In addition to the detection probability information, SMMO observers will also provide information on species and group size with which to calibrate the OT.

The most important surfacings are those made before the OT detects the animals, and the first surfacing detected by the OT. Thereafter, repeat detections of the same animal/group by the OT are useful information for refining the detection function shape, and for gleaning information about surfacing rates, but do not bear directly on the main question we wish to answer. Hence, most effort by the SMMOs should go into detecting marine mammals before the OT has seen them, and determining whether each of these surfacings is detected by the OT. Once a group has been detected, the SMMOs should feel free to concentrate on searching for new animals/groups, unless tracking of already detected groups is straightforward. One of the two SMMOs should be searching for new groups, especially if the other SMMO is following a group. The SMMOs are encouraged to search with binoculars or big eye binoculars as much as possible.

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1.4 Overview of the manual

This manual describes the survey protocol and sighting procedures of the various observers and details the data to be collected. It should be borne in mind that the protocol may need to be adapted if procedures are found to be infeasible. Contact details for the St Andrews team are given in section 1.5.

1.5 Contact details

If anything is unclear, or the protocol can not be implemented, then do not hesitate to contact the support team at St Andrews University, Scotland. Note that the UK is 10 hours ahead of Hawaii.

NAME	TELEPHONE	EMAIL	FAX
Len Thomas	+44 1334 461801	len@mcs.st-and.ac.uk	+44 1334 461800
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1 SURVEY PROCEDURE

1.1 Search platforms

2.1.1 Frigate

The platforms available for observation on a frigate are the bridge, bridge wings (with Big Eyes installed), the upper bridge and the fantail (at the stern of the ship).

1.2 Observer configuration

2.2.1 OT

Dedicated LOs are positioned on the upper bridge and fantail with additional observers operating opportunistically on the bridge. On destroyers or cruisers Los will be located on the bridge wings. An acoustic observer may also be available. We assume that the forward LO (on the upper bridge of a frigate) will be the one primarily making confirmed sightings, and that all sightings by other members of the OT will be reported to them. Officers on the bridge or in combat operations center are responsible for entering marine mammal records into a log (Appendix B); this log will not be used in the current survey as it is not sufficiently detailed for our purposes – instead the LMMO will keep detailed records (see below). All OT personnel should search independently of the SMMOs.

2.2.2 MMO

Four MMO are required; two on the bridge wings who are actively searching (SMMOs), one with the navy LO on the upper bridge (the LMMO), and one recording data (DMMO). The primary purpose of the LMMO on the upper bridge is to record all detections and surfacings detected by the OT. The MMO should all be in contact with each other and also be aware of any sightings made by the OT.

It is anticipated that the MMOs will rotate positions, for example, port SMMO, LMMO, starboard SMMO, DMMO (resting).

It is also conceivable that the LMMO may sometimes be able to operate as an additional search platform, aiding the SMMOs, if they are able to stand behind the LO and hence not cue them with their sightings. This is something that will need to be determined on board the vessel.

It is our hope that the MMOs will be able to use headset radios to communicate among themselves with the DMMO recording data and prompting SMMOs for additional information. Looking down greatly increases the chance of losing a tracked animal, missing sightings, etc.

2.3 OT procedure

It is important that the OT search as usual and independently of the MMO. Having detected a marine mammal, the LO should report each surfacing of the group they detect to the LMMO. The LMMO will be positioned on the upper bridge will record this information. However, the LO should not alter their usual search behaviour in order to better detect repeat surfacings – they should carry on with whatever search behaviour they would use if the MMOs were not present.

If the bridge, or other member of the OT, detect an animal, they should inform the LO. This will both inform the LMMO who can record the information and allow the LO to track each surfacing. It is not necessary for the bridge or other observers to inform the LO of each surfacing they detect after the first one, if it is obvious it is of the same group, unless this is their normal procedure. As stated earlier, we are not focussed on repeat surfacings.

It is our understanding that OT have access to a compass and this should be used to determine the angle from the trackline to the sighting if this is their usual method. Distances are estimated by eye.

2.4 SMMO procedure

The main functions of the SMMO are to detect and track marine mammals and determine whether sightings made by the OT and reported to them by the LMMO are duplicates with sightings they have made. The SMMOs should search from the vessel to the horizon using binoculars concentrating forward of the vessel to abeam. The search pattern is:

- Port observer: searches on the port side of the vessel from about 5^{o} starboard to abeam.
- Starboard observer: searches on the starboard side from about 5^{o} port to abeam.

On detecting an animal, they should attempt to record each surfacing until the animal goes abeam. Tracking an animal has three uses: it helps to identify any animals subsequently seen by the OT; species and group size can be more accurate (because animals and groups are seen more than once) and information on surfacing behaviour is required for the analyses. The MMOs will need to be in contact with each other and thus be aware of any sightings made by the OT which will help with duplicate identification; duplicate sightings are animals seen first by the SMMO and then by the OT (as reported by the LO via the LMMO).

If the OT detect an animal prior to the SMMO, then the SMMO should attempt to locate it to determine species and group size and then continue to track and record each surfacing (but see section 3.4, below). If the OT sighting occurs during SMMO tracking, the SMMO should continue to track the animal until it is lost, or goes abeam, and then attempt to locate the sighting made by the OT.

SMMO should primarily concentrate their search effort forward of abeam but if substantial numbers of animals approach the vessel from behind abeam (i.e. dolphins that can swim faster than the vessel) then it may be necessary to search behind abeam.

Angleboards should ideally be used to measure bearings to sightings relative to the ship and the binoculars should have reticles for use in calculating distances.

Each SMMO should submit information via radio to the DMMO for data entry into the sighting form. Effort information should be recorded on an MMO effort form.

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The SMMOs assess the duplicate status of each surfacing.

If there are too many animals in view for an SMMO to keep track of, the SMMO should choose a small number of trials (one or two) that they can track accurately and follow them until it is clear the OT has duplicated that target or the track ends.

2.5 LMMO

The primary function of the LMMO is to record information (section 4) on the first sightings of all the OT. Information on all subsequent sightings should also be recorded if possible. The LMMO will pass the information of sightings to the SMMOs as soon as possible to determine if the OT has duplicated as sighting made by the SMMOs. In some cases this will inform the SMMOs of animals not yet detected. The LMMO can also actively search for animals and inform the SMMOs of any sightings they make (so the SMMOs can use them to set up trials), as long as this does not cue the LO or compromise data recording.

3 SIGHTING PROTOCOL

This section relates to the procedure to be followed on detecting a marine mammal.

3.1 LO

On sighting a marine mammal, the LO should inform the LMMO giving all required information (see section 4) but in particular time of sighting, species group, sighting angle, sighting distance and group size. The LO should also give the information for any subsequent sightings of the same group to the LMMO.

3.2 Bridge (or other OT member)

On sighting, or detecting, a marine mammal, the bridge should inform the LMMO – this may be via the LO if LMMO is not in direct contact with the bridge. Subsequent sightings of the same should also be passed to the LO, although it seems likely in practice that the primary responsibility for tracking already sighted groups within the OT will fall upon the LO.

3.3 SMMO

On sighting a marine mammal, the SMMO should

1. Relay "sighting" to the DMMO.
2. When prompted by DMMO, provide the following information: species, sighting angle, sighting distance and group size. Other information (such as cue or behaviour) should be collected if there is time.
3. Attempt to track the animal, recording information on all subsequent sightings.
4. Assess duplicate status, maybe in consultation with the LMMO.
5. Inform the bridge of any animal within the operational standoff range of the vessel if active sonar operations are taking place.

3.4 Tracking priority

The first priority for SMMOs is to find and track animals before the OT see them, to set up trials for the OT. When the OT report a sighting (via the LMMO) of a new group they should determine whether it is a duplicate or not (i.e. something they were tracking already). A secondary priority is to track groups already seen by the OT, to determine resighting rates. With this in mind, the procedure for SMMOs on detecting an animal is as follows:

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- On locating an animal, or group, attempt to track until the animal is lost or is a long way behind and unlikely to approach the vessel.
- If the OT detect an animal while both SMMOs are searching (i.e. not tracking anything), one SMMO should attempt to locate the OT sighting (to confirm species and group size) and continue to track it and record each surfacing. This will be necessary to determine how many surfacings the OT detect. The other SMMO should continue to search as setting up new trials is more important.
- If the OT detect an animal while one SMMO is engaged in tracking, that SMMO should determine whether the OT sighting is a duplicate or not. If it is, the SMMO should continue tracking the group while the other SMMO searches for new groups. If it is not, the SMMO should continue tracking their group, while the other SMMO attempts to track the group seen by the OT, if possible. If this is not possible, the other SMMO should revert to searching for new groups to track.
- If the OT detect an animal while both SMMOs are engaged in tracking, the SMMOs should continue determine if the OT sighting is a duplicate or not. In either case, they should continue tracking their groups until the track is finished or the group is sighted by the OT.

3.5 Group size definition

In the case of aggregated groups, the angle and distance measurement should be estimated to the geometric centre of the aggregation. A group can be thought of as the smallest unit that can be tracked as a unit. A convenient rule is, for example, to define a group as containing animals not more than 3 animal lengths from each other (this may depend on species). The group may exhibit the same swimming pattern and general behaviour although not necessarily with a synchronised surfacing pattern.

Difficulties may arise when animals are not in tight, easily defined clusters, but in loose aggregations whose boundaries and group size must be determined subjectively. In this case, it is better to identify smaller, homogenous groups within the aggregation, and associate each with an angle, distance and group size.

Problems can also arise when a group is formed of animals swimming in a long line at relatively equal distances from each other (e.g. pilot whales). In this case, group boundaries can be taken at convenient discontinuities in the distribution.

Large groups of dolphins may comprise of several hundreds of animals. Often these groups are compact and form a single unit. Sometimes subgroups may form but may only last for a short time with frequent interchange of animals between groups. In this case, it is better to treat the whole group as a single unit. As these groups will have a continuous cue, it is not necessary to make continuous resightings, but only at appropriate intervals, say 5 minutes or perhaps more frequently close to the vessel.

If relatively stable subgroups can be identified, then the details for the first subgroup sighted should be recorded and then this subgroup should be followed. Include a comment that it is part of a larger aggregation, and if possible, how many other subgroups there are in the aggregation and group sizes. A duplicate sighting would occur if the OT detects the subgroup being tracked.

If a groups splits while being tracked, then one subgroup should be tracked. The groups sizes recorded should reflect that the group has split and is now smaller than the original sighting. The fact that the

group has split should be recorded in the data. When tracking of the subgroup has finished, the SMMO should then try to relocate one of the other subgroups and track it.

3.6 Surfacing and availability

A surfacing is defined as any opportunity that an animal is available to be detected visually. This could be when the animals are at the surface or even below the surface if the water is clear enough.

Some animals may be intermittently available, for example if they are at the surface for a short time and then dive and then return to the surface. Others might be continuously available, for example large groups of dolphin schools which surface asynchronously. As ever, it is important to record the first sighting of these and as discussed in section 3.5, record the final sighting and, if feasible, at appropriate intervals such as every 5 minutes.

Some animals may provide both intermittent and continuous cues (i.e. a blow but then stays close to the surface and if the water is clear enough can still be seen). In this case, treat each discrete surfacing (ie. fluke, blow, body) as a resurfacing but include a comment that the animal is continuously available.

4 DATA COLLECTION

It is anticipated that data will be recorded by the DMMO onto paper forms and transcribed at the end of each day. The information collected by the OT is recorded by the LMMO onto a sightings form. Sightings by the SMMOs are recorded or transcribed onto a MMO sighting form. Forms for search effort and weather and other basic information are also provided. Note the form number and total number of forms (at the top of the paper form) is used to prevent forms being lost.

4.1 Sightings form

This form should be used to record all sighting information. All information is required upon initial sighting. Information needed for each resurfacing is indicated in bold.

FIELD	DESCRIPTION
SIGHTING #	**This is the number of each sighting and should be sequential.**
RESIGHTING #	**The number of times the object has been resighted. The initial sighting will have a resighting number of zero and subsequent resightings will be 1, 2, etc. Each resighting starts a new column on the sighting report form.**
RESIGHTING. STATUS	**D definite resightings (at least 90% likely to be the same animal or group)** **P possible resighting (more than 50% likely)** **R remote resighting (less than 50% likely)**
TIME	**Time of sighting.**
SPECIES CODE	**The five letter code used to identify the species. Refer to section 4.4. If a species is not listed, then include this information in the 'Comment' for the record.**
DURATION (if cue continuous)	**If the cue is continuous, then indicate the length of time, you were observing this sighting.**
ANIMAL (A) bearing	**Estimated angle of the bow of the ship to the sighting. A sighting dead ahead is 0^{o} and angles go from 0-360^{o}.**
SIGHTING DISTANCE	**Estimate of sighting distance in metres?**
GROUP SIZE	**Give the best estimate of group size, including calves. In mixed schools enter the number of each species.**

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DUPLICATE SIGHT #	**Duplicate sighting number. This allows duplicate sightings to be cross-referenced.**
DUPLICATE TRIAL	**Indicate if this is a valid duplicate:** **Yes – sighting seen first by MMO** **No – sighting seen first by OT**
DUPLICATE STATUS	**Duplicate status of a sighting:** **D – definite duplicate (at least 90% likely to be the same animal)** **P – possible duplicate (more than 50% likely)** **R – remote change of being a duplicate (less than 50% likely)**
SHIP LATITUDE	
SHIP LONGITUDE	
SHIP (S) BEARING	
RELATIVE MOTION A/S & A'S BEARING	Indicates of the animal is opening away from the ship, closing towards the ship, or moving parallel to the ship's track. "None" if animal is stationary. The heading of the animal relative to the ship should be recorded relative to the line of sight where 0° indicates the animal is heading directly away, 90° indicates the animal is heading from left to right, 180° - directly towards the ship, 270° - heading right to left.
DETECTION SENSOR	Observer who made the sighting: MMO + observer code LO Bridge Acoustic
NUMBER OF CALVES	Enter the number of calves in a group.
SIGHTING CUE	Indicator of cue which led to the sighting: (just use words if more convenient) BL - blow BW – bowride BY - body DV - dive FL – fluke up GL – glint of sunlight off body HS – head slap JU - jump /breach/spin PA – peduncle arch PP – porpoise PS – pectoral fin slap SL- slick, footprint or ring SN – spin SP - splash TS – tail slap WL – seabirds or other associated wildlife OT – other
BEHAVIOUR	BR – Breaching BW – Bow riding FD – Feeding FL - Fluking FS – Flipper slapping ML – Milling

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	LO – Logging RE – Resting TR – Travelling TS – Tail slap VO - Vocalizing
END OF TRACK	Reason for stopping a track. BE - sighting behind the beam LO - sighting lost OB - sighting obscured NC - no change of the sighting with respect to the boat (this may happen if the sighting is far away) MA - sighting passed to other LO to follow OT – other
OPERATIONS INFORMATION	Were any mitigation measures implemented?
COMMENT	Any additional information.

4.1.1 Sighting number/Duplicate sighting number

The duplicate sighting number on the sightings form is the number given to the surfacing by the LMMO, and called down to the SMMOs. If the SMMOs think this is the same as a surfacing they sighted, they give write down the LMMOs sighting number under "DUPLICATE SIGHT #" on the form. Two types of duplicate sighting can be distinguished: those that represent valid trials for estimating the OT detection function and those that do not. Valid trials are where the SMMO saw the surfacing independently (for example because they were tracking the group) and then the LMMO radios down to inform the SMMO that a surfacing has been seen by the OT, and the SMMO determines it's the same as the one they just saw. In this scenario, "Yes" should be entered under "DUPLICATE TRIAL". By contrast, trials do not occur when the LMMO alerts the SMMOs to a surfacing that the OT have seen but the SMMOs had not previously seen, and then the SMMOs see the surfacing and record information on it. In this case, although it's a duplicate (because both OT and SMMO saw the surfacing), it is not a valid trial as the OT saw it first directed the SMMO to see it. Hence "No" should be entered under "DUPLICATE TRIAL".

This duplicate information should be recorded by the SMMO since they are making any duplicate assessment. It is not necessary for the LMMO to fill in this information. The LMMO just need to pass sighting numbers of OT sightings to the SMMO so that the SMMO can fill in the duplicate information on their forms.

4.1.2 Multi species sighting

When recording groups of mixed species, record the information on separate lines but assign the same sighting number.

4.1.3 High density regions

It is anticipated that in the region chosen for the survey, animal density will be low. However, if the density of animals is high, so that the assessment of duplicate status becomes difficult, then indicate this on the effort form (see section 4.2). Cross-referencing of duplicates may need to be reconsidered. If density of animals is high (i.e. detections occur more than once every few minutes), then the timing of sightings becomes critical.

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4.2 MMO Effort/weather form

This form should be completed by the LMMO every time an 'event' occurs, for example at the start/end of search effort, observer rotation, changes in the weather. If the density of animals is too high to make it difficult to assess duplicate status, then indicate this in the 'Event' field. Sometimes the weather will be too bad for searching, in which there will be no search effort.

FIELD	DESCRIPTION
EFFORT	Whether search effort is ON or OFF.
EVENT	Record the event: 1 – begin search effort 2 – stop search effort 3 – observer rotation 4 – weather change 5 – transect waypoint 6 – high animal density 7 – back to normal animal density 8 – end of day
TIME	Time of event
LATITUDE	
LONGITUDE	
Port MMO	MMO who is searching on port side of vessel.
Starboard MMO	MMO who is searching on starboard of vessel.
LMMO	MMO who is acting as liaison MMO.
DMMO	MMO who is data recorder
SEA STATE	Beaufort Sea state on a scale of 0-7.

Beaufort number	Wind speed kt	km/h	mph	m/s	Mean wind speed (kt / km/h / mph)	Description	Wave height m	ft	Sea conditions	Land conditions
0	0	0	0	0-0.2	0 / 0 / 0	Calm	0	0	Flat.	Calm. Smoke rises vertically.
1	1-3	1-6	1-3	0.3-1.5	02 / 04 / 2	Light air	0.1	0.33	Ripples without crests.	Wind motion visible in smoke.
2	4-6	7-11	4-7	1.6-3.3	05 / 09 / 6	Light breeze	0.2	0.66	Small wavelets. Crests of glassy appearance, not breaking	Wind felt on exposed skin. Leaves rustle.
3	7-10	12-19	8-12	3.4-5.4	9 / 17 / 11	Gentle breeze	0.6	2	Large wavelets. Crests begin to break; scattered whitecaps	Leaves and smaller twigs in constant motion.
4	11-16	20-29	13-18	5.5-7.9	13 / 24 / 15	Moderate breeze	1	3.3	Small waves.	Dust and loose paper raised. Small branches begin to move.
5	17-21	30-39	19-24	8.0-10.7	19 / 35 / 22	Fresh breeze	2	6.6	Moderate (1.2 m) longer waves. Some foam and spray.	Smaller trees sway.
6	22-27	40-50	25-31	10.8-13.8	24 / 44 / 27	Strong breeze	3	9.9	Large waves with foam crests and some spray.	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
7	28-33	51-62	32-38	13.9-17.1	30 / 56 / 35	Near gale	4	13.1	Sea heaps up and foam begins to streak.	Whole trees in motion. Effort to walk against the wind.
8	34-40	63-75	39-46	17.2-20.7	37 / 68 / 42	Gale	5.5	18	Moderately high waves with breaking crests forming spindrift. Streaks of foam.	Twigs broken from trees. Cars veer on road.
9	41-47	76-87	47-54	20.8-24.4	44 / 81 / 50	Strong gale	7	23	High waves (2.75 m) with dense foam. Wave crests start to roll over. Considerable spray.	Light structure damage.
10	48-55	88-102	55-63	24.5-28.4	52 / 96 / 60	Storm	9	29.5	Very high waves. The sea surface is white and there is considerable tumbling. Visibility is reduced.	Trees uprooted. Considerable structural damage.
11	56-63	103-117	64-72	28.5-32.6	60 / 111 / 69	Violent storm	11.5	37.7	Exceptionally high waves.	Widespread structural damage.
12	>63	>117	>72	>32.7	N/A	Hurricane	14+	46+	Huge waves. Air filled with foam and spray. Sea completely white with driving spray. Visibility very greatly reduced.	Massive and widespread damage to structures.

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SONAR	Is sonar On or Off?
EXPLOSIVES	Are explosives in use: Yes or No.
VISIBILITY	General impression for spotting marine animals: B – Bad (<0.5km) P – Poor (0.5 – 1.5km) M – Moderate (1.5 – 10km) G – Good (10 - 15km) E – Excellent (<15km)
WAVE HEIGHT	Light (0 – 3ft) Moderate (4 – 6ft) Heavy (>6ft)
SWELL DIRECTION	
WIND DIRECTION	
WIND SPEED	
% GLARE PORT	
% GLARE STARBOARD	
% CLOUD COVER	

4.3 MMO Observer code form

This should be completed at the start of the survey and the observer codes decided. The heights are needed if reticle readings have to be converted to distances.

FIELD	DESCRIPTION
CODE	Two letter code for each observer.
NAME OF OBSERVER	Name of the observer
EYE HEIGHT	Eye height (in feet) of the observer (to be used for converting reticle estimates to distances).
PLATFORM HEIGHT	Height of SMMO platform (in feet) above sea level.

4.4 Table of species codes

CODE	COMMON NAME	SCIENTIFIC NAME
BALMU	Blue whale	*Balaenoptera musculus*
BALPH	Fin whale	*Balaenoptera physalus*
MEGNO	Humpback whale	*Megaptera novaeangliae*
BALAC	Minke whale	*Balaenoptera acutorostrata*
BALED	Bryde's whale	*Balaenoptera edeni*
BALBO	Sei whale	*Balaenoptera borealis*
BAL--	Unidentified rorqual	Balaenopteridae
WHALE	Unidentified whale	
ZIP--	Unidentified beaked whales	Ziphiid
MES--	Unidentified *Mesoplodon*	*Mesoplodon* spp.

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MESDE	Blainville's beaked whale	*Mesoplodon densirostris*
ZIPCA	Cuvier's beaked whale	*Ziphius cavirostris*
INDPA	Longman's beaked whale	*Indopacetus pacificus*
PHYMA	Sperm whale	*Physeter macrocephalus*
KOGBR	Pygmy sperm whale	*Kogia breviceps*
KOGSI	Dwarf sperm whale	*Kogia simus*
KOG--	Unidentified pygmy/dwarf sperm whale	*Kogia* spp.
ORCOR	Killer whale	*Orcinus orca*
PSECR	False killer whale	*Pseudorca crassidens*
FERAT	Pygmy killer whale	*Feresa attenuata*
PEPEL	Melon-headed whale	*Peponocephala electra*
GLOMA	Short-finned pilot whale	*Globicephala macrorhynchus*
TURTR	Bottlenose dolphin	*Tursiops truncatus*
STEAT	Pantropical spotted dolphin	*Stenella attenuata*
GRAGR	Risso's dolphin	*Grampus griseus*
STELO	Spinner dolphin	*Stenella longirostris*
STECO	Striped dolphin	*Stenella coeruleoalba*
STEBR	Rough-toothed dolphin	*Steno bredanensis*
LAGHO	Fraser's dolphin	*Lagenodelphis hosei*
DOLPH	Unidentified dolphin	
CET--	Unidentified cetacean	
CHEMY	Green turtle	*Chelonia mydas*
EREIM	Hawksbill turtle	*Eretmochelys imbricata*
DERCO	Leatherback turtle	*Dermochelys coriacea*
CARCA	Loggerhead turtle	*Caretta caretta*
LEPOL	Olive ridley turtle	*Lepidochelys olivacea*
TURTL	Unidentified turtle	
MONSC	Hawaiian monk seal	*Monachus schauinslandi*

5 OTHER ACTIVITIES

5.1 Final cruise report

At the end of the cruise a brief report which contains a general evaluation of the survey (i.e. suitability of vessel, platform locations, search procedure, sighting protocol, equipment, general operation etc.) would be helpful. Perhaps include a summary of the survey data collected (number of miles/km searched, number of sightings of each species) and any problems that have occurred, any adaptations to the protocol that may have been implemented or if any new species codes have been added. This information will be useful to refine survey methods for the next survey and in the analysis of the data. This cruise report should describe the trials that are to be included in the analysis, unambiguously indicating only the trials that should be used. This list of trial numbers would integrate all information contained in the data commentary from the perspective of the observers who collected the data.

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5.2 And finally!

Have a good time and enjoy the survey! Don't forget you can contact the St Andrews team at any time (time difference allowing).

Last updated 3 Dec 2010

APPENDIX A EQUIPMENT LIST

LO Equipment

Each LO should have the following equipment, which are all provided:

- Compass for measuring sighting angle
- 7x50 binoculars for searching
- Big Eyes for group size
- Headsets or other means of communicating with bridge

MMO Equipment

Each MMO should have the following equipment:

- 7x50 Binoculars with reticles
- Compass (provided on platform)
- GPS or synchronised digital watch
- Radios (handheld or headsets to communicate with other MMO)
- Clipboard
- Pencils
- MMO sighting forms
- MMO effort/weather forms (LMMO only)
- Equipment to communicate with bridge
- Crib sheet for converting reticles to distances
- Crib sheet of species codes.

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APPENDIX B LO DATA – DAILY MARINE MAMMAL LOG

The following table describes the data recorded in the LO 'Daily marine mammal log'.

FIELD	DESCRIPTION
A. DTG	Date and time of sighting DDHHMM Z MMM YY
B. Species/Type of mammal	Types are Whale/Dolphin/Porpoise/Seal/Sea lion/Turtle/Generic (i.e. unknown)
C. Number of mammals	Number
D. Calves	Yes/No
E. Initial detection source	Visual/Aural
F. Initial bearing/range	Bearing in degrees (true)/ Range in yards
G. Unit position	Latitude DDMMSS N/S and Longitude DDDMMSS E/W
H. Unit course/speed	Course in degrees (true)/ Speed in knots
I. Last known bearing/range	Bearing in degrees (true)/ Range in yards
J. Total time visually observed	Time in minutes
K. Wave height	Wave height in feet
L. Visibility	Visibility in nautical miles
M. MFAS status	On/Off
N. MFAS action taken	Powerdown -6dB/Powerdown -10dB/Shutdown/None
The following fields are completed if MFAS was transmitting when a mammal was sighted and subsequently powered down/shut down, or course changed.	
O. Duration of action	Minutes
P. Maneuver conducted	Turn STBD/Turn PORT
Q. Degrees of course change	Degrees
R. Range action taken	Range in yards
S. Action impact	Tactical degradation assessment – examples: None Slight - degraded ASW screen integrity when ship manoeuvred to open whales Moderate – lost contract when power reduced Significant – engagement interrupted when MFAS as shutdown
T. Narrative of observation	Examples: Dolphins sighted at 1200yds off port bow, closing on ship. Manoeuvred to confirm bow riding and continued MFAS operations.