Annual Report No. 5:

Operation of the Surveillance Towed Array Sensor System

Low Frequency Active (SURTASS LFA) Sonar

Onboard the R/V *Cory Chouest*
and
USNS IMPECCABLE (T-AGOS 23)

Under the National Marine Fisheries Service

Letters of Authorization

of 15 August 2006

May 2007

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ACRONYMS AND ABBREVIATIONS

ASW	Antisubmarine Warfare
BRS	Behavioral Response Study
CEE	Controlled Exposure Experiment
CFR	Code of Federal Regulations
CLFA	Compact Low Frequency Active
CNO	Chief of Naval Operations
CW	Continuous Wave
DASN(E)	Deputy Assistant Secretary of the Navy for Environment
dB	Decibel(s)
DoC	Department of Commerce
DoD	Department of Defense
DON	Department of the Navy
DSEIS	Draft Supplemental Environmental Impact Statement
EIS	Environmental Impact Statement
EO	(Presidential) Executive Order
ESA	Endangered Species Act
FOEIS/EIS	Final Overseas Environmental Impact Statement/Environmental Impact Statement
FM	Frequency Modulated
fm	Fathom(s)
FR	Federal Register
FSEIS	Final Supplemental Environmental Impact Statement
ft	Feet
FY	Fiscal Year
HF	High Frequency
HF/M3	High Frequency Marine Mammal Monitoring
HLA	Horizontal Line Array
Hz	Hertz
IUCN	International Union for Conservation of Nature and Natural Resources
km	Kilometer(s)
kph	Kilometer(s) per hour
LF	Low Frequency
LFA	Low Frequency Active
LFAS	Low Frequency Active Sonar
LFS SRP	Low Frequency Sound Scientific Research Program
LOA	Letter of Authorization
LTM	Long Term Monitoring
LTS	LFA Transmit System
m	Meter(s)
MF	Mid-Frequency
MFA	Mid-Frequency Active
MILDET	Military Detachment
min	Minute(s)
MMC	Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MoD	Ministry of Defence
NDAA	National Defense Authorization Act
NEPA	National Environmental Policy Act of 1969
NGO	Non-Governmental Organization
nm	Nautical mile(s)
NMFS	National Marine Fisheries Service

NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRC	National Research Council
OBIA	Offshore Biologically Important Area(s)
OIC	Officer in Charge
ONR	Office of Naval Research
Pa	Pascal
RL	Received Level
rms	Root Mean Squared
ROD	Record of Decision
R/V	Research Vessel
SEIS	Supplemental Environmental Impact Statement
SEL	Sound Exposure Level
SERDP	Strategic Environmental Research and Development Program
SL	Source Level
SMRU	Sea Mammal Research Unit
SONAR	SOund Navigation And Ranging
SPL	Sound Pressure Level
SRP	Scientific Research Program
SURTASS	Surveillance Towed Array Sensor System
T-AGOS	Ocean Surveillance Ship
UK	United Kingdom
U.S.	United States
U.S.C.	United States Code
USNS	United States Naval Ship
VLA	Vertical Line Array
Symbols	
=	Equal to
/	Divided by
+	Plus
≥	Greater than or equal to
>	Greater than
<	Less than
~	Approximately
±	Plus or minus
μ	Micro (10^{-6})
Log	Logarithm

1.0 INTRODUCTION

Under the Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar Final Rule 50 CFR 216.186(b) and Condition 8(b) of the annual SURTASS LFA sonar Letters of Authorization (LOAs) for the USNS IMPECCABLE (T-AGOS 23) and Research Vessel (R/V) *Cory Chouest*, this report provides an unclassified summary of the classified quarterly reports of SURTASS LFA operations for the period 16 February 2006 through the quarter ending 15 February 2007.

1.1 Purpose of this Report

As a requirement of the Regulations for the Taking of Marine Mammals Incidental to Navy Operations of SURTASS LFA Sonar, 50 CFR 216 Subpart Q (67 *Federal Register* [FR] 46785-89), this annual report for operation of SURTASS LFA sonar onboard the USNS IMPECCABLE (T-AGOS 23) and R/V *Cory Chouest* has been prepared in accordance with the requirements of the LOAs issued by the United States Department of Commerce (DoC), National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) (Appendices A and B). The primary purpose of this annual report is to provide NMFS with unclassified SURTASS LFA sonar operations information to assist them in their evaluation of future Navy LOA applications.

Because there is a potential that operation of the SURTASS LFA sonar could result in incidental harassment of marine mammals, it was decided in consultation with NMFS that the employment of SURTASS LFA would require authorization by rule making for a five-year period with annual renewals through the issuance of LOAs for each SURTASS LFA vessel for areas of intended operation. On 1 April 1998, NMFS agreed to be a cooperating agency under the National Environmental Policy Act (NEPA) for the SURTASS LFA Environmental Impact Statement (EIS). NMFS is the federal regulator for the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA).

1.2 SURTASS LFA Sonar Description

SURTASS LFA is a long-range sonar system that operates in the low frequency (LF) band (100-500 Hertz [Hz]). There are presently two SURTASS LFA sonar systems, one each onboard the USNS IMPECCABLE (T-AGOS 23) and R/V *Cory Chouest*, both operating in the northwestern Pacific Ocean. These systems have both passive and active components.

The active system component, LFA, is an adjunct to the passive detection system, SURTASS, and is planned for use when passive system performance proves inadequate. LFA is a set of acoustic transmitting source elements suspended by cable from underneath a ship. These elements, called projectors, are devices that produce the active sound pulse, or ping. The projectors transform electrical energy to mechanical energy that set up vibrations or pressure disturbances within the water to produce a ping.

The characteristics and operating features of LFA are provided below:

- The source is a vertical line array (VLA) of up to 18 source projectors suspended below the vessel. LFA's transmitted sonar beam is omnidirectional (i.e., a full 360 degrees) in the horizontal (nominal depth of the LFA array center is 122 m [400 ft]), with a narrow vertical beamwidth that can be steered above or below the horizontal.
- The source frequency is between 100 and 500 Hz (the LFA system's physical design does not allow for transmissions below 100 Hz). A variety of signal types can be used, including continuous wave (CW) and frequency-modulated (FM) signals. Signal bandwidth is approximately 30 Hz.
- The source level (SL) of an individual source projector is approximately 215 decibels (dB). The sound field of the LFA array can never be higher than the SL of an individual projector.
- The typical LFA transmitted sonar signal is not a constant tone, but a transmission of various waveforms that vary in frequency and duration. A complete sequence of transmissions is referred to as a ping and lasts from 6 to 100 seconds, although the duration of each continuous frequency transmission is never longer than 10 seconds.
- Duty cycles (ratio of sound "on" time to total time) are less than 20 percent—20 percent is the maximum physical limit of the LFA system. Typical duty cycles are approximately 7.5 to 10 percent.
- The time between pings is typically from 6 to 15 minutes.

The passive, or listening, part of the system is SURTASS, which detects returning echoes from submerged objects, such as submarines, through the use of hydrophones. These devices transform mechanical energy (received acoustic sound wave) to an electrical signal that can be analyzed by the signal processing system of the sonar. The SURTASS hydrophones are mounted on a horizontal receive array that is towed behind the vessel. The array length is 1,500 m (4,920 ft) with an operational depth of 152 m (500 ft) to 457 m (1,500 ft). The SURTASS LFA ship must maintain a minimum speed of approximately 5.6 kilometers per hour (kph) (3 knots) through the water in order to tow the hydrophone array in the horizontal plane. The return signals or echoes, which are usually below background or ambient noise level, are then processed and evaluated to identify and classify potential underwater targets.

References to Underwater Sound Levels
1. References to underwater sound pressure levels (SPL) in this document are values given in dBs and are assumed to be standardized at 1 microPascal at 1 m (dB re 1 µPa at 1 m [root mean squared-rms]) for SL and dB re 1 m (rms) for received level (RL), unless otherwise specified. 2. References to underwater sound exposure level (SEL) in this document refer to the squared pressure over a duration of the sound referenced to the standard underwater sound reference level (1 µPa) expressed in dB, and are assumed to be standardized at dB re 1 μPa^2-s, unless otherwise specified. Sources: Urick (1983); ANSI S1.8-1989

1.3 The Critical Need for SURTASS LFA

The original stated purpose for the SURTASS LFA sonar from the Final Overseas Environmental Impact Statement/Environmental Impact Statement (FOEIS/EIS) for SURTASS LFA Sonar was:

> "The purpose of the proposed action is to meet U.S. need for improved capability to detect quieter and harder-to-find foreign submarines at long range. This capability would provide U.S. forces with adequate time to react to, and defend against, potential submarine threats while remaining a safe distance beyond a submarine's effective weapons range." (DON, 2001)

This statement remains valid, and may be more compelling now than when it was presented in the FOEIS/EIS in January 2001. With the Cold War ending more than a decade ago, the Navy is faced with a smaller number of diesel-electric submarines, and although their operations are confined to smaller areas, their operational and weapons capabilities have increased measurably. Moreover, today's maritime strategies rely heavily on quiet submarines to patrol the littorals, blockade strategic choke points, and stalk aircraft carrier battle groups (Goldstein and Murray, 2003).

The shift from open ocean areas to shallow, acoustically complex near-shore areas forces drastic changes in the ways in which anti-submarine warfare (ASW) operations can be conducted. The United States and numerous other nations have looked at numerous acoustic and non-acoustic solutions to this problem, including active sonar. According to the Netherlands Organization for Applied Scientific Research – Physics and Electronics Laboratory, "The smaller and quieter coastal diesel-electric and midget submarines can only be detected in the noisy coastal environments by a low frequency active sonar (LFAS) approach" (Ort et al, 2003). Their work and the research of other organizations have shown that LFAS is successful at long-range detection, even in shallow water. Active sonar does not depend on the submarine target to generate noise; therefore, the use of active sonar eliminates any advantage gained by the use of quieting technologies.

The Navy's primary mission is to maintain, train, equip, and operate combat-ready naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas. The Secretary of the Navy and Chief of Naval Operations (CNO) have continually validated that ASW is a critical part of that mission—a mission that requires access to both the high seas and the littorals. In order to be prepared for all potential threats, the Navy must not only continue to test and train in the open ocean, but also in littoral environments[1].

[1] Littoral Environment—The Navy defines littoral as the region that horizontally encompasses the land/watermass interface from fifty (50) statute miles ashore to two hundred (200) nautical miles at sea; extends vertically from the bottom of the ocean to the top of the atmosphere and from the land surface to the top of the atmosphere (Naval Oceanographic Office, 1999).

Excerpts from Statement of Admiral William J. Fallon, U.S. Navy
Vice Chief of Naval Operations
before the
Subcommittee on Readiness and Management Support
United States Senate Armed Services Committee
on Environmental Sustainment
March 13, 2003

"……New ultra-quiet diesel-electric submarines armed with deadly torpedoes and cruise missiles are proliferating widely. New technologies such as these could significantly threaten our fleet as we deploy around the world to assure access for joint forces, project power from the sea, and maintain open sea-lanes for trade. To successfully defend against such threats, our Sailors must train realistically with the latest technology, including next-generation passive and active sonars."

"The Navy has immediate need for SURTASS LFA. The Chief of Naval Operations has stated that Anti-Submarine Warfare (ASW) is essential to sea control and maritime dominance. Many nations are capable of employing submarines to deny access or significantly delay execution of joint and coalition operations in support of our vital interests. The submarine threat today is real and in some ways has become more challenging than during the Cold War. Of the approximately 500 non-U.S. submarines in the world, almost half that number are operated by non-allied nations. Of greatest concern are the new ultra-quiet diesel-electric submarines armed with deadly torpedoes and cruise missiles being produced by the People's Republic of China, Iran, and North Korea."

"These diesel submarines are very difficult to detect outside the range at which they can launch attacks against U.S. and allied ships using passive sonar systems. Active systems like SURTASS LFA, when used in conjunction with other anti-submarine sensor and weapons systems, are necessary to detect, locate and destroy or avoid hostile submarines before they close within range of our forces. To ensure our Sailors are properly prepared to counter this growing submarine threat, we must make certain they train with the best systems available."

1.4 The Regulatory Process

SURTASS LFA sonar was the first Navy program for an operational system to have completed the NEPA process, a process that began on 18 July 1996, when the Navy published its Notice of Intent (NOI) in the *Federal Register* (67 FR 37452) to prepare an EIS for SURTASS LFA Sonar under NEPA and Presidential Executive Order (EO) 12114. It culminated with the signing of the Record of Decision (ROD) on 16 July 2002 (67 FR 48145). During the NEPA analysis for the Navy's FOEIS/EIS for SURTASS LFA sonar operations (DON, 2001), there were scientific data gaps concerning the potential for moderate-to-low exposure levels to affect cetacean hearing ability or modify biologically important behavior. The results of this Low Frequency Sound Scientific Research Program (LSF SRP) found that these effects would be minimal.

Based on the scientific analyses detailed in the Navy application and further supported by information and data contained in the Navy's FOEIS/EIS for SURTASS LFA sonar operations, NMFS concurred with the Navy that the operations of SURTASS LFA sonar would result in the incidental harassment of only small numbers of marine mammals, have no more than a negligible impact on the affected marine mammal stocks or habitats, and not have an unmitigable adverse impact on Arctic subsistence uses of marine mammals; and thus issued the initial LOA (67 FR 55818) under the MMPA Final Rule (50 CFR Part 216 Subpart Q) (67 FR 46785) for the

operation of SURTASS LFA Sonar on R/V *Cory Chouest*. (67 FR 46783). The Navy's ESA Section 7 consultation with the NMFS and permitting requirements under the MMPA concluded with NMFS's issuance of the Biological Opinion and Incidental Take Statement (NMFS, 2002a; 2002b). Since the initial LOA was issued in 2002, the Navy has requested annual renewals in accordance with 50 CFR §216.189 for the remaining four years of the current rule for the R/V *Cory Chouest* and USNS IMPECCABLE. NMFS has subsequently issued the LOAs (68 FR 50123, 69 FR 51996, 70 FR 49919, 71 FR 48537).

On November 24, 2003 the National Defense Authorization Act (NDAA) for Fiscal Year 2004 (NDAA FY04) (Public Law 108-136) was passed by Congress. Included in this law were amendments to the MMPA (16 U.S.C. 1361 *et seq.*) that apply where a "military readiness activity" is concerned. Of special importance for SURTASS LFA sonar take authorization, the NDAA amended Section 101(a)(5) of the MMPA, which governs the taking of marine mammals incidental to otherwise lawful activities. The term "military readiness activity" is defined in Public Law 107-314 (16 U.S.C. § 703 note) to include all training and operations of the Armed Forces that relate to combat; and the adequate and realistic testing of military equipment, vehicles, weapons and sensors for proper operation and suitability for combat use. NMFS and the Navy have determined that the Navy's SURTASS LFA sonar testing and training operations that are the subject of NMFS's July 16, 2002 Final Rule constitute a military readiness activity because those activities constitute "training and operations of the Armed Forces that relate to combat" and constitute "adequate and realistic testing of military equipment, vehicles, weapons and sensors for proper operation and suitability for combat use."

Changes to the MMPA set forth in the NDAA FY04 amended the act in three ways. First, it focused the definition of harassment to biologically significant impacts. Second, it removed references to small numbers and specific geographic regions as applied to incidental take authorizations. Third, it provided for a national defense exemption. SURTASS LFA sonar is not involved in any national defense exemptions. The Congressional Conference Report specifically notes regarding the new definition of harassment that it will provide greater clarity for the Department of Defense (DoD) and regulatory agencies and properly focus authorizations of military readiness activities on biologically significant impacts to marine mammals, as a science-based approach. As noted by Congress, such changes do not undermine the law's original intent, instead eliminating terms that have proven more valuable as a basis for litigation than forcing legitimate or demonstrative protection to marine mammals.

1.5 Litigation

On 7 August 2002, several non-governmental organizations (NGOs) filed suit against the Navy and NMFS over SURTASS LFA sonar use and permitting. The Court recognized the Navy's National Security requirements for operations to continue as the case proceeded. On 15 November 2002, the Court issued a tailored Preliminary Injunction for operations of LFA in a stipulated area in the northwest Pacific Ocean/Philippine Sea, and south and east of Japan. On 25 January 2003, the R/V *Cory Chouest*, having met all environmental compliance requirements, commenced testing and training in the northwest Pacific Ocean under this tailored Preliminary Injunction.

The Court issued a ruling on the parties' motions for summary judgment in the SURTASS LFA litigation on 26 August 2003. The Court found deficiencies in the Navy's and NMFS' compliance under NEPA, ESA, and MMPA. The Court, however, indicated that a total ban of employment of LFA would pose a hardship on the Navy's ability to protect National Security by ensuring military preparedness and the safety of those serving in the military from hostile submarines. Based on mediation the Court issued a tailored Permanent Injunction on 14 October 2003, allowing SURTASS LFA operations from both R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) in stipulated areas in the northwest Pacific Ocean/Philippine Sea, Sea of Japan, East China Sea, and South China Sea with certain year-round and seasonal restrictions. On 7 July 2005, the Court amended the injunction to expand the potential areas of operation based on real world contingencies, as shown in Figure 1.

Under the Court's opinion, NMFS was found to have improperly conflated its negligible impact determinations with small numbers requirements. As a result of the NDAA FY04 amendments to the MMPA eliminating this conundrum, the Court vacated and dismissed the MMPA small numbers and specific geographic regions claims on 2 December 2004.

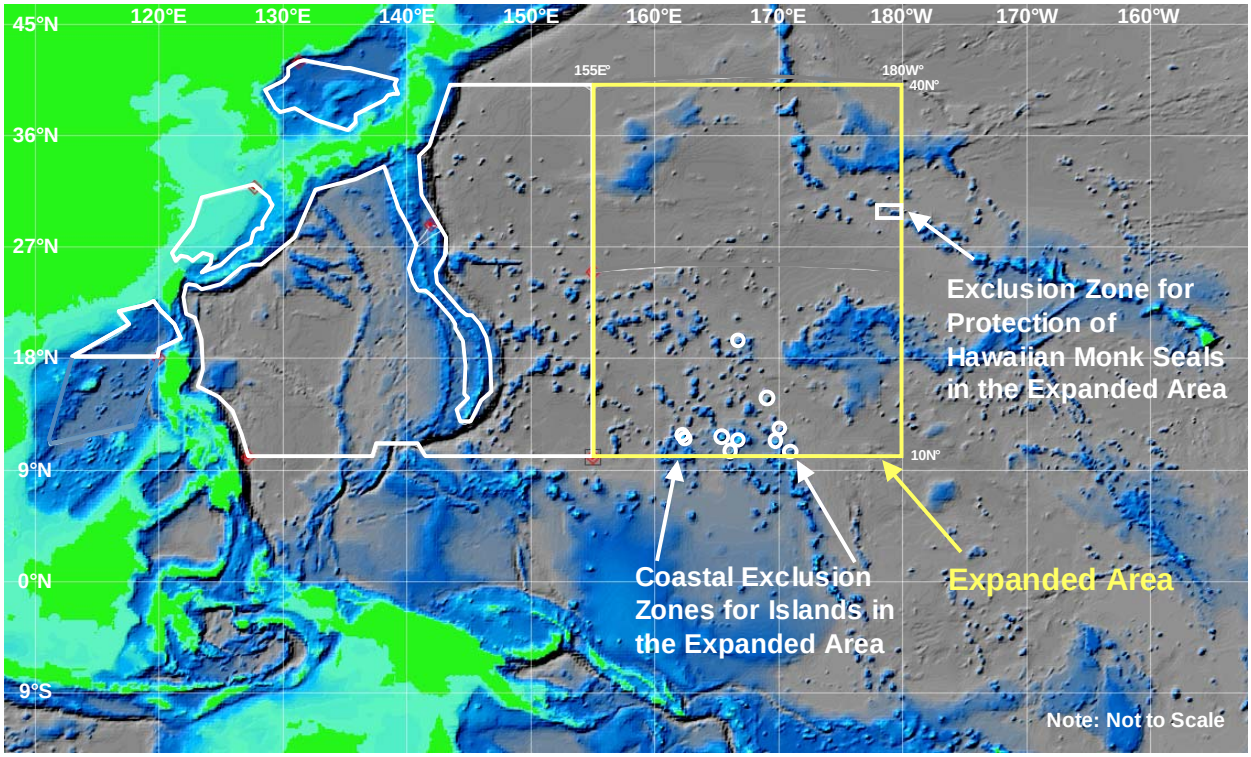

Figure 1. SURTASS LFA Sonar Operations Areas Permitted under Stipulation Regarding Permanent Injunction as Amended

1.6 Supplemental Environmental Impact Statement

In response to U.S. District Court ruling on the motion for preliminary injunction, the Deputy Assistant Secretary of the Navy for Environment (DASN(E)) decided that the purposes of NEPA would be served by supplemental analysis of employing SURTASS LFA sonar systems. On 11 April 2003, the DASN(E) directed the Navy to prepare a supplemental EIS to address concerns identified by the Court to provide additional information regarding the environment that could potentially be affected by the SURTASS LFA sonar systems and additional information related to mitigation.

The Draft Supplemental Environmental Impact Statement (DSEIS) was completed in November 2005 (DON, 2005b) with the 90-day comment period ending in February 2006. During this period three public hearings were held in Washington, DC; San Diego, CA; and Honolulu, HI. Ninety seven (97) comments were received on the DSEIS.

The Final Supplemental Environmental Impact Statement (FSEIS), which included detailed responses to comments received, was completed in May 2007 (DON, 2007b). This Final SEIS evaluates the potential environmental effects of employment of Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) sonar systems. The proposed action herein is the U.S. Navy employment of up to four SURTASS LFA sonar systems in the oceanic areas as presented in Figure 1-1 (SURTASS LFA Sonar Systems Potential Areas of Operations) of the FOEIS/EIS for SURTASS LFA Sonar (DON, 2001). Based on current operational requirements, exercises using these sonar systems would occur in the Pacific, Atlantic, and Indian oceans, and the Mediterranean Sea. To reduce adverse effects on the marine environment, areas would be excluded as necessary to prevent 180-dB sound pressure level (SPL) or greater within specific geographic range of land, in offshore biologically important areas during biologically important seasons, and in areas necessary to prevent greater than 145-dB SPL at known recreational and commercial dive sites.

The purpose of the SURTASS LFA Sonar SEIS is to:

- Address concerns of the U.S. District Court for the Northern District of California in its 26 August 2003 Opinion and Order in relation to compliance with the NEPA, ESA, and MMPA[2];
- Provide information necessary to apply for a new five-year Rule that would provide for incidental takes under the MMPA when the current rule expires in 2007, taking into account legislative changes to the MMPA and the need to employ up to four SURTASS LFA sonar systems;
- Analyze potential impacts for LFA system upgrades; and
- Provide additional information and analyses pertinent to the proposed action.

[2] On 2 December 2004, the Court vacated and dismissed the MMPA claims based on the National Defense Authorization Act Fiscal Year 2004 (NDAA FY04) amendments to the MMPA.

1.7 Application for Follow-on Incidental Take Authorization

On 12 May 2006, the Navy submitted an Application to the NMFS for LOAs under Section 101 (a)(5)(A) of the MMPA for the activities associated with the employment of up to four SURTASS LFA sonar systems for a period of five years (16 August 2007 to 15 August 2012) (DON, 2006a).

On 9 June 2006, the Navy submitted a Biological Assessment for the Employment of SURTASS LFA Sonar requesting that NMFS review the document. The Navy further requested a Biological Opinion/Incidental Take Statement under Section 7 on the ESA for a period of five years (16 August 2007 to 15 August 2012) (DON, 2006c).

On 28 September 2006, NMFS publish a Notice of Receipt of Application and a request of public comments. The public comment period closed on 30 October 2006. Next, NMFS will publish a Proposed Rule and request for comment.

2.0 MITIGATION MEASURES

Under the current rule, NMFS has issued one-year LOAs to the Navy for the USNS IMPECCABLE and R/V *Cory Chouest* for an estimated 12 to 16 active sonar missions between the two ships (or equivalent shorter missions) not to exceed 432 hours of transmit time between the two ships during the annual period of effectiveness of each of these LOAs. Further, NMFS required that, under these LOAs, the Navy must minimize to the greatest extent practicable any adverse impacts on marine mammals, their habitats, and the availability of marine mammals for subsistence.

Mitigation protocols were initially set forth in the SURTASS LFA Sonar FOEIS/EIS, and modified by NMFS in their Final Rule and by the tailored Permanent Injunction issued by the Court in 14 October 2003, as amended on 7 July 2005 (see Section 3.0). Under the conditions of the Final Rule and the LOAs, the mitigation measures discussed below have been implemented. Mitigation protocols set forth in the Record of Decision, NOAA/NFMS Final Rule and LOAs, and Court orders have been promulgated by the CNO (N774) through executive direction messages of 12 August 2002, 31 October 2003, 13 August 2004, 16 August 2005, and 16 August 2006.

2.1 Final Rule and LOA Conditions

In its Final Rule and LOAs, as issued, NMFS added additional requirements relating to interim operational retrictions and sound field restrictions in offshore areas of specific National Marine Sanctuaries whose boundaries extend beyond 12 nm (22 km).

2.1.1 Interim Operational Restrictions

In the SURTASS LFA Final Rule under the MMPA (67 FR 46785), NMFS added interim operational restrictions in the Final Rule to preclude the potential for injury to marine mammals by resonance effects. These include: 1) establishment of a 1-km (0.54-nm) buffer shutdown zone outside of the 180-dB LFA mitigation zone; and 2) limiting the operational frequency of SURTASS LFA sonar to 330 Hz and below.

The first restriction included a SURTASS LFA sonar system shutdown within a buffer zone that extends 1 km (0.54 nm) from the outer limit of the 180-dB safety zone (SURTASS LFA mitigation zone). This may extend up to 2 km (1.1 nm) from the vessel, depending on oceanographic conditions. At this distance, SPLs will be significantly less intense than 180 dB. Second, NMFS imposed an operational restriction on the frequency of the SURTASS LFA sonar sound to 330 Hz and below. The intentions of these measures were to ensure, to the greatest extent practicable, that marine mammals would not be injured by the SURTASS LFA sonar signal. These protective measures would be retained until scientific documentation could be provided which indicated that they could be modified while still providing sufficient protection for marine mammals.

In the SURTASS LFA Sonar Final SEIS (DON, 2007a) and the Final Comprehensive Report (DON 2007a) a detailed analysis of the 330 Hz restriction was provided. It was concluded that

the analyses sponsored by the Navy (Cudahy and Ellison 2002; Laurer et al. 2002), reports on two workshops on acoustic impacts (DOC 2002; Cox et al. 2006), and the National Research Council (NRC) Ocean Studies Board (NRC 2005) support the conclusion that resonance from LFA operations is not a "reasonable foreseeable" impact, providing the empirical and documentary evidence that resonance and/or tissue damage from LFA transmissions are unlikely to occur in marine mammals in the frequency range 330 to 500 Hz within or outside the LFA mitigation zone. As a result, the Navy has requested NMFS to lift the interim operational restriction in the new rule making.

2.1.2 National Marine Sanctuaries Restrictions

The NMFS Final Rule (50 CFR § 216.184(e)(3)) requires that SURTASS LFA sonar will not be operated such that the sound field exceeds 180 dB (RL) within the offshore boundaries that extend beyond 12 nm (22 km) of the following National Marine Sanctuaries:

- Monterey Bay,
- Gulf of the Farallones, and
- Cordell Bank.

Additionally, SURTASS LFA sonar will not be operated such that the sound field exceeds 180 dB (RL) within 23 nm (37.4 km) of the coast during the months of December, January, March, and May of each year in the Olympic Coast National Marine Sanctuary.

None of these areas were within the authorized operational areas for LFA during the period of this report.

2.2 Mitigation and Monitoring Requirements

The objective of these mitigation measures is to avoid risk of injury to marine mammals, sea turtles, and human divers. This objective is met by:

- Ensuring that coastal waters within 22 km (12 nm) of shore are not exposed to SURTASS LFA sonar signal levels $\geq$ 180 dB received level (RL);
- Ensuring that no offshore biologically important areas are exposed to SURTASS LFA sonar signal levels $\geq$ 180 dB RL during critical seasons;
- Minimizing exposure of marine mammals and sea turtles to SURTASS LFA sonar signal levels below 180 dB RL by monitoring for their presence and suspending transmissions when one of these organisms approached the SURTASS LFA mitigation (safety) and buffer zones as shown in Figure 2; and
- Ensuring that no known recreational or commercial dive sites are subjected to LF sound pressure levels greater than 145 dB RL.

Strict adherence to these measures ensures that there will be no significant impact on marine mammal stocks, sea turtle stocks, and recreational or commercial divers. Table 1 is a summary of the proposed mitigation, the criteria for each, and the actions required.

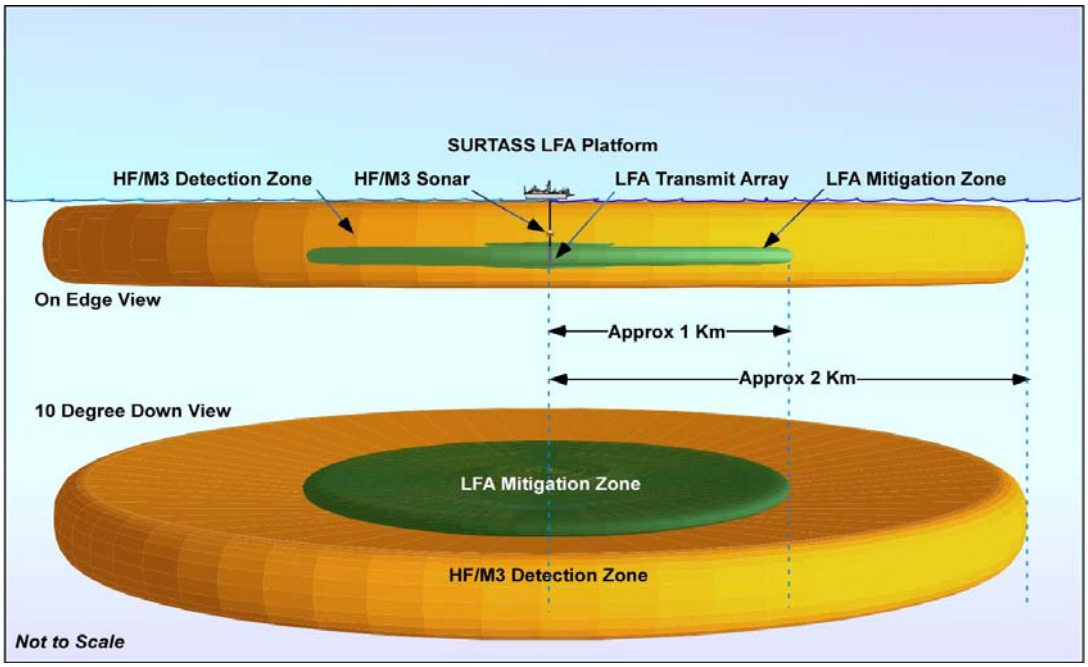

Figure 2. HF/M3 Sonar Detection and LFA Mitigation/Buffer Zones

Table 1. Summary of Mitigation

Mitigation	Criteria	Actions
Geographic Restrictions		
22 km (12 nm) from coastline and offshore biologically important areas during biologically important seasons outside of 22 km (12 nm)	Sound field below 180 dB RL, based on SPL modeling.	Delay/suspend SURTASS LFA sonar operations.
Recreational and commercial dive sites (known)	Sound field not to exceed 145 dB RL, based on SPL modeling.	Delay/suspend SURTASS LFA sonar operations.
Monitoring to Prevent Injury to Marine Mammals and Sea Turtles		
Visual Monitoring	Potentially affected species sighted near the vessel but outside of the LFA mitigation and/or buffer zones.	Notify Officer in Charge (OIC).
	Potentially affected species sighted within the LFA mitigation or buffer zones.	Delay/suspend SURTASS LFA sonar operations.
Passive Acoustic Monitoring	Potentially affected species detected.	Notify OIC.
Active Acoustic Monitoring	Contact detected and determined to have a track that would pass within the LFA mitigation or buffer zones.	Notify OIC.
	Potentially affected species detected inside of the LFA mitigation or buffer zones.	Delay/suspend SURTASS LFA sonar operations.

2.2.1 Geographic Restrictions

The following geographic restrictions apply to the employment of SURTASS LFA sonar:

- SURTASS LFA sonar-generated sound field will be below 180 dB RL within 22 km (12 nm) of any coastlines and in offshore areas outside this zone that have been determined by NMFS and the Navy to be biologically important;
- When in the vicinity of known recreational or commercial dive sites, SURTASS LFA sonar will be operated such that the sound fields at those sites will not exceed 145 dB RL; and
- SURTASS LFA sonar operators will estimate SPL prior to and during operations to provide the information necessary to modify operations, including the delay or suspension of transmissions, in order not to exceed the 180-dB and 145-dB RL sound field criteria cited previously.

2.2.1.1 Offshore Biologically Important Areas

Offshore Biologically Important Areas (OBIAs) are areas of the world's oceans outside of 22 km (12 nm) of a coastline where marine animals of concern (those animals listed under the ESA and/or marine mammals) congregate in high densities to carry out biologically important activities. These areas include:

- Migration corridors;
- Breeding and calving grounds; and
- Feeding grounds.

There are four areas designated by the Navy and NMFS as offshore areas of critical biological importance for marine mammals in the SURTASS LFA Sonar FOEIS/EIS and Final Rule. These are:

- Shoreward of the 200-meter isobath off the North American East Coast, from 28 to 50 degrees North latitude, west of 40 degrees West longitude—year-round.
- Antarctic Convergence Zone, delimited by the following: 1) 30 to 80 degrees East longitude along the 45-degree South latitude; 2) 80 to 150 degrees East longitude along the 55-degree South latitude; 3) 150 degree East to 50 degree West longitude along the 60-degree South latitude; and 4) 50 degree West to 30 degree East longitude along the 50-deg South latitude—October through March (IUCN, 1995).
- Costa Rica Dome, centered at 9 degrees N latitude and 88 degrees W longitude—year round (Longhurst, 1998; Chandler et al., 1999).
- Penguin Bank, Hawaiian Archipelago, centered at 21 degrees North latitude and 157 degrees 30 minutes West longitude—November 1 through May 1.

None of these areas were within the authorized operational areas for LFA during the period of this report.

2.2.1.2 Recreational and Commercial Dive Sites

SURTASS LFA sonar operations are constrained in the vicinity of known recreational and commercial dive sites to ensure that the sound field at such sites does not exceed 145 dB RL. Recreational dive sites are generally defined as coastal areas from the shoreline out to the 40-m (130-ft) depth contour, which are frequented by recreational divers; but it is recognized that there are other sites that may be outside this boundary.

2.2.1.3 Sound Field Modeling

SURTASS LFA sonar operators will estimate SPL prior to and during operations to provide the information necessary to modify operations, including the delay or suspension of transmissions, in order not to exceed the 180-dB and 145-dB RL sound field criteria cited above. Sound field limits are estimated using near-real-time environmental data and underwater acoustic performance prediction models. These models are an integral part of the SURTASS LFA sonar processing system. The acoustic models help determine the sound field by predicting the SPLs, or RLs, at various distances from the SURTASS LFA sonar source location. Acoustic model updates are nominally made every 12 hours, or more frequently when meteorological or oceanographic conditions change.

If the sound field criteria listed above were exceeded, the sonar operator would notify the Officer in Charge (OIC), who would order the delay or suspension of transmissions. If it were predicted that the SPLs would exceed the criteria within the next 12 hours, the OIC would also be notified in order to take the necessary action to ensure that the sound field criteria would not be exceeded.

2.2.2 Monitoring to Prevent Injury to Marine Animals

The following monitoring to prevent injury to marine animals is required under the conditions of the LOAs when employing SURTASS LFA sonar:

- **Visual monitoring** for marine mammals and sea turtles from the vessel during daylight hours by personnel trained to detect and identify marine mammals and sea turtles;
- **Passive acoustic monitoring** using the passive (LF) SURTASS array to listen for sounds generated by marine mammals as an indicator of their presence; and
- **Active acoustic monitoring** using the High Frequency Marine Mammal Monitoring (HF/M3) sonar, which is a Navy-developed, enhanced high frequency (HF) commercial sonar, to detect, locate, and track marine mammals and, to some extent, sea turtles, that may pass close enough to the SURTASS LFA sonar's transmit array to enter the LFA mitigation and buffer zones.

2.2.2.1 Visual Monitoring

Visual monitoring includes daytime observations for marine mammals and sea turtles from the vessel. Daytime is defined as 30 min before sunrise until 30 min after sunset. Visual monitoring begins 30 min before sunrise or 30 min before the SURTASS LFA sonar is deployed. Monitoring continues until 30 min after sunset or until the SURTASS LFA sonar is recovered. Observations are made by personnel trained in detecting and identifying marine mammals and

sea turtles. The objective of these observations is to maintain a track of marine mammals and/or sea turtles observed and to ensure that none approach the source close enough to enter the LFA mitigation zone.

These personnel maintain a topside watch and marine mammal/sea turtle observation log during operations that employ SURTASS LFA sonar in the active mode. The numbers and identification of marine mammals/sea turtles sighted, as well as any unusual behavior, is entered into the log. A designated ship's officer monitors the conduct of the visual watches and periodically reviews the log entries. There are two potential visual monitoring scenarios.

First, if a potentially affected marine mammal or sea turtle is sighted outside of the LFA mitigation zone, the observer notifies the OIC. The OIC then notifies the HF/M3 sonar operator to determine the range and projected track of the animal. If it is determined that the animal will pass within the LFA mitigation zone, the OIC orders the delay or suspension of SURTASS LFA sonar transmissions when the animal enters the LFA mitigation zone. If the animal is visually observed within 1-km buffer zone outside of the LFA mitigation zone, the OIC orders the immediate delay or suspension of SURTASS LFA sonar transmissions. The observer continues visual monitoring/recording until the animal is no longer seen.

Second, if the potentially affected animal is sighted anywhere within the LFA mitigation or buffer zones, the observer notifies the OIC who orders the immediate delay or suspension of SURTASS LFA sonar transmissions.

All sightings are recorded in the log and provided as part of the Long Term Monitoring (LTM) Program as discussed in FOEIS/EIS Subchapter 2.4.2 to monitor for potential long-term environmental effects.

2.2.2.2 Passive Acoustic Monitoring

Passive acoustic monitoring is conducted when SURTASS is deployed, using the SURTASS towed horizontal line array (HLA) to listen for vocalizing marine mammals as an indicator of their presence. If the sound is estimated to be from a marine mammal that may be potentially affected by SURTASS LFA sonar, the technician notifies the OIC who alerts the HF/M3 sonar operator and visual observers. If prior to or during transmissions, the OIC then orders the delay or suspension of SURTASS LFA sonar transmissions when the animal enters the LFA mitigation and buffer zones.

All contacts are recorded in the log and provided as part of the LTM Program to monitor for potential long-term environmental effects.

2.2.2.3 Active Acoustic Monitoring

HF active acoustic monitoring uses the HF/M3 sonar to detect, locate, and track marine mammals (and possibly sea turtles) that could pass close enough to the SURTASS LFA sonar array to enter the LFA mitigation zone. HF acoustic monitoring begins 30 min before the first SURTASS LFA sonar transmission of a given mission is scheduled to commence and continues

until transmissions are terminated. Prior to full-power operations, the HF/M3 sonar power level is ramped up over a period of 5 min from 180 dB SL in 10-dB increments until full power (if required) is attained to ensure that there are no inadvertent exposures of local animals to RLs $\geq$ 180 dB from the HF/M3 sonar. There are two potential scenarios for mitigation via active acoustic monitoring.

First, if a contact is detected outside the LFA mitigation and buffer zones, the HF/M3 sonar operator determines the range and projected track of the animal. If it is determined that the animal will pass within the LFA mitigation and buffer zones, the sonar operator notifies the OIC. The OIC then orders the delay or suspension of transmissions when the animal is predicted to enter the LFA mitigation and buffer zones.

Second, if a contact is detected by the HF/M3 sonar within the LFA mitigation or buffer zones, the observer notifies the OIC who orders the immediate delay or suspension of transmissions.

All contacts are recorded in the log and provided as part of the LTM Program.

2.2.2.4 Resumption of SURTASS LFA Transmissions

SURTASS LFA sonar transmissions can commence/resume 15 minutes after there is no further detection by the HF/M3 sonar and there is no further visual observation of the animal within the LFA mitigation and buffer zones.

3.0 PERMANENT INJUNCTION FOR SURTASS LFA OPERATIONS

During the period of this report, both SURTASS LFA sonar systems were operated under the tailored Permanent Injunction issued on 14 October 2003, as amended on 7 July 2005. Details of the authorized areas of operation are provided in two LOAs (APPENDICES A and B) and shown in Figure 1. The associated charts provided in APPENDICES A and B reflect the coastal exclusion zones wherein received sound pressure levels will not exceed 180 dB.

4.0 SUMMARY OF SURTASS LFA OPERATIONS FOR FIFTH YEAR ANNUAL REPORT

Under 50 CFR 216.186(b) and LOA Condition 8(b), this annual report consists of an unclassified summary of the quarterly reports as of 90 days prior to the expiration of the current LOAs. Therefore, this annual report will cover only those quarterly reports submitted subsequent to the due date of the last annual report in May 2006. This annual report will include the third and fourth quarterly reports under the fourth year LOAs and first and second quarterly reports under the fifth year LOAs for the USNS IMPECCABLE and R/V *Cory Chouest*, for the period of 16 February 2006 through 15 February 2007.

4.1 SURTASS LFA Operations for Fifth Annual Report

Under the conditions of the Court's tailored Permanent Injunction, two SURTASS LFA sonar systems are currently operating under LOAs issued by NMFS for the period 16 August 2006 to 15 August 2007. The LFA system onboard R/V *Cory Chouest* commenced reintroduction to the Fleet in January 2003 and is presently operating in the western North Pacific. The second system onboard USNS IMPECCABLE (T-AGOS 23) commenced sea trials in late February 2004 and full Fleet operations in fiscal year (FY) 05. This report includes five training missions from the R/V *Cory Chouest* and 14 training mission for the USNS IMPECCABLE.

The purposes of the training missions are to provide fully functional hardware and software, extensive training, job experience, and operational/system monitoring in a variety of LFA mission scenarios and acoustic environments.

The keys to SURTASS LFA success are:

- Assuring LFA Transmit System (LTS) reliability, maintainability, and availability through system maintenance, system shakedown and correction of deficiencies, and LTS training.
- Assuring the system hardware and software (processing, communications, support systems) reliability, maintainability, and availability through system interface testing, system function testing, system operational testing, system load testing, and the correction of deficiencies.
- Training of SURTASS LFA crew through at-sea training in diverse environments and missions.
- Updating the SURTASS LFA Employment Guidelines documentation.
- Testing and certification of the system performance in a variety of missions and environments. The environments should range from familiar acoustic environments during system shakedown to operationally significant environments for crew training.
- Successful system employment in a variety of tactical and strategic scenarios in diverse acoustic environments.
- Operational training with the HF/M3 sonar and compliance with all other applicable mitigation requirements.

4.1.1 R/V *Cory Chouest* Training Missions

Training missions for the R/V *Cory Chouest* consisted of five missions covering a period of approximately 30.1 days with 54.2 hours of transmissions by the LFA array and included the operation of the HF/M3 sonar and compliance with all other applicable mitigation requirements. These missions occurred in the North and West Philippine Sea, the Sea of Japan, and the South China Sea from February 2006 to July 2006.

4.1.2 USNS IMPECCABLE Training Missions

Training missions for the USNS IMPECCABLE consisted of fourteen missions covering a period of approximately 55 days with 99 hours of transmissions by the LFA array and included the operation of the HF/M3 sonar and compliance to the mitigation requirements. These missions occurred in the North and West Philippine Sea, Guam, and the South China Sea from May 2006 to February 2007.

4.2 Estimates of Marine Mammal Stocks Potentially Affected

In its annual LOA applications, the Navy provides estimates of the percentage of marine mammal stocks that could potentially be affected in the biogeographic regions of proposed LFA operations for the 12-month period of the LOA(s). In this annual report, the Navy provides a post-operational assessment of whether incidental harassment occurred within the LFA mitigation buffer zone and estimates of the percentages of marine mammal stocks possibly harassed incidentally using predictive modeling based on dates/times/location of operations, system characteristics, oceanographic/environmental conditions, and animal demographics. The basis for the methodology used for the acoustic modeling to analyze risk and produce the incidental harassment estimates was essentially the scientific analysis process used in the SURTASS LFA Final EIS (DON, 2001) and detailed in the Navy's second year application to NMFS for LOAs (DON, 2003a).

During the period of this annual report, LFA operational missions were conducted in areas generally defined as Sites 2, 3, 4, 5, and 7 in the LOA applications (DON, 2005a; 2006a) and Provinces 50, 53, 56, 63, 64, and 69 as defined in the Final Rule section 216.180.

4.2.1 Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected

Overall planning for operations during the LOA periods was based first on the identification of the general ocean areas where testing, training and routine LFA operations were desired, development of criteria for these mission areas, and then the determination of the best operational sites and seasons within these mission areas that would have the least potential for impacts on marine mammals while meeting the Navy's operational requirements. Potential mission sites within each mission area were then analyzed with regard to spatial and temporal factors. Based on operational requirements for LFA and the tailored Permanent Injunction as amended, the general ocean areas were within the Philippine Sea, northwest Pacific Ocean, Sea of Japan, East China Sea and South China Sea. Marine mammal density and stock/abundance estimates were then assembled.

APPENDIX C provides information on how the density and stock/abundance estimates were derived for the operational areas shown in Figure 3. These data were derived from best available published source documentation, and provided general area information for mission areas, with species-specific information on the animals that could potentially occur in those areas, including estimates for their stock/abundance and density. Animal demographics (stocks and densities) are based on current literature reviews of the western North Pacific Ocean as cited in APPENDIX C.

Analyses for pre-operational estimates were performed at nominal potential operational sites, encompassing all four seasons, which provide a conservative estimate of the potential for impacts to marine mammal stocks in those provinces where operations were proposed.

Operations occurred in sites 2, 3, 4, 5, and 7 as shown in Figure 3. Tables 2 through 6 provide pre-operational risk estimates for marine mammal stocks in these operating areas (Sites 2 through 5 and 7) as presented in the Navy's application for LOAs (DON, 2006a). These values supported the conclusion that these pre-operational risk estimates for marine mammal stocks were below—for most cases, well below—the criteria delineated by NMFS in the Final Rule (67 FR 46785-89). Upon completion of the missions under the requested authorization, these estimates were refined and submitted to NMFS under the reporting requirements of the Final Rule and the conditions of the LOAs, as issued. The pre-operational estimates were based on the fifth year LOA application (DON, 2006a) for a nominal 9-day mission length.

4.2.2 Post-Operational Estimates of Marine Mammal Stocks Potentially Affected

SURTASS LFA operations during the period of this annual report comprised 19 missions totaling 85.1 days of operations with 153.2 hours of active transmissions by the LFA array. The general areas of these missions were the Philippine Sea in LOA Provinces 53 and 56, depicted in Figure 3 as Sites 2 and 3; Guam in LOA Province 56 and 63, depicted in Figure 3 as Site 4; the Sea of Japan in LOA Province 50 and 53, depicted in Figure 3 as Site 5; and the South China Sea in LOA Provinces 64 and 69, depicted in Figure 3 as Site 7.

Tables 7 through 11 provide post-operational estimates of the percentage of marine mammal stocks affected by the 85.1 days of SURTASS LFA sonar operations both within and outside the 180-dB mitigation zone. The same methodology was utilized as that used for the pre-operational analysis discussed above in Sections 4.2 and 4.2.1, except that the durations of each mission were based on actual transmission times and oceanographic environmental conditions were based on the date/time/location of the actual operations. Animal density and stock/abundance estimates were updated based on current literature reviews of the western North Pacific Ocean operational areas shown in Figure 3 (see APPENDIX C).

4.2.3 Summary of Results

The percentage of marine mammal stocks estimated to be exposed between 120 and 180 dB for both pre- and post-operational estimates are shown in Tables 2 through 11. Tables 7 through 11 demonstrate that the post-operational estimates are below the 12 percent for any marine mammal stock, the maximum percentage authorized in LOA Condition 6 (g).

The post-operational incidental harassment assessments in Tables 7 through 11 demonstrate that there were no marine mammal exposures to received levels at or above 180 dB. These results are supported by the results from the visual, passive acoustic and active acoustic monitoring efforts discussed in Section 4.3. In addition, a review of stranding data for the period did not indicate any stranding events associated with the times and locations of LFA operations.

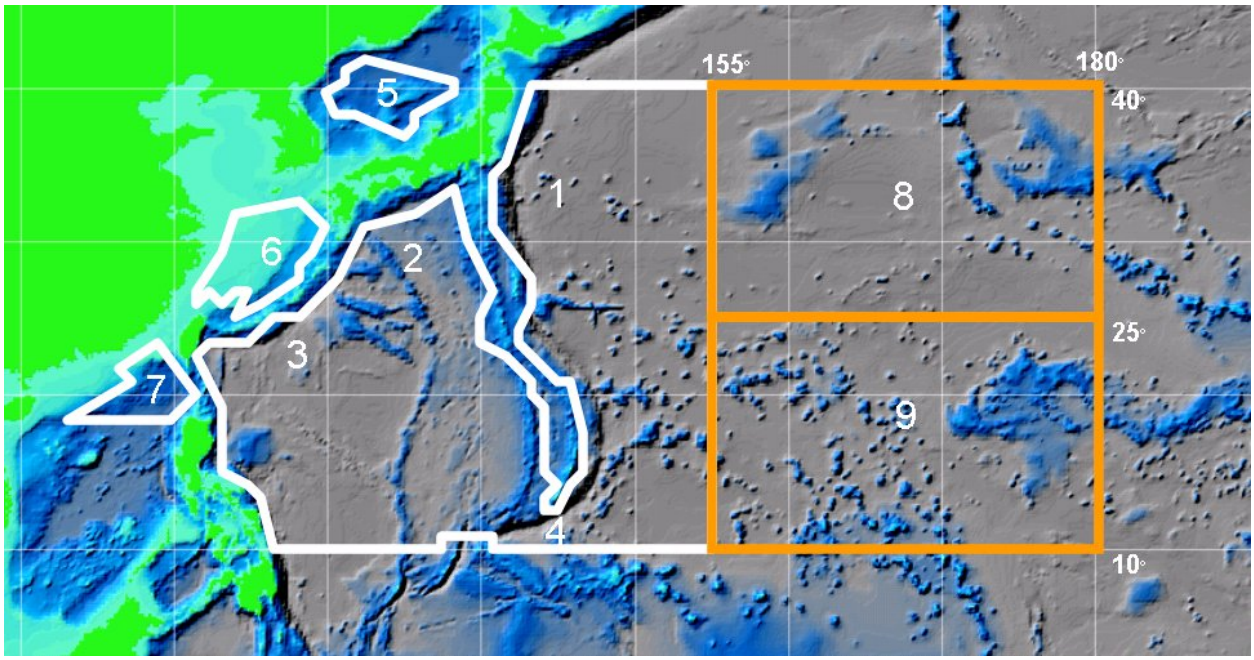

Figure 3. SURTASS LFA Sonar Western Pacific Operational Areas

Table 2. Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 2

Mission Area: North Philippine Sea					
Site 2	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Bryde's whale	180	22000	0.25	0.00
	Minke whale	1320	25049	1.62	0.00
	N. Pacific right whale	3	922	0.10	0.00
	Sperm whale	300	102112	0.24	0.00
	Kogia	930	350553	0.07	0.00
	Cuvier's beaked whale	1620	90725	0.55	0.00
	Blainville's beaked whale	150	8032	0.58	0.00
	Ginkgo-toothed beaked whale	150	22799	0.20	0.00
	Killer whale	120	12256	0.30	0.00
	False killer whale	870	16668	1.61	0.00
	Pygmy killer whale	630	30214	0.64	0.00
	Melon-headed whale	360	36770	0.30	0.00
	Short-finned pilot whale	4590	53608	2.64	0.00
	Risso's dolphin	3180	83289	1.50	0.00
	Common dolphin	16860	3286163	0.17	0.00
	Bottlenose dolphin	4380	168791	1.02	0.00
	Spinner dolphin	150	1015059	0.00	0.00
	Pantropical spotted dolphin	4110	438064	0.32	0.00
	Striped dolphin	9870	570038	0.58	0.00
	Rough-toothed dolphin	1770	145729	0.41	0.00
	Fraser’s dolphin	1200	220789	0.18	0.00
	Pacific white-sided dolphin	3570	931000	0.13	0.00

Note: Pre-operational estimates were based on projected operations and marine mammal density and stock numbers from the fifth year LOA application (DON, 2006a).

Table 3. Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 3

Mission Area: West Philippine Sea					
Site 3	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Fin whale	60	9250	0.25	0.00
	Bryde's whale	180	22000	0.32	0.00
	Minke whale	990	25049	1.55	0.00
	Humpback whale (winter only)	0	394	0.00	0.00
	Sperm whale	300	102112	0.09	0.00
	Kogia	510	350553	0.04	0.00
	Cuvier's beaked whale	90	90725	0.03	0.00
	Blainville's beaked whale	150	8032	0.84	0.00
	Ginkgo-toothed beaked whale	150	22799	0.22	0.00
	False killer whale	870	16668	2.05	0.00
	Pygmy killer whale	630	30241	0.82	0.00
	Melon-headed whale	4290	36770	4.57	0.00
	Short-finned pilot whale	2280	53608	1.67	0.00
	Risso's dolphin	3180	83289	1.82	0.00
	Common dolphin	16860	3286163	0.23	0.00
	Bottlenose dolphin	4380	168791	1.24	0.00
	Spinner dolphin	150	1015059	0.01	0.00
	Pantropical spotted dolphin	4110	438064	0.42	0.00
	Striped dolphin	4920	570038	0.39	0.00
	Rough-toothed dolphin	1770	145729	0.54	0.00
	Fraser's dolphin	1200	220789	0.24	0.00
	Pacific white-sided dolphin	7350	931000	0.35	0.00

Note: Pre-operational estimates were based on projected operations and marine mammal density and stock numbers from the fifth year LOA application (DON, 2006a).

Table 4. Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 4

Mission Area: Guam					
Site 4	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Blue whale	60	9250	0.16	0.00
	Fin whale	60	9250	0.16	0.00
	Bryde's whale	270	22000	0.34	0.00
	Minke whale	60	25049	0.07	0.00
	Humpback whale (winter only)	0	4005	0.00	0.00
	Sperm whale	300	102112	0.07	0.00
	Kogia	510	350553	0.03	0.00
	Cuvier's beaked whale	1620	90725	0.40	0.00
	Blainville's beaked whale	390	8032	1.09	0.00
	False killer whale	630	16668	1.27	0.00
	Melon-headed whale	2790	36770	2.55	0.00
	Short-finned pilot whale	600	53608	0.38	0.00
	Risso's dolphin	210	83289	0.15	0.00
	Bottlenose dolphin	750	168791	0.20	0.00
	Spinner dolphin	3000	1015059	0.12	0.00
	Pantropical spotted dolphin	31410	438064	2.81	0.00
	Striped dolphin	18060	570038	1.24	0.00
	Rough-toothed dolphin	1740	145729	0.47	0.00

Note: Pre-operational estimates were based on projected operations and marine mammal density and stock numbers from the fifth year LOA application (DON, 2006a).

Table 5. Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 5

Mission Area: Sea of Japan					
Site 5	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Fin whale	270	9250	0.76	0.00
	Bryde's whale	30	22000	0.04	0.00
	Minke whale	120	25049	0.13	0.00
	Minke J stock	48	893	1.40	0.00
	Gray whale	3	100	0.78	0.00
	N. Pacific right whale	3	922	0.09	0.00
	Sperm whale	240	102112	0.05	0.00
	Stejneger's beaked whale	420	8000	1.18	0.00
	Baird's beaked whale	90	8000	0.25	0.00
	Cuvier's beaked whale	1290	90725	0.32	0.00
	Ginkgo-toothed beaked whale	150	22799	0.15	0.00
	False killer whale	810	9777	2.47	0.00
	Melon-headed whale	3	36770	0.00	0.00
	Short-finned pilot whale	420	53608	0.23	0.00
	Risso's dolphin	2190	83289	0.88	0.00
	Common dolphin	25800	3286163	0.25	0.00
	Bottlenose dolphin	270	105138	0.09	0.00
	Spinner dolphin	3	1015059	0.00	0.00
	Pantropical spotted dolphin	4110	219032	0.60	0.00
	Pacific white-sided dolphin	900	931000	0.03	0.00
	Dall's porpoise	15600	76720	6.45	0.00

Note: Pre-operational estimates were based on projected operations and marine mammal density and stock numbers from the fifth year LOA application (DON, 2006a).

Table 6. Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 7

Mission Area: South China Sea					
Site 7	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Fin whale	60	9250	0.07	0.00
	Bryde's whale	180	22000	0.08	0.00
	Minke whale	990	25049	0.41	0.00
	Gray whale (winter only)	0	100	0.00	0.00
	Sperm whale	300	102112	0.02	0.00
	Kogia	510	350553	0.01	0.00
	Cuvier's beaked whale	90	90725	0.01	0.00
	Blainville's beaked whale	150	8032	0.17	0.00
	Ginkgo-toothed beaked whale	150	22799	0.06	0.00
	False killer whale	540	9777	0.62	0.00
	Pygmy killer whale	630	30214	0.23	0.00
	Melon-headed whale	2610	36770	0.79	0.00
	Short-finned pilot whale	2289	53608	0.48	0.00
	Risso's dolphin	3180	83289	0.57	0.00
	Common dolphin	13830	3286163	0.05	0.00
	Bottlenose dolphin	4380	105138	0.66	0.00
	Spinner dolphin	330	1015059	0.00	0.00
	Pantropical spotted dolphin	4122	219032	0.25	0.00
	Striped dolphin	4929	570038	0.11	0.00
	Rough-toothed dolphin	1200	145729	0.11	0.00
	Fraser's dolphin	1200	220789	0.07	0.00

Note: Pre-operational estimates were based on projected operations and marine mammal density and stock numbers from the fifth year LOA application (DON, 2006a).

Table 7. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 2 in Spring/Summer/Fall

North Philippine Sea					
Site 2	**Animal**	**Stock**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Bryde's whale	Western North Pacific	22000	0.07	0.00
	Minke whale	Western North Pacific	25000	0.43	0.00
	N. Pacific right whale	Western North Pacific	922	0.03	0.00
	Sperm whale	North Pacific	102112	0.04	0.00
	Kogia	North Pacific	350553	0.02	0.00
	Cuvier's beaked whale	North Pacific	90725	0.17	0.00
	Blainville's beaked whale	North Pacific	8032	0.17	0.00
	Ginkgo-toothed beaked whale	North Pacific	22799	0.06	0.00
	Killer whale	North Pacific	12256	0.11	0.00
	False killer whale	Western North Pacific	16668	0.52	0.00
	Pygmy killer whale	Western North Pacific	30214	0.21	0.00
	Melon-headed whale	Western North Pacific	36770	0.11	0.00
	Short-finned pilot whale	Western North Pacific	53608	0.86	0.00
	Risso's dolphin	Western North Pacific	83289	0.46	0.00
	Common dolphin	Western North Pacific	3286163	0.06	0.00
	Bottlenose dolphin	Western North Pacific	168791	0.32	0.00
	Spinner dolphin	Western North Pacific	1015059	0.00	0.00
	Pantropical spotted dolphin	Western North Pacific	438064	0.11	0.00
	Striped dolphin	Western North Pacific	570038	0.18	0.00
	Rough-toothed dolphin	Western North Pacific	145729	0.13	0.00
	Fraser’s dolphin	Western North Pacific	220789	0.06	0.00
	Pacific white-sided dolphin	Western North Pacific	67769	0.41	0.00

Note: Post-operational estimates were based on the actual operating hours whereas the pre-operational estimates were based on projected operations over the course of each annual LOA. Post-operational marine mammal density and stock numbers were based on the most current data in the fifth year LOA application (DON, 2006a).

Table 8. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 3 in Summer/Fall/Winter

West Philippine Sea					
Site 3	**Animal**	**Stock**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Fin whale	North Pacific	9250	0.44	0.00
	Bryde's whale	Western North Pacific	22000	0.55	0.00
	Minke whale	Western North Pacific	25049	2.37	0.00
	Humpback whale (winter only)	Western North Pacific	394	0.00	0.00
	Sperm whale	North Pacific	102112	0.15	0.00
	Kogia	North Pacific	350553	0.08	0.00
	Cuvier's beaked whale	North Pacific	90725	0.05	0.00
	Blainville's beaked whale	North Pacific	8032	1.31	0.00
	Ginkgo-toothed beaked whale	North Pacific	22799	0.37	0.00
	False killer whale	Western North Pacific	16668	3.48	0.00
	Pygmy killer whale	Western North Pacific	30241	1.39	0.00
	Melon-headed whale	Western North Pacific	36770	2.17	0.00
	Short-finned pilot whale	Western North Pacific	53608	2.82	0.00
	Risso's dolphin	Western North Pacific	83289	3.05	0.00
	Common dolphin	Western North Pacific	3286163	0.38	0.00
	Bottlenose dolphin	Western North Pacific	168791	2.08	0.00
	Spinner dolphin	Western North Pacific	1015059	0.01	0.00
	Pantropical spotted Dolphin	Western North Pacific	438064	0.71	0.00
	Striped dolphin	Western North Pacific	570038	0.66	0.00
	Rough-toothed dolphin	Western North Pacific	145729	0.91	0.00
	Fraser's dolphin	Western North Pacific	220789	0.41	0.00
	Pacific white-sided dolphin	Western North Pacific	931000	2.18	0.00

Note: Post-operational estimates were based on the actual operating hours whereas the pre-operational estimates were based on projected operations over the course of each annual LOA. Post-operational marine mammal density and stock numbers were based on the most current data in the fifth year LOA application (DON, 2006a).

Table 9. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 4 in Summer

Guam					
Site 4	**Animal**	**Stock**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Blue whale	North Pacific	9250	0.04	0.00
	Fin whale	North Pacific	9250	0.04	0.00
	Bryde's whale	Western North Pacific	22000	0.09	0.00
	Minke whale	Western North Pacific	25000	0.02	0.00
	Humpback whale (winter only)	Central North Pacific	4005	0.00	0.00
	Sperm whale	North Pacific	102112	0.02	0.00
	Kogia	North Pacific	350553	0.01	0.00
	Cuvier's beaked whale	North Pacific	90725	0.11	0.00
	Blainville's beaked whale	North Pacific	8032	0.29	0.00
	False killer whale	Western North Pacific	35132	0.33	0.00
	Melon-headed whale	Western North Pacific	36770	0.66	0.00
	Short-finned pilot whale	Western North Pacific	53608	0.10	0.00
	Risso's dolphin	Western North Pacific	83289	0.03	0.00
	Bottlenose dolphin	Western North Pacific	168791	0.05	0.00
	Spinner dolphin	Western North Pacific	1015059	0.03	0.00
	Pantropical spotted dolphin	Western North Pacific	438064	0.74	0.00
	Striped dolphin	Western North Pacific	570038	0.33	0.00
	Rough-toothed dolphin	Western North Pacific	145729	0.12	0.00

Note: Post-operational estimates were based on the actual operating hours whereas the pre-operational estimates were based on projected operations over the course of each annual LOA. Post-operational marine mammal density and stock numbers were based on the most current data in the fifth year LOA application (DON, 2006a).

Table 10. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 5 in Spring

Guam					
Site 5	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Fin whale	270	9250	0.26	0.00
	Blue whale	30	22000	0.01	0.00
	Minke whale	120	25000	0.04	0.00
	Minke J stock	48	893	0.47	0.00
	Gray whale	3	100	0.26	0.00
	N. Pacific right whale	3	922	0.03	0.00
	Sperm whale	240	102112	0.02	0.00
	Stejneger's beaked whale	420	8000	0.41	0.00
	Baird's beaked whale	90	8000	0.09	0.00
	Cuvier's beaked whale	1290	90725	0.11	0.00
	Ginkgo-toothed beaked whale	150	22799	0.05	0.00
	False killer whale	810	9777	0.84	0.00
	Melon-headed dolphin	3	36770	0.00	0.00
	Short-finned dolphin	420	53608	0.08	0.00
	Risso's dolphin	2190	83289	0.31	0.00
	Common dolphin	25800	3286163	0.08	0.00
	Bottlenose dolphin	270	105138	0.03	0.00
	Spinner dolphin	3	1015059	0.00	0.00
	Pantropical spotted dolphin	4110	219032	0.20	0.00
	Pacific white-sided dolphin	900	67769	0.14	0.00
	Dall's porpoise	15600	76720	2.18	0.00

Note: Post-operational estimates were based on the actual operating hours whereas the pre-operational estimates were based on projected operations over the course of each annual LOA. Post-operational marine mammal density and stock numbers were based on the most current data in the fifth year LOA application (DON, 2006a).

Table 11. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 7 in Spring/Fall/Winter

Site 7	Animal	# Animals Stock	% Affected (w/mit) 120-180 dB	% Affected (w/mit) ≥ 180 dB
	Fin whale	9250	0.28	0.00
	Bryde's whale	22000	0.35	0.00
	Minke whale	25049	1.29	0.00
	Gray whale (winter only)	100	0.00	0.00
	Sperm whale	102112	0.09	0.00
	Kogia	350553	0.05	0.00
	Cuvier's beaked whale	90725	0.04	0.00
	Blainville's beaked whale	8032	0.67	0.00
	Ginkgo-toothed beaked whale	22799	0.23	0.00
	False killer whale	9777	2.59	0.00
	Pygmy killer whale	30214	0.98	0.00
	Melon-headed whale	36770	3.92	0.00
	Short-finned pilot whale	53608	2.01	0.00
	Risso's dolphin	83289	2.38	0.00
	Common dolphin	3286163	0.22	0.00
	Bottlenose dolphin	105138	2.72	0.00
	Spinner dolphin	1015059	0.02	0.00
	Pantropical spotted dolphin	219032	1.04	0.00
	Striped dolphin	570038	0.48	0.00
	Rough-toothed dolphin	145729	0.47	0.00
	Fraser's dolphin	220789	0.30	0.00

Note: Post-operational estimates were based on the actual operating hours whereas the pre-operational estimates were based on projected operations over the course of each annual LOA. Post-operational marine mammal density and stock numbers were based on the most current data in the fifth year LOA application (DON, 2006a).

4.3 Mitigation Effectiveness

Under LOA Condition 8(b)(i) the following assessment of the effectiveness of the mitigation measures is provided. There are no recommendations for mitigation improvements at this time.

4.3.1 LFA Mitigation and Buffer Zones

During the missions, the minimum radial distance to the safety zone from the LFA array was 1 km (0.54 nm). Therefore, the safety and buffer zones comprised a 2-km (1.08-nm) radius.

4.3.2 Visual Monitoring

Visual observers, trained in marine mammal identification, were posted as specified in LOA Condition 7(a)(i) and CNO executive directives (see Section 2.0). The personnel responsible for marine animal visual monitoring were trained in the proper methods, procedures, and protocols required to detect and to identify marine animals in accordance with Condition 7(c) of the LOAs. During the 19 missions, one marine mammal sighting was noted.

During an operation on the USNS IMPECCABLE, there was one visual sighting of an unknown whale species. There were no visual sightings during operations on the R/V *Cory Chouest*.

4.3.3 Passive Acoustic Monitoring

The embarked military detachment (MILDET) and system support engineers monitored the SURTASS passive displays for marine mammal vocalizations as specified in LOA Condition 7(a)(ii). There were no passive acoustic detections.

4.3.4 Active Acoustic Monitoring

The HF/M3 sonar was operated continuously during the course of the missions in accordance with LOA Conditions 6(c) and 7(a)(iii). The HF/M3 sonar was "ramped-up" prior to operations as required. During 5 of the 19 missions, there were 38 HF/M3 alerts that were identified as possible marine mammal or sea turtle detections. No additional correlating data were available to further verify, identify, or clarify these detections.

4.3.5 Delay/Suspension of Operations

Because the HF/M3 sonar detections noted above met the minimum shutdown criteria (two HF/M3 detection alerts within six seconds), the requisite protocols were followed under LOA Condition 6(b). LFA transmissions were delayed/suspended on 45 occasions. On the USNS IMPECCABLE, operations were delayed/suspended one time due to visual detection of marine mammals. On the R/V *Cory Chouest*, there were 38 delays/suspensions due to possible marine mammal or sea turtle detections on the HF/M3, and 6 times due to HF/M3 sonar failure.

4.4 Assessment of Long-Term Effects and Estimated Cumulative Impacts

Because the impacts that were encountered during the period of this report are consistent with what was projected in the FOEIS/EIS and supporting documentation, the Navy's assessment of the long-term and cumulative impact of employment of SURTASS LFA remain consistent with the analysis of such impacts in the FOEIS/EIS.

5.0 LONG TERM MONITORING AND RESEARCH

As part of its continuing commitment to protect the environment, the Navy is carrying out a LTM Program to assess and analyze the potential for effects of the employment of SURTASS LFA on the marine environment.

The principal objectives of the LTM Program for the SURTASS LFA sonar system are to:

- Analyze and assess the effectiveness of proposed mitigation measures, and make recommendations for improvements where applicable, to incorporate them as early as possible, with NMFS concurrence;
- Provide the necessary input data for reports on estimates of percentages of marine mammal populations affected by SURTASS LFA sonar operations, using predictive modeling based on operating location, system characteristics, and animal demographics;
- Study the potential effects of Navy SURTASS LFA sonar-generated underwater sound on long-term ecological processes relative to LF sound-sensitive marine animals, focusing on the application of Navy technology for the detection, classification, localization, and tracking of these animals; and
- Collaborate, as feasible, with pertinent Navy, academic, and industry laboratories and research organizations, and where applicable, with Allied navy and academic laboratories.

The LTM Program consists of two parts—reporting and research.

5.1 Reporting Requirements Under the Final Rule and Letters of Authorization

The first part of the LTM Program consists of NMFS-directed reports under the MMPA Final Rule and LOAs. These reports provide information for assessments of whether incidental harassment of marine mammals occurred within the SURTASS LFA mitigation and buffer zones during operations, based upon data from the monitoring mitigation (visual, passive acoustic, active acoustic). Data analysis from the LTM Program and post-operation acoustic information are utilized to estimate the percent of marine mammal stocks potentially exposed to SURTASS LFA received levels below 180 dB.

During routine operations of SURTASS LFA, technical and environmental data are collected and recorded. These include data from visual and acoustic monitoring, ocean environmental measurements, and technical operational inputs. As part of the LTM Program and as stipulated in the MMPA Final Rule and LOAs, the following reports are required:

- Mission reports are provided to NMFS on a quarterly basis for each vessel, including all active-mode missions that have been completed 30 days or more prior to the date of the deadline for the report.
- The Navy submits annual reports to NMFS 90 days prior to expiration of the LOAs.
- The Navy will provide a final comprehensive report analyzing any impacts of SURTASS LFA sonar on marine mammal stocks during the 5-year period of the regulations.

5.2 Research

NMFS's original Letter of Authorization (67 FR 55818) and Final Rule (67 FR 46785) included the conduct of additional research involving the topics listed in Table 12 below. According to the first LOA, the U.S. Navy must conduct research in at least one of these areas. The research activities listed would help to increase the knowledge of marine mammal species and the determination of levels of impacts from potential takes.

5.2.1 Research Status

Table 12 below provides the status of research that has been conducted, is underway or is being planned to address NMFS's research topics based on the eight recommended research topics provided in the preamble to the Final Rule (67 FR 46782).

5.2.2 Navy-Sponsored Research

The Office of Naval Research (ONR) sponsors significant research to study the potential effects of its activities on marine mammals. The Navy spends on average $10M to $14M annually on marine mammal research at universities, research institutions, federal laboratories, and private companies. In 2004 and 2005, Navy-funded research produced approximately 65 peer-reviewed articles in professional journals. Publication in open professional literature thorough peer review is the benchmark for the quality of the research. This ongoing marine mammal research include hearing and hearing sensitivity, auditory effects, dive and behavioral response models, noise impacts, beaked whale global distribution, modeling of beaked whale hearing and response, tagging of free ranging marine animals at-sea, and radar-based detection of marine mammals from ships. These studies, though not specifically related to LFA operations, are crucial to the overall knowledge base on marine mammals and the potential effects from underwater anthropogenic noise.

In addition, ONR and the Strategic Environmental Research and Development Program (SERDP) have funded the development and fieldwork for sound-and-orientation recording tags (DTAGs), which have been successfully attached with suction cups to beaked whales and sperm whales (Tyack et al., 2006). In particular, these data are providing tremendous amounts of information on the movement and diving behavior of beaked whales, both of which are important to know in order to understand the acoustic exposure to which the animals may be subjected.

Under the NMFS Final Rule, the Navy is required to conduct research in accordance with 50 CFR § 216.185(e) and the LOAs, as issued. As demonstrated in Table 12, the Navy has and is continuing to meet these recommended research requirements (67 FR 46782). The SURTASS LFA Sonar LTM Program has been budgeted by the Navy at a level of approximately $1M per year for five years, starting with the issuance of the first LOA. Planning has commenced for a 2007-2008 deep-diving odontocetes behavioral response study (BRS) to determine the potential effects of LFA, mid-frequency active (MFA), and seismic sources on beaked whales and other deep diving odontocetes at an estimated cost of $3M per year.

Table 12. Research Status

NMFS Research Topics	Status
Systematically observe SURTASS LFA sonar training exercises for injured or disabled marine animals	As reported in the annual reports (DON, 2003b; 2004b; 2005c; 2006b), post-operational incidental harassment assessments demonstrate that there were no known marine mammal exposures to RLs at or above 180 dB (Subsection 4.2). These findings are supported by the results from the visual, passive acoustic and active acoustic monitoring efforts discussed in Subsection 4.3. In addition, a review of recent stranding data from the National Science Museum of Tokyo, Japan and Internet sources did not indicate any stranding events associated with the times and locations of LFA operations (Subsection 4.3)
Compare the effectiveness of the three forms of mitigation (visual, passive acoustic, HF/M3 sonar)	A summary of mitigation effectiveness is provided in Subsection 4.1.8 of the Final Comprehensive Report (DON 2007a).
Behavioral reactions of whales to sound levels that were not tested during the research phase, specifically between 155 and 180 dB	Preliminary assessment of the feasibility of conducting such research indicates that a Scientific Research Permit (SRP) under the MMPA, backed up with a National Environmental Protection Act environmental assessment would be required. The potential for acquiring authorization to intentionally expose marine mammals to RLs up to 180 dB would be expected to be extremely low. Moreover, it should be noted that for the Low Frequency Sound SRP conducted in 1997-98, where the goal was to expose blue, fin, gray and humpback whales to RLs up to 160 dB, even with total control of placement of the LFA source in relation to known animal locations and movements, it was rare to achieve RLs at the animals greater than 150 dB. Intentions are to hold discussions with NMFS on the practicability of future research of this nature.
Responses of sperm and beaked whales to LF sonar signals	• Expert marine biologist and bio-acousticians agree that the conduct of controlled exposure experiments (CEE) with sperm and/or beaked whales will prove to be extremely complicated and expensive. Nevertheless, the Navy and NMFS are going forward with the planning for beaked whale BRSs, using controlled exposures of LF, mid-frequency (MF) and seismic sources, with execution during the summer/fall of 2007 and 2008. • At an April 2004 Beaked Whale Workshop organized by the Marine Mammal Commission (MMC) in Baltimore, MD, there was unanimous support for CEEs as a top research priority to be used to gather critical information on beaked whale responses to sound. A Summary report of this workshop is available at: http://www.mmc.gov/sound/ and also in Cox et al. (2006). • During a November 2004 Beaked Whale Research Planning Workshop at St. Andrews University, UK, jointly funded by the University's Sea Mammal Research Unit (SMRU) and the UK Ministry of Defence (MoD), SMRU provided a strawman proposal for conducting CEEs with beaked whales. • A second SMRU/MoD meeting in October 2005 of leading scientists in the fields of marine bio-acoustics and whale research, in Oxford UK, produced a draft research strategy on The Effects of Anthropogenic Sound on Marine Mammals, which focuses on a risk assessment framework of 5 steps: 1) Hazard identification; 2) Animal exposure assessment; 3) Animal dose-response assessment; 4) Risk characterization; and 5) Risk management. Navy funding supported this research effort. • The Navy is funding SMRU and QinetiQ (UK) to help provide the framework for future national and international research on the responses of beaked whales to LF sonar signals. • The Navy and NMFS met the 2006 goal to develop an agreed-upon experimental plan for follow-on field research (e.g., BRSs) with beaked whales in 2007/2008. The Navy convened an *ad hoc* scientific working group meeting in April 2006 to

NMFS Research Topics	Status
	concentrate on the details of a 2007 beaked whale BRS; independent scientists from Cornell University, Woods Hole Oceanographic Institution, and St. Andrews University attended, which developed a plan of action with milestones for the 2007/2008 experiments. Navy and industry funding is supporting this research effort. • The Deep-Diving Odontocetes BRS Planning Meeting was held in Oct 2006 with participants from Cornell University, Woods Hole Oceanographic Institution, St. Andrews University, NMFS, Navy, and the seismic exploration industry. The primary objectives were to agree upon a plan for the BRS 2007 Scientific Research Permit (SRP) Application under the MMPA, and set the BRS organization.
Habitat preferences of beaked whales	The ONR has funded the following research that has been published: MacLeod, C. D., and G. Mitchell. 2006. Key areas for beaked whales worldwide. J. Cetacean Res. Manage. 7(3):309-322. MacLeod, C.D., W.F. Perrin, R. Pitman, J. Barlow, L. Balance, A. D'Amico, T. Gerrodette, G. Joyce, K.D. Mullin, D.L. Palka, and G.T. Waring. 2006. Known and inferred distributions of beaked whale species (Cetacea: Ziphiidae). J. Cetacean Res. Manage. 7(3):271-286. The U.S. Navy/ONR and SERDP have funded the following research on predicting the distribution of marine mammal species, including beaked whales: Redfern, J.V., M.C. Ferguson, E.A. Becker, K.D. Hyrenbach, C. Good, J. Barlow, K. Kaschner, M.F. Baumgartner, K.A. Forney, L.T. Ballance, P. Fauchald, P. Halpin, T. Hamazaki, A.J. Pershing, S.S. Qian, A. Read, S.B. Reilly, L. Torres, and F. Werner. 2006. Techniques for cetacean–habitat modeling. MEPS 310:271-295. Ferguson, M. C., J. Barlow, B., S. B. Reilly, and T. Gerrodette. 2006. Predicting Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale population density from habitat characteristics in the Eastern Tropical Pacific Ocean. JCRM 7(3):287-299. As part of the BRS planning, a Navy-funded draft document from SMRU has identified three “top-tier,” three “second-tier” and eight “third-tier” sites (i.e., habitat preferences of beaked whales), including discussion for each on: 1) scientific impact; 2) logistics and cost; 3) team qualifications; and 4) permits and politics. • Top Tier: Bahamas, Azores, Canaries. • Second Tier: Bay of Biscay, Hawaii, Ligurian Sea (Genoa Canyon). • Third Tier: Alboran Sea, Baja California, Western Greece, New Zealand, Tasmania, Japan (Yokosuka Bay), Washington State (Quinalt Canyon), Caribbean Sea (esp. eastern Puerto Rico and Virgin Islands). These data will be further examined and beaked whale experts consulted in determining the oceanic area and specific sites for the conduct of the proposed BRS field research effort. Navy funding supports this research effort.
Passive acoustic monitoring for the possible silencing of calls of large whales using bottom-mounted hydrophones	Four research efforts in the North Atlantic (NORLANT, 2004, 2005, 2006-01, 2006-02) have addressed this topic. The research reports for these tasks are classified; unclassified summary reports have been produced. Navy funding has supported and continues to support these research efforts.
Continued research with the HF/M3 Sonar	Based on system component maintenance history and training experience with the HF/M3 sonars installed onboard the R/V *Cory Chouest* and the USNS IMPECCABLE, the HF/M3 sonar is being upgraded for integration into the installations of Compact Low Frequency Active (CLFA) Sonar on the T-AGOS 19 Class vessels.

NMFS Research Topics	Status
Long-term, cumulative effects on a stock of marine mammals that is expected to be regularly exposed to LFA and monitor it for population changes throughout the five-year period.	Detecting and scientifically validating a change in a marine mammal population (e.g, trend, demographics) is extremely difficult. It is unrealistic to expect that a single factor would explain population changes. Also, for LFA, research results indicate that some whales will respond to LFA over relatively short temporal periods and over small spatial areas, and it is recognized that this research was only capable of testing for responses over short time periods and spatial scales. There is no evidence that LFA could have an effect on individual survivorship or reproductive success, or population trends or demographics. However, research on the appropriate temporal and spatial scales has not been conducted to address this level of potential impact, so questions concerning the level of impact at such scales remain unanswered.

5.2.3 Incident Monitoring

This LTM Program element comprises two parts: (1) recreational or commercial diver incident monitoring, and (2) marine mammal and sea turtle stranding incident monitoring. The Navy coordinates with the principal clearinghouse for information on diver-related incidents, Divers Alert Network (DAN). The Navy also monitors and reviews data on strandings from federal, state, and international organizations. No incidents were noted during the period of this report.

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APPENDIX A

Letter of Authorization Governing the Take of Marine Mammals Incidental to the U.S. Navy's Operation of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar on the R/V *Cory Chouest*, Office of Protected Resources, National Marine Fisheries Service, August 15, 2006

DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

Letter of Authorization

The Chief of Naval Operations (N774), Department of the Navy, 2000 Navy Pentagon, Washington, D.C. 20350-2000, and persons operating under his authority, are authorized to conduct the activity specified below pursuant to 50 CFR Part 216, Subpart Q--Taking of Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) sonar subject to the provisions of the Marine Mammal Protection Act (16 U.S.C. 1361 et seq.; MMPA), the Regulations Governing Small Takes of Marine Mammals Incidental to Specified Activities (50 CFR Part 216, Subpart I)(the Regulations) and the following conditions:

1. This Authorization is valid for the period August 16, 2006, through August 15, 2007.

2. This Authorization is valid only for the unintentional taking of the species of marine mammals identified in 50 CFR § 216.180(b) and Condition 3(c) of this Authorization governing the taking of these animals incidental to the activity specified in Condition 3(a) within those biogeographic areas specified in Condition 3(b) and shall be valid only for takings consistent with the provisions in 50 CFR § 216.182 and the terms of this Authorization as specified below.

3. (a) This Authorization is valid only for activities associated with the operation of the SURTASS LFA Sonar onboard the *R/V Cory Chouest*. The signals transmitted by the SURTASS LFA sonar source must be between 100 and 330 Hertz (Hz) with a source level for each of the 18 projectors no more than 215 dB (re: 1 micro Pascal (μPa) at 1 meter (m)) and a maximum duty cycle of 20 percent.

(b) This Authorization, combined with an Authorization for the USNS IMPECCABLE, is valid for an estimated total of 16 nominal 9-day active sonar missions between the two ships (or equivalent shorter missions not to exceed a total of 432 hours of transmit time between the two ships during the period of effectiveness of this Authorization) in accordance with boundary conditions described in enclosure 1 of the Navy's March 31, 2006 application (attached). These operating areas are contained within the Archipelagic Deep Basins Province, the Western Pacific Warm Pool Province, and the North Pacific Tropical Gyre West Province all within the Pacific Trade Wind Biome; the Kuroshio Current Province and the Northern Pacific Transition Zone Province within the Pacific Westerly Winds Biome; the North Pacific Epicontinental Sea Province within the Pacific Polar Biome; and the China Sea Coastal Province within the North Pacific Coastal Biome, as identified in 50 CFR § 216.180(a).

(c) The incidental take of marine mammals under the activity identified in Condition 3(a) is limited to the following species:

(i) Mysticete whales-blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), minke whale (*Balaenoptera acutorostrata*), Bryde's whale (*Balaenoptera edeni*), sei whale (*Balaenoptera borealis*), northern Pacific right whale (*Eubalaena japonica*), and gray whale (*Eschrichtius robustus*).

(ii) Odontocete whales-sperm whale (*Physeter macrocephalus*), dwarf and pygmy sperm whales (*Kogia simus* and *K. breviceps*), short-finned pilot whale (*Globicephala macrorhynchus*), Risso's dolphin (*Grampus griseus*), rough-toothed dolphin (*Steno bredanensis*), Fraser's dolphin (*Lagenodelphis hosei*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), Dall's porpoise (*Phocoenoides dalli*), spinner dolphin (*Stenella longirostris*), pantropical spotted dolphin (*S. attenuata*), striped dophin (*S. coeruleoalba*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), melon-headed whale (*Peponocephala spp.*), Baird's (*Berardius bairdii*), *Mesoplodon* spp. [including Stejneger's (*Mesoplodon stejnegeri*)], Hubbs' (*M. carlhubbsi*), Blaineville's (*M. densirostris*) beaked whales, ginko-toothed beaked whale (*M. ginkgodens*), Cuvier's beaked whale (*Ziphius cavirostris*), killer whale (*Orcinus orca*), false killer whale (*Pseudorca crassidens*), and pygmy killer whale (*Feresa attenuata*).

(iii) Pinnipeds-Hawaiian monk seal (*Monachus shauinslandi*)

(d) The taking of marine mammals by the Holder of this Authorization is limited to the incidental taking of marine mammal species identified in Condition 3(c) by Level A and Level B harassment (as defined in the MMPA and 50 CFR § 216.3) within those areas authorized under Condition 3(b). Taking of marine mammal species not listed under Condition 3(c) by harassment, injury, or mortality, or the taking by mortality of any marine mammal species listed under Condition 3(c) is prohibited.

4. The Holder of this Authorization, and any individuals operating under his authority, must not broadcast the SURTASS LFA sonar signal at a frequency greater than 330 Hz.

5. The Holder of this Authorization, and any individuals operating under his authority, are required to cooperate with the National Marine Fisheries Service (NMFS) and any other Federal agency with jurisdiction in the monitoring of impacts of the activity on marine mammals.

6. Mitigation

The Holder of this Authorization, and any individuals operating under his authority, must conduct the activity identified in 50 CFR § 216.180 and Condition 3(a) of this Authorization in a manner that minimizes, to the greatest extent practicable, adverse impacts on marine mammals, their habitats, and the availability of marine mammals for subsistence. When conducting operations identified in 50 CFR § 216.180, the following mitigation measures must be implemented:

(a) Through monitoring described under 50 CFR § 216.185 and Condition 7 of this Authorization, the Holder of this Authorization (and any individuals operating under his

authority) must ensure, to the greatest extent practicable, that no marine mammal is subjected to a sound pressure level of 180 dB (re 1 μPa_{rms}) or greater.

(b) If a marine mammal is detected within the area subjected to a sound pressure level of 180-dB (re 1 μ Pa_{rms}) or greater (safety zone) or within the 1 kilometer (km) (0.5 nautical mile (nm)) buffer zone extending beyond the 180-dB (re 1 μ Pa_{rms}) safety zone, SURTASS LFA sonar transmissions will be immediately delayed or suspended. Transmissions will not resume earlier than 15 minutes after:

(i) All marine mammals have left the area of the safety and buffer zones; and

(ii) There is no further detection of any marine mammal within the safety and buffer zones as determined by the visual, passive or active acoustic monitoring described in 50 CFR § 216.185 and Condition 7.

(c) The High Frequency Marine Mammal Monitoring (HF/M3) sonar source referenced in 50 CFR § 216.185 will be ramped-up slowly to operating levels over a period of no less than 5 minutes. The HF/M3 source level will not be increased if a marine mammal is detected during ramp-up. Ramp-up may continue once marine mammals are no longer detected by any of the three monitoring programs. HF/M3 sonar will be ramped-up:

(i) At least 30 minutes prior to any SURTASS LFA sonar transmissions;

(ii) Prior to any SURTASS LFA sonar calibrations or testing that are not part of regular SURTASS LFA sonar transmissions described in Condition 6(c)(i); and

(iii) Anytime after the HF/M3 source has been powered down for more than 2 minutes.

(d) The SURTASS LFA sonar will not be operated such that the SURTASS LFA sonar sound field exceeds 180 dB (re 1 μ Pa_{rms}):

(i) At a distance of 12 nm (22 km) or less from any coastline, including offshore islands, or within the Hawaiian monk seal exclusion zones and coastal exclusion zones described in enclosure 1 of the Navy's March 31, 2006 application (attached) and

(ii) Within any offshore area that has been designated as biologically important for marine mammals under 50 CFR § 216.184(f) and described in Condition 6(e), that exists outside the applicable coastal exclusion zones.

(e) The following areas have been designated by NMFS as offshore areas of critical biological importance for marine mammals (by season if appropriate):

	Name of Area	Location of Area	Months of Importance
(i)	200-m isobath North American East Coast	From 28^0 N to 50^0 N west of 40^0 W	Year-Round
(ii)	Antarctic Convergence Zone	30^0 E to 80^0 E:45^0 S 80^0 E to 150^0 E:55^0 S 150^0 E to 50^0 W:60^0 S 50^0 W to 30^0 E:50^0 S	October 1 through March 31
(iii)	Costa Rica Dome	Centered at 9^0 N and 88^0 W	Year-Round
(iv)	Penguin Bank	Centered at 21^0N and 157^0 30' W	November 1 through May 1

(f) In order to meet the sound pressure level criteria in Conditions 6(b) and 6(d), the SURTASS LFA sonar safety zone (distance to the 180-dB (re 1 μ Pa_{rms}) isopleth) will be estimated prior to and during operations using near-real-time environmental data and underwater acoustic prediction models. These sound field estimates will be updated every 12 hours, or more frequently when meteorological or oceanographic conditions change.

(g) All SURTASS LFA sonar missions will be planned to ensure that no greater than 12 percent of any marine mammal stock is incidentally harassed by SURTASS LFA sonar operations during the effective period of this Authorization. The Holder of this Authorization must coordinate with the Holder of the Letter of Authorization issued to the USNS IMPECCABLE to ensure that this condition is met for both vessels combined.

7. Monitoring

The Holder of this Authorization, and any individuals operating under his authority, must:

(a) Perform the following monitoring mitigation:

(i) Visual monitoring from the ship's bridge during all daylight hours;

(ii) Passive acoustic monitoring using the low frequency, passive SURTASS to listen for vocalizing marine mammals; and

(iii) Active acoustic monitoring using the HF/M3 sonar to locate and track marine mammals in relation to the SURTASS LFA sonar vessel and the sound field produced by

the SURTASS LFA sonar source array.

(b) Perform monitoring under Condition 7(a) to:

(i) Commence at least 30 minutes before the first SURTASS LFA sonar transmission (30 minutes before sunrise for visual monitoring);

(ii) Continue between transmission pings; and

(iii) Continue for at least 15 minutes after completion of the SURTASS LFA sonar transmission exercise (30 minutes after sunset for visual monitoring), or if marine mammals are showing abnormal behavioral patterns, for a period of time until behavior patterns return to normal or conditions prevent continued observations.

(c) Designate qualified on-site individuals to conduct the mitigation, monitoring and reporting activities specified in this Authorization. The Holder of this Authorization will hire one or more qualified marine mammal biologists, highly experienced in marine mammal observation techniques, to train observers for conducting visual monitoring.

(d) Conduct research in accordance with the requirements of 50 CFR § 216.185. Under this Authorization such research must include at least one of the following: (1) the behavioral reactions of cetaceans to sound levels that were not tested during the research phase, specifically between 155 dB and 180 dB, (2) the responses of sperm and beaked whales to LF sonar signals, (3) the habitat preferences of beaked whales, (4) passive acoustic monitoring for the possible silencing of calls of large whales using bottom- mounted hydrophones, and (5) long term, cumulative effects on a stock of marine mammal that is expected to be regularly exposed to LFA sonar and monitor it for population changes throughout the five-year period. In consultation with the Holder of this Authorization, NMFS will make a final determination on which of these listed research items will be conducted during the period of this Authorization.

8. Reporting

The Holder of this Authorization must:

(a) Submit quarterly, classified mission reports to the Director, Office of Protected Resources, NMFS no later than 30 days after the end of the quarter beginning on August 16, 2006. Each quarterly, classified mission report will include all active-mode missions that have been completed during the quarter. Specifically, these reports will include dates/times of exercises, location of vessel, LOA province, location of the safety and buffer zones in relation to the LFA sonar array, marine mammal observations, and records of any delays or suspensions of operations. Marine mammal observations will include animal type and/or species, number of animals sighted, date and time of observations, type of detection (visual, passive acoustic, HF/M3 sonar), bearing and range from vessel, abnormal behavior (if any), and remarks/narrative (as necessary). The report will include the Navy's assessment of whether any taking occurred within the SURTASS LFA sonar safety and buffer zones and estimates of the percentage of

marine mammal stocks affected (both for the quarter and cumulatively for the year covered by the LOA) by SURTASS LFA sonar operations (both within and outside the safety and buffer zones), using predictive modeling based on operating locations, dates/times of operations, system characteristics, oceanographic environmental conditions, and animal demographics. In the event that no SURTASS LFA missions are completed during a quarter, a report of negative activity will be provided.

(b) Submit an annual, unclassified report to the Director, Office of Protected Resources, NMFS, no later than 90 days prior to expiration of this Authorization. This report will provide NMFS with an unclassified summary of the year's quarterly reports and will include the Navy's assessment of whether any taking occurred within the SURTASS LFA sonar mitigation and buffer zones and estimates of the percentage of marine mammal stocks affected by SURTASS LFA sonar operations (both within and outside the safety and buffer zones), using predictive modeling based on operating locations, dates/times of operations, system characteristics, oceanographic environmental conditions, and animal demographics. The annual report will also include:

(i) Analysis of the effectiveness of the mitigation measures with recommendations for improvements where applicable;

(ii) Assessment of any long-term effects from SURTASS LFA sonar operations; and

(iii) Any discernible or estimated cumulative impacts from SURTASS LFA sonar operations.

9. A copy of this Authorization and the attached Subpart Q of the regulations must be in the possession of the Officer in Charge of the Military Detachment (MILDET) on board the *R/V Cory Chouest* in order to conduct the activity under the authority of this Letter of Authorization.

AUG 15 2006

Date

James H. Lecky, Director
Office of Protected Resources
National Marine Fisheries Service

APPENDIX B

Letter of Authorization Governing the Take of Marine Mammals Incidental to the U.S. Navy's Operation of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar on the USNS IMPECCABLE, Office of Protected Resources, National Marine Fisheries Service, August 15, 2006

DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

Letter of Authorization

The Chief of Naval Operations (N774), Department of the Navy, 2000 Navy Pentagon, Washington, D.C. 20350-2000, and persons operating under his authority, are authorized to conduct the activity specified below pursuant to 50 CFR Part 216, Subpart Q--Taking of Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) sonar subject to the provisions of the Marine Mammal Protection Act (16 U.S.C. 1361 et seq.; MMPA), the Regulations Governing Small Takes of Marine Mammals Incidental to Specified Activities (50 CFR Part 216, Subpart I)(the Regulations) and the following conditions:

1. This Authorization is valid for the period August 16, 2006, through August 15, 2007.

2. This Authorization is valid only for the unintentional taking of the species of marine mammals identified in 50 CFR § 216.180(b) and Condition 3(c) of this Authorization governing the taking of these animals incidental to the activity specified in Condition 3(a) within those biogeographic areas specified in Condition 3(b) and shall be valid only for takings consistent with the provisions in 50 CFR § 216.182 and the terms of this Authorization as specified below.

3. (a) This Authorization is valid only for activities associated with the operation of the SURTASS LFA Sonar onboard the USNS IMPECCABLE. The signals transmitted by the SURTASS LFA sonar source must be between 100 and 330 Hertz (Hz) with a source level for each of the 18 projectors no more than 215 dB (re: 1 micro Pascal (μPa) at 1 meter (m)) and a maximum duty cycle of 20 percent.

(b) This Authorization, combined with an Authorization for *R/V Cory Chouest*, is valid for an estimated total of 16 nominal 9-day active sonar missions between the two ships (or equivalent shorter missions not to exceed a total of 432 hours of transmit time between the two ships during the period of effectiveness of this Authorization) in accordance with boundary conditions described in enclosure 1 of the Navy's March 31, 2006 application (attached). These operating areas are contained within the Archipelagic Deep Basins Province, the Western Pacific Warm Pool Province, and the North Pacific Tropical Gyre West Province all within the Pacific Trade Wind Biome; the Kuroshio Current Province and the Northern Pacific Transition Zone Province within the Pacific Westerly Winds Biome; the North Pacific Epicontinental Sea Province within the Pacific Polar Biome; and the China Sea Coastal Province within the North Pacific Coastal Biome, as identified in 50 CFR § 216.180(a).

(c) The incidental take of marine mammals under the activity identified in Condition 3(a) is limited to the following species:

(i) Mysticete whales-blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), minke whale (*Balaenoptera acutorostrata*), Bryde's whale (*Balaenoptera edeni*), sei whale (*Balaenoptera borealis*), northern Pacific right whale (*Eubalaena japonica*), and gray whale (*Eschrichtius robustus*).

(ii) Odontocete whales-sperm whale (*Physeter macrocephalus*), dwarf and pygmy sperm whales (*Kogia simus* and *K. breviceps*), short-finned pilot whale (*Globicephala macrorhynchus*), Risso's dolphin (*Grampus griseus*), rough-toothed dolphin (*Steno bredanensis*), Fraser's dolphin (*Lagenodelphis hosei*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), Dall's porpoise (*Phocoenoides dalli*), spinner dolphin (*Stenella longirostris*), pantropical spotted dolphin (*S. attenuata*), striped dophin (*S. coeruleoalba*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), melon-headed whale (*Peponocephala spp.*), Baird's (*Berardius bairdii*), *Mesoplodon* spp. [including Stejneger's (*Mesoplodon stejnegeri*)], Hubbs' (*M. carlhubbsi*), Blaineville's (*M. densirostris*) beaked whales, ginko-toothed beaked whale (*M. ginkgodens*), Cuvier's beaked whale (*Ziphius cavirostris*), killer whale (*Orcinus orca*), false killer whale (*Pseudorca crassidens*), and pygmy killer whale (*Feresa attenuata*).

(iii) Pinnipeds-Hawaiian monk seal (*Monachus shauinslandi*)

(d) The taking of marine mammals by the Holder of this Authorization is limited to the incidental taking of marine mammal species identified in Condition 3(c) by Level A and Level B harassment (as defined in the MMPA and 50 CFR § 216.3) within those areas authorized under Condition 3(b). Taking of marine mammal species not listed under Condition 3(c) by harassment, injury, or mortality, or the taking by mortality of any marine mammal species listed under Condition 3(c) is prohibited.

4. The Holder of this Authorization, and any individuals operating under his authority, must not broadcast the SURTASS LFA sonar signal at a frequency greater than 330 Hz.

5. The Holder of this Authorization, and any individuals operating under his authority, are required to cooperate with the National Marine Fisheries Service (NMFS) and any other Federal agency with jurisdiction in the monitoring of impacts of the activity on marine mammals.

6. Mitigation

The Holder of this Authorization, and any individuals operating under his authority, must conduct the activity identified in 50 CFR § 216.180 and Condition 3(a) of this Authorization in a manner that minimizes, to the greatest extent practicable, adverse impacts on marine mammals, their habitats, and the availability of marine mammals for subsistence. When conducting operations identified in 50 CFR § 216.180, the following mitigation measures must be implemented:

(a) Through monitoring described under 50 CFR § 216.185 and Condition 7 of this Authorization, the Holder of this Authorization (and any individuals operating under his

authority) must ensure, to the greatest extent practicable, that no marine mammal is subjected to a sound pressure level of 180 dB (re 1 μPa_{rms}) or greater.

(b) If a marine mammal is detected within the area subjected to a sound pressure level of 180-dB (re 1 μ Pa_{rms}) or greater (safety zone) or within the 1 kilometer (km) (0.5 nautical mile (nm)) buffer zone extending beyond the 180-dB (re 1 μ Pa_{rms}) safety zone, SURTASS LFA sonar transmissions will be immediately delayed or suspended. Transmissions will not resume earlier than 15 minutes after:

(i) All marine mammals have left the area of the safety and buffer zones; and

(ii) There is no further detection of any marine mammal within the safety and buffer zones as determined by the visual, passive or active acoustic monitoring described in 50 CFR § 216.185 and Condition 7.

(c) The High Frequency Marine Mammal Monitoring (HF/M3) sonar source referenced in 50 CFR § 216.185 will be ramped-up slowly to operating levels over a period of no less than 5 minutes. The HF/M3 source level will not be increased if a marine mammal is detected during ramp-up. Ramp-up may continue once marine mammals are no longer detected by any of the three monitoring programs. HF/M3 sonar will be ramped-up:

(i) At least 30 minutes prior to any SURTASS LFA sonar transmissions;

(ii) Prior to any SURTASS LFA sonar calibrations or testing that are not part of regular SURTASS LFA sonar transmissions described in Condition 6(c)(i); and

(iii) Anytime after the HF/M3 source has been powered down for more than 2 minutes.

(d) The SURTASS LFA sonar will not be operated such that the SURTASS LFA sonar sound field exceeds 180 dB (re 1 μ Pa_{rms}):

(i) At a distance of 12 nm (22 km) or less from any coastline, including offshore islands, or within the Hawaiian monk seal exclusion zones and coastal exclusion zones described in the Navy's March 31, 2006 application (attached) and

(ii) Within any offshore area that has been designated as biologically important for marine mammals under 50 CFR § 216.184(f) and described in Condition 6(e), that exists outside the applicable coastal exclusion zones.

(e) The following areas have been designated by NMFS as offshore areas of critical biological importance for marine mammals (by season if appropriate):

	Name of Area	Location of Area	Months of Importance
(i)	200-m isobath North American East Coast	From 28^0 N to 50^0 N west of 40^0 W	Year-Round
(ii)	Antarctic Convergence Zone	30^0 E to 80^0 E:45^0 S 80^0 E to 150^0 E:55^0 S 150^0 E to 50^0 W:60^0 S 50^0 W to 30^0 E:50^0 S	October 1 through March 31
(iii)	Costa Rica Dome	Centered at 9^0 N and 88^0 W	Year-Round
(iv)	Penguin Bank	Centered at 21^0N and 157^0 30' W	November 1 through May 1

(f) In order to meet the sound pressure level criteria in Conditions 6(b) and 6(d), the SURTASS LFA sonar safety zone (distance to the 180-dB (re 1 μ Pa_{rms}) isopleth) will be estimated prior to and during operations using near-real-time environmental data and underwater acoustic prediction models. These sound field estimates will be updated every 12 hours, or more frequently when meteorological or oceanographic conditions change.

(g) All LFA sonar missions will be planned to ensure that no greater than 12 percent of any marine mammal stock is incidentally harassed by SURTASS LFA sonar operations during the effective period of this Authorization. The Holder of this Authorization must coordinate with the Holder of the Letter of Authorization issued to the *R/V Cory Chouest* to ensure that this condition is met for both vessels combined.

7. Monitoring

The Holder of this Authorization, and any individuals operating under his authority, must:

(a) Perform the following monitoring mitigation:

(i) Visual monitoring from the ship's bridge during all daylight hours;

(ii) Passive acoustic monitoring using the low frequency, passive SURTASS to listen for vocalizing marine mammals; and

(iii) Active acoustic monitoring using the HF/M3 sonar to locate and track marine mammals in relation to the SURTASS LFA sonar vessel and the sound field produced by

the SURTASS LFA sonar source array.

(b) Perform monitoring under Condition 7(a) to:

(i) Commence at least 30 minutes before the first SURTASS LFA sonar transmission (30 minutes before sunrise for visual monitoring);

(ii) Continue between transmission pings; and

(iii) Continue for at least 15 minutes after completion of the SURTASS LFA sonar transmission exercise (30 minutes after sunset for visual monitoring), or if marine mammals are showing abnormal behavioral patterns, for a period of time until behavior patterns return to normal or conditions prevent continued observations.

(c) Designate qualified on-site individuals to conduct the mitigation, monitoring and reporting activities specified in this Authorization. The Holder of this Authorization will hire one or more qualified marine mammal biologists, highly experienced in marine mammal observation techniques, to train observers for conducting visual monitoring.

(d) Conduct research in accordance with the requirements of 50 CFR § 216.185. Under this Authorization such research must include at least one of the following: (1) the behavioral reactions of cetaceans to sound levels that were not tested during the research phase, specifically between 155 dB and 180 dB, (2) the responses of sperm and beaked whales to LF sonar signals, (3) the habitat preferences of beaked whales, (4) passive acoustic monitoring for the possible silencing of calls of large whales using bottom- mounted hydrophones, and (5) long term, cumulative effects on a stock of marine mammal that is expected to be regularly exposed to LFA sonar and monitor it for population changes throughout the five-year period. In consultation with the Holder of this Authorization, NMFS will make a final determination on which of these listed research items will be conducted during the period of this Authorization.

8. Reporting

The Holder of this Authorization must:

(a) Submit quarterly, classified mission reports to the Director, Office of Protected Resources, NMFS, no later than 30 days after the end of the quarter beginning on August 16, 2005. Each quarterly, classified mission report will include all active-mode missions that have been completed during the quarter. Specifically, these reports will include dates/times of exercises, location of vessel, LOA province, location of the safety and buffer zones in relation to the LFA sonar array, marine mammal observations, and records of any delays or suspensions of operations. Marine mammal observations will include animal type and/or species, number of animals sighted, date and time of observations, type of detection (visual, passive acoustic, HF/M3 sonar), bearing and range from vessel, abnormal behavior (if any), and remarks/narrative (as necessary). The report will include the Navy's assessment of whether any taking occurred within the SURTASS LFA sonar safety and buffer zones and estimates of the percentage of

marine mammal stocks affected (both for the quarter and cumulatively for the year covered by the LOA) by SURTASS LFA sonar operations (both within and outside the safety and buffer zones), using predictive modeling based on operating locations, dates/times of operations, system characteristics, oceanographic environmental conditions, and animal demographics. In the event that no SURTASS LFA missions are completed during a quarter, a report of negative activity will be provided.

(b) Submit an annual, unclassified report to the Director, Office of Protected Resources, NMFS, no later than 90 days prior to expiration of this Authorization. This report will provide NMFS with an unclassified summary of the year's quarterly reports and will include the Navy's assessment of whether any taking occurred within the SURTASS LFA sonar mitigation and buffer zones and estimates of the percentage of marine mammal stocks affected by SURTASS LFA sonar operations (both within and outside the safety and buffer zones), using predictive modeling based on operating locations, dates/times of operations, system characteristics, oceanographic environmental conditions, and animal demographics. The annual report will also include:

(i) Analysis of the effectiveness of the mitigation measures with recommendations for improvements where applicable;

(ii) Assessment of any long-term effects from SURTASS LFA sonar operations; and

(iii) Any discernible or estimated cumulative impacts from SURTASS LFA sonar operations.

9. A copy of this Authorization and the attached Subpart Q of the regulations must be in the possession of the Officer in Charge of the Military Detachment (MILDET) on board the USNS IMPECCABLE in order to conduct the activity under the authority of this Letter of Authorization.

AUG 15 2006

Date

James H. Lecky, Director
Office of Protected Resources
National Marine Fisheries Service

APPENDIX C

Background for Marine Mammal Density and Stock Estimates for SURTASS LFA Fifth Annual Report

Background for Marine Mammal Density and Stock Estimates for SURTASS LFA 5th Year LOA Annual Report

Stipulation Area #2 North Philippine Sea

Specific Species Information:

Bryde's whale: Yoshida and Kato (1999) identified 3 stocks of Bryde's whales in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific. Density estimates were derived from scouting vessels sighting data (Ohsumi, 1977). The IWC website is source of stock estimate for the western North Pacific stock (22,000). Ohizumi et al. (2002) conducted winter sighting surveys, observing Bryde's whales at about 20°N, which is the southern limit of their summer range. Barlow (2003) observed Bryde's whales around Hawaiian Islands, deriving comparable density estimates.

minke whale: The south coast of Honshu and Shikoku were whaling grounds for this species (Ohsumi 1978). Animals are migratory from the offshore western North Pacific waters. Minke whales are migratory animals, with a summer distribution extending north to the Chukchi Sea and a winter distribution extending south to near the equator (Perrin and Brownell 2002). Two stocks of minke whales are recognized in the western North Pacific, the "O" stock in the Okhotsk Sea and off the eastern side of Japan and the "J" stock around the Korean peninsula and in the Sea of Japan (Pastene et al. 1998). Animals in this region are believed to be part of the "O" stock. Buckland et al. (1992) conducted sighting surveys in July and August in the western North Pacific and Sea of Okhotsk. Density estimates were derived from encounter rates and effective search widths for the offshore population (Standard Error (SE) = 0.17). The stock estimate is for the western North Pacific/Sea of Okhotsk stock (25,049 individuals) (Buckland et al. 1992). Ferguson and Barlow (2001, 2003) computed density estimates in offshore areas of the eastern tropical Pacific an order of a magnitude lower.

North Pacific right whale: The western North Pacific right whale population is considered distinct from the eastern population, arbitrarily separated by the 180° line of longitude (Best et al. 2001). The Okhotsk Sea, Kuril Islands, and eastern Kamchatka coast represent major feeding grounds for the western population (Brownell et al. 2001) where animals are typically found May through September (Clapham et al. 2004). Various areas have been proposed for breeding and calving grounds, including the Ryukyu Islands, Yellow Sea, Sea of Japan, offshore waters far from land, and the Bonin Islands, but a lack of winter sightings (December-February) makes a definitive assessment impossible (Brownell et al. 2001). Clapham et al. (2004) note the extensive offshore component to the right whale's distribution in the 19th century data. Movement north in spring (peak months of February-April) and south in fall (peak months September-Dececember) suggest the possibility of two putative sub-populations in the western population that are kept apart by the Japanese islands, though this seems unlikely (Brownell et al. 2001, Clapham et al. 2004). Data from Japanese sighting cruises in the Okhotsk Sea provide an abundance estimate of 922 animals (CV=0.433, 95% CI=404-2,108) (Best et al. 2001) for the western North Pacific population. The western population may be affected by proposed LFA operations in the spring, fall and winter in the North Philippine Sea.

sperm whale: Three stocks are recognized in U.S. EEZ waters, a North Pacific stock that migrates between Alaska and the western North Pacific, a central North Pacific stock around Hawaii, and a California/Oregon/Washington stock off the U.S. west coast (Angliss and Lodge 2002). Preliminary data indicate that the best abundance estimate for the western North Pacific is 102,112 individuals (CV=0.155) (Angliss and Lodge 2002). Sightings collected by Kasuya and Miyashita (1988) suggest that that there are two stocks of sperm whales in the western North Pacific, a northwestern stock with females that summer off the Kuril Islands (~50°N) and winter off Hokkaido and Sanriku (~40°N), and the southwestern North Pacific stock with females that summer off Hokkaido and Sanriku (~40°N) and winter around the Bonin Islands (~25°N). The males of these two stocks are found north of the range of the corresponding females, i.e., in the Bering Sea (~55°N) and off Hokkaido and Sanriku (~40°N), respectively, during the summer. As such, the density estimate is considered comparable to the Barlow (2003) estimate of 0.0029 animals/km^2 during the winter, and to Mobley's estimate (0.0010 animals/km^2) where sperm whales were generally seen in the outer 5% of survey effort (Mobley et al. 2000) during the spring, summer and fall.

Kogia: Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic distribution, not believed to be concentrated anywhere. Summing the abundances of *Kogia breviceps, Kogia simus, and Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001), an overall abundance of 350,553 animals was computed in the eastern tropical Pacific. At this northern latitude, only expect *Kogia breviceps*. Reviewing density estimates calculated in the eastern Pacific Ocean at about 30° N (Ferguson and Barlow 2003), a density estimate of 0.0031/km^2 and an abundance estimate of 166,553 was modeled.

Cuvier's beaked whale: No density or stock estimate data are available for this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that best data available are a density estimate (0.0054/km^2) and an abundance estimate of 90,725 animals from the eastern Pacific (Ferguson and Barlow 2003).

Blainville's beaked whale: Miyazaki et al. (1987) reported 2 strandings on Taiwan and one stranding on the southern Ryukyu Archipelago. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate. The *Mesoplodon densirostris* estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate is 8,032.

ginkgo-toothed beaked whale: Miyazaki et al. (1987) reported 5 strandings of *M. ginkgodens* from the east coast of Japan and 2 strandings from the east coast of Taiwan. Of the 15 known strandings of *M. ginkgodens*, Palacios (1996) reported 8 off Taiwan and Japan. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data on *Mesoplodon* spp. from the eastern Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

killer whale: A few schools have been seen off the southeast coast of Honshu (off Taiji) in April, October, and November; however, none have been taken in the drive fisheries (Miyashita 1993). Without any data for the western North Pacific, best available data are from the long-term

time series is the eastern tropical Pacific (Ferguson and Barlow 2001, 2003); density estimate (0.0004/km^2) and abundance estimate (12,256).

false killer whale: Miyashita (1993) estimated abundance of false killer whales from 34 sighting cruises associated with the Japanese drive fishery (16,668 (CV=0.263)). He also derived density estimates in 1° latitude by 1° longitude boxes from which an average was derived for the modeled site.

pygmy killer whale: Kishiro and Kasuya (1993) reviewed the historical catches of Japanese drive fisheries. No pygmy killer whales were caught in Taiji fisheries (located on the south coast of Kii Peninsula of Japan), but Leatherwood and Reeves (1983) reported that they were seen relatively frequently in the tropical Pacific off Japan. Without data available in the western North Pacific, a density estimate (0.0021/km^2) and abundance estimate (30,214) from eastern Pacific (Ferguson and Barlow 2003) were used.

melon-headed whale: Leatherwood and Reeves (1983) reported that melon-headed whales are not observed frequently anywhere except in the Philippine Sea, especially near Cebu Island. Abundance estimated from eastern Pacific (36,770 animals) (Ferguson and Barlow 2001, 2003). A density estimate from similar latitudes in the eastern Pacific (Ferguson and Barlow 2001, 2003) was used (0.0012/km^2). This value is very similar to the estimate from Mobley et al. (2000): 0.0021/km^2.

short-finned pilot whale: Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 (CV=0.224)). He also derived density estimates in 1° latitude by 1° longitude boxes from which an average was derived for the modeled site.

Risso's dolphin: Miyashita (1993) reported an abundance estimate (83,289 (CV=0.179)) and density estimate off southern Japan/east Taiwan (0.0106/km^2).

common dolphin: There are no data on density or abundance estimates for this species in the western Pacific (Miyashita 1993). Common dolphins are gregarious, and it is not unusual to find them associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. They are pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour, and found in waters of temperature 10-28°C (50-82.4ºF). These animals are very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves 1983). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern Pacific (Ferguson and Barlow 2001, 2003) at the same latitudes are appropriate.

bottlenose dolphin: Miyashita (1993) reports an abundance estimate (168,791 (CV=0.261)) and density estimate off southern Japan (0.0146/km^2).

spinner dolphin: Gilpatrick et al. (1987) did not report any sightings from the Pacific coast of Japan, and this species was not mentioned in historical Japanese whaling records (Kishiro and Kasuya 1993). No data on density or abundance estimates are available (Miyashita 1993).

Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Taiwan and in the Philippine Sea. Miyashita (1993) abundance estimate (438,064 (CV=0.174)) and density estimate off southern Japan/east Taiwan (0.0137/km^2) were used.

striped dolphin: There are two concentrations in western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. There is also the potential for three populations in the area: one south of 30°N, one inshore north of 30°N, and one offshore north of 30°N, east of 145°E. However, the boundaries between these populations have not been resolved (Miyashita 1993). Therefore, Miyashita (1993) derived a total population estimate (570,038 (CV=0.186)). The density estimate off southern Japan/east Taiwan (0.0329/km^2) was used.

rough-toothed dolphin: This species has a primarily pelagic distribution in tropical to warm temperate waters. They are seen from time to time with bottlenose dolphins and short-finned pilot whales, and are reportedly rare off Japan and in the heavily studied eastern tropical Pacific. There are no data on abundance or density estimates for the western North Pacific; therefore, a density estimate (0.0059/km^2) from eastern Pacific waters was used (Ferguson and Barlow 2001, 2003)**.**

Fraser's dolphin: Being a highly gregarious species, groups of a hundred to a thousand Fraser's dolphins have been observed. They are occasionally found mixed in herds of spotted dolphins and observed in company of false killer whales, sperm whales, striped dolphins, and spinner dolphins. Their diet consists of squid, crustaceans, and deep-sea fish (Leatherwood and Reeves 1983). Kishiro and Kasuya (1993) reported catches off the Pacific coast of Japan in drive fisheries. Dolar et al. (2003) reported Fraser's and spinners found together in the eastern Sulu Sea, Philippines. Comparing the feeding ecology of spinner and Fraser's dolphins, spinners feed primarily in upper 200 m (656 ft) but maybe as deep as 400 m (1312 ft), whereas Fraser's are more diverse, feeding from the surface to as deep as 600 m (1968 ft). Without any data on abundance or density estimates for the western North Pacific, it is roughly estimated that data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

Pacific white-sided dolphin: No data on density or abundance estimates are available in the western North Pacific (Miyashita 1993). A gregarious species, these pelagic, offshore creatures are encountered along or seaward of the 183-m (100-fm) contour. They feed at night on the deep-scattering layer and have a primarily temperate distribution, found north of tropical waters and south of arctic waters (Leatherwood and Reeves 1983). Recent research on genetic differentiation suggests that animals found in coastal Japanese waters and the Sea of Japan belong to a different population than animals found in offshore North Pacific waters (Hayano et al. 2004). Sighting surveys in the North Pacific were analyzed to estimate the abundance of Pacific white-sided dolphins as 931,000 individuals (Buckland et al. 1993). This estimate is over an order of magnitude larger than the abundance estimate in the eastern North Pacific (Ferguson and Barlow 2001, 2003). Without any data on density estimates for the western North Pacific

(Miyashita 1993), it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Mobley et al. 2000, Barlow 2003).

Stipulated Area #3 West Philippine Sea

Specific Species Information:

fin whale: Fin whales winter to about 20°N, including waters along the Pacific coast of Japan. Since fin whales migrate south from offshore waters of the northwest Pacific, density and stock estimates were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Masaki 1977, Ohsumi 1977, Tillman 1977). These data are comparable to density estimates in offshore areas of the eastern tropical Pacific (Ferguson and Barlow 2001, 2003).

Bryde's whale: Animals found around the Bonin Islands are an offshore morph of *Balaenoptera edeni*. 3 stocks are currently recognized in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific (Yoshida and Kato 1999). The Ohsumi (1977) density estimate was used. The IWC website is source of stock estimate for the western North Pacific stock (22,000). Ohizumi et al. (2002) conducted winter sighting surveys, observing Bryde's whales at about 20°N, which is the southern limit of their summer range. Barlow (2003) observed Bryde's whales around the Hawaiian Islands, deriving a comparable density estimate.

minke whale: The south coast of Honshu and Shikoku were whaling grounds for the minke whale (Ohsumi 1978). Animals are migratory from the offshore western North Pacific waters. Minke whales are migratory animals, with a summer distribution extending north to the Chukchi Sea and a winter distribution extending south to near the equator (Perrin and Brownell 2002). Two stocks of minke whales are recognized in the western North Pacific, the "O" stock in the Okhotsk Sea and off the eastern side of Japan and the "J" stock around the Korean peninsula and in the Sea of Japan (Pastene et al. 1998). Animals in this region are believed to be part of the "O" stock. Buckland et al. (1992) conducted sighting surveys in July and August in the western North Pacific and Sea of Okhotsk. Density estimates were derived from encounter rates and effective search widths for the offshore population (Standard Error (SE) = 0.17). The stock estimate is for the western North Pacific/Sea of Okhotsk stock (25,049 individuals) (Buckland et al. 1992). Ferguson and Barlow (2001, 2003) computed density estimates in offshore areas of the eastern tropical Pacific an order of a magnitude lower.

humpback whale: Humpback whales are only expected in this region during the winter, and they are typically found in water depths of less than 183 m (100 fm). Humpback wintering grounds in the western North Pacific are the Ryukyu Islands, Formosa and Bonin Islands (Evans 1987). Three populations of humpbacks are recognized in U.S. EEZ waters, the third being the (quoted from Angliss and Lodge 2002): "winter/spring population of Japan which, based on Discovery Tag information, probably migrate to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966, Nishiwaki 1966, Darling 1991) - referred to as the Western North Pacific stock. Some recent exchange between winter/spring areas has been documented (Darling and McSweeney 1985, Baker et al. 1986, Darling and Cerchio 1993), as well as movement between Japan and British Columbia, and

Japan and the Kodiak Archipelago (Darling et al. 1996, Calambokidis et al. 1997)." The best abundance estimate for the western North Pacific stock is 394 (CV=0.084) (Angliss and Lodge 2002).

sperm whale: Three stocks are recognized in U.S. EEZ waters, a North Pacific stock that migrates between Alaska and the western North Pacific, a central North Pacific stock around Hawaii, and a California/Oregon/Washington stock off the U.S. west coast (Angliss and Lodge 2002). Preliminary data indicate that the best abundance estimate for the western North Pacific is 102,112 individuals (CV=0.155) (Angliss and Lodge 2002). Sightings collected by Kasuya and Miyashita (1988) suggest that that there are two stocks of sperm whales in the western North Pacific, a northwestern stock with females that summer off the Kuril Islands (~50°N) and winter off Hokkaido and Sanriku (~40°N), and the southwestern North Pacific stock with females that summer off Hokkaido and Sanriku (~40°N) and winter around the Bonin Islands (~25°N). The males of these two stocks are found north of the range of the corresponding females, i.e., in the Bering Sea (~55°N) and off Hokkaido and Sanriku (~40°N), respectively, during the summer. As such, the density estimate is considered comparable to the Barlow (2003) estimate of 0.0029 animals/km^2 during the winter, and to Mobley's estimate (0.0010 animals/km^2) where sperm whales were generally seen in the outer 5% of survey effort (Mobley et al. 2000) during the spring, summer and fall.

Kogia: Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic distribution that are not believed to be concentrated anywhere specific. Summing the abundances of *Kogia breviceps, Kogia simus, and Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001), an overall abundance of 350,553 animals was computed in the eastern tropical Pacific. At this latitude, expect *Kogia breviceps* and *Kogia simus*. Reviewing density estimates calculated in the eastern Pacific Ocean at about 20°N (Ferguson and Barlow 2003), a density estimate of 0.0017/km^2 was modeled.

Cuvier's beaked whale: No data are available for Cuvier's beaked whales in this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that best data available are a density estimate (0.0003/km^2) and an abundance estimate of 90,725 animals from the same latitudes in the eastern Pacific (Ferguson and Barlow 2003).

Blainville's beaked whale: Miyazaki et al. (1987) reported 2 strandings on Taiwan and one stranding on the southern Ryukyu Archipelago. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate. The *Mesoplodon densirostris* abundance estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate is 8,032.

ginkgo-toothed beaked whale: Miyazaki et al. (1987) reported 2 strandings of *M. ginkgodens* from the east coast of Taiwan. Of the 15 known *M. ginkgodens* strandings, Palacios (1996) reported 8 off Taiwan and Japan. Leatherwood and Reeves (1983) stated that some hunting of this species apparently takes place in Taiwan. Since no data on density or stock estimates are available for this species, it was roughly estimated that the density and abundance estimates for *Mesoplodon* spp. at the same latitudes in the eastern Pacific (Ferguson and Barlow 2001, 2003) are approximate.

false killer whale: Miyashita (1993) estimated the abundance of false killer whales from 34 sighting cruises associated with the Japanese drive fishery (16,668 (CV=0.263)). He also derived density estimates in 1° latitude by 1° longitude boxes from which an average was derived for the modeled site.

pygmy killer whale: Kishiro and Kasuya (1993) reviewed the historical catches of Japanese drive fisheries. No pygmy killer whales were caught in Taiji fisheries (located on the south coast of Kii Peninsula of Japan), but Leatherwood and Reeves (1983) reported that they were seen relatively frequently in the tropical Pacific off Japan. Without data available in the western North Pacific, a density estimate (0.0021/km^2) and abundance estimate (30,214) from eastern Pacific (Ferguson and Barlow 2003) was used.

melon-headed whale: Leatherwood and Reeves (1983) reported that melon-headed whales are not observed frequently anywhere except in the Philippine Sea, especially near Cebu Island. Density and abundance estimates from the eastern Pacific (Ferguson and Barlow 2003) were used.

short-finned pilot whale: Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 (CV=0.224)). He also derived density estimates in 1° latitude by 1° longitude boxes. There was limited coverage of the Philippine Sea, but Kishiro and Kasuya (1993) reported a southern limit to the short-finned pilot whale range of approximately 20°N; therefore, a density estimate was derived as one-half the density estimate of the area south of Japan. Kasuya et al. (1988) suggest that there might be more than one stock of short-finned pilot whales off the Pacific coast of Japan and Taiwan, since there is a southern form found south of the Kuroshio Current front (south of 35°N) and a northern form found between the Kuroshio Current front and the Oyashio Current front (from approximately 35-43°N). However, the northern form has not been harvested by Japanese drive fisheries (Kishiro and Kasuya 1993), and it was therefore not included in the above analyses (Miyashita 1993).

Risso's dolphin: Miyashita (1993) abundance estimate (83,289 (CV=0.179)) and density estimate off southern Japan/east Taiwan (0.0106/km^2) were used.

common dolphin: There are no data on density or stock estimates for this gregarious species (Miyashita 1993). It is not unusual to find common dolphins associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. These pelagic, offshore creatures are encountered along or seaward of the 100-fm contour and are found in waters of temperature 10-28°C (50-82.4°F). They are very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves 1983). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

bottlenose dolphin: Miyashita (1993) abundance estimate (168,791 (CV=0.261)) and density estimate off southern Japan (0.0146/km^2) were used.

spinner dolphin: Gilpatrick et al. (1987) reported a high density of sightings in the Korea Strait, but none were reported from the Philippine Sea. Spinners are also not mentioned in historical Japanese whaling records (Kishiro and Kasuya 1993), and no data on density or abundance estimates are available (Miyashita 1993). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Taiwan and in the Philippine Sea. The Miyashita (1993) abundance estimate (438,064 (CV=0.174)) and density estimate off southern Japan/east Taiwan ($0.0137/km^2$) were used.

striped dolphin: Two concentrations exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. However, there is the potential for only one population in the area: one south of 30°N, though the boundaries between these populations have not been resolved (Miyashita 1993). Therefore, Miyashita (1993) derived a total population estimate (570,038 (CV=0.186)). One-half the density estimate from off southern Japan/east Taiwan for this site ($0.0164/km^2$) was used.

rough-toothed dolphin: Their distribution is primarily pelagic, in tropical to warm temperate waters. Rough-toothed dolphins are seen from time to time with bottlenose dolphins and short-finned pilot whales, and are reportedly rare off Japan and in the heavily studied eastern tropical Pacific. No data on stock or density estimates for the western North Pacific are available; therefore, a density estimate ($0.0059/km^2$) and an abundance estimate from the ETP (145,729) were used (Ferguson and Barlow 2001, 2003)**.**

Fraser's dolphin: Kishiro and Kasuya (1993) reported takes of Fraser's dolphin off the Pacific coast of Japan in the Japanese drive fisheries. Dolar et al. (2003) reported Fraser's and spinners found together in the eastern Sulu Sea, Philippines. Amano et al. (1996) also stated that Fraser's dolphins are common in Philippine waters. A highly gregarious species, groups of a hundred to a thousand have been observed, are occasionally found mixed in herds of spotted dolphins, and observed in the company of false killer whales, sperm whales, striped dolphins, and spinner dolphins. Their diet consists of squid, crustaceans, and deep-sea fish (Leatherwood and Reeves 1983). A comparison of the feeding ecology of spinner and Fraser's dolphins indicates that spinners feed primarily in upper 200 m (656 ft), but maybe as deep as 400 m (1312 ft), whereas Fraser's dolphins are more diverse, feeding from the surface to as deep as 600 m (1968 ft). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

Pacific white-sided dolphin: There are no data on density or stock estimates available for this species (Miyashita 1993). These pelagic, offshore animals are encountered along or seaward of the 100-fm contour, and feed at night on the deep-scattering layer. Pacific white-sided dolphins have a primarily temperate distribution, found north of tropical waters and south of arctic waters (Leatherwood and Reeves 1983). Recent research on genetic differentiation suggests that animals found in coastal Japanese waters and the Sea of Japan belong to a different population than

animals found in offshore North Pacific waters (Hayano et al. 2004). Sighting surveys in the North Pacific were analyzed to estimate the abundance of Pacific white-sided dolphins as 931,000 individuals (Buckland et al. 1993). This estimate is over an order of magnitude larger than the abundance estimate in the eastern North Pacific (Ferguson and Barlow 2001, 2003). Without any data on density estimates for the western North Pacific (Miyashita 1993), it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Mobley et al. 2000, Barlow 2003).

Stipulation Area #4 Guam

General Area Information:

There has been no recent research of marine mammals in the vicinity of Guam (Dr. J. Mobley, Jr., Univ. of Hawaii-West Oahu, pers. comm.). Eldredge (1991) compiled the first list of published and unpublished records, reporting 19 species from the region. Since there are no data on density or stock estimates for animals found in this region, the density and abundance estimates from western North Pacific and the NOAA Fisheries Southwest Fisheries Science Center surveys of the eastern tropical Pacific were applied to this area as the best available data (Ferguson and Barlow 2001, 2003). Guam references currently available are Kami and Lujan (1976), Donaldson (1983), and Eldredge (1991).

Specific Species Information:

blue whale: A Hawaiian stock of blue whale is recognized for U.S. management purposes, though they are extremely rare in the area (Carretta et al. 2002). It is hypothesized that blue whales that feed along the Aleutian Island chain in the summer spend the winter north of Hawaii, though only one visual sighting of blue whales has been recorded (Carretta et al. 2002). Further evidence of their occurrence in the area exists in acoustic recordings. Stafford et al. (2001) showed that recordings made near Kaneohe, Hawaii from August 1992 through April 1993 consisted of approximately 30% of the northwest Pacific blue whale call type and 70% of northeast Pacific call type. Other papers on acoustic censusing of blue whales in the eastern North Pacific are Moore et al. (1997) and Stafford et al. (1999). Because of the limited data available for the Hawaiian stock and the current uncertainty in blue whale stock delineation in the North Pacific (IWC recognizes only one stock in North Pacific; NOAA Fisheries delineates two stocks in U.S. EEZ waters, though up to five populations are believed to exist in the entire North Pacific basin (Reeves et al. 1998); and acoustic data suggest two populations), data on fin whales are most appropriate to apply to blue whales. The density estimate is 0.0002/km^2 and the stock estimate is 9250. These data are comparable to density estimates in offshore areas of the eastern tropical Pacific (ETP) (Ferguson and Barlow 2001, 2003).

fin whale: These animals are typically not expected south of 20°N, so it is unlikely that they would be encountered near Guam. One Hawaii stock is recognized (Carretta et al. 2002), and there has been one sighting in Hawaiian waters in recent years (February) (Mobley et al. 1996). There has been acoustic evidence for fin whale presence in fall and winter (Thompson and Friedl 1982, Moore et al. 1998). Because of the limited data available for the Hawaiian stock, and no

data available for the Guam region, density estimates and stock abundance were derived from data on the eastern North Pacific stock (Ferguson and Barlow 2003). The stock estimate is 9250 for animals outside of the Gulf of California, and a density estimate of 0.0002/km^2 based on one-half the density offshore of CA/OR/WA was derived. It is conservative to use the eastern North Pacific data because McDonald and Fox (1999) derived an average calling whale density estimate of 0.027 animals per 1000 km^2 (0.000027/km^2) based on recordings made north of Oahu, Hawaii – a value an order of magnitude less than what was modeled. The seasonal maximum calling whale density was about three times the average, or 0.081 animals/1000 km^2 (McDonald and Fox 1999), still considerably less than the modeled density.

The following table from McDonald and Fox (1999) gives a sense of the variability in the derivation of call density estimates. Based on the chosen methodology and parameters, the call density ranged from 0.011/1000 km^2 to 0.106/1000 km^2.

TABLE I. Relation of average call density estimate to time constant and range (From McDonald and Fox, 1999)

SNR	Range (km)	Number of Detections		Call Density/1000 km^2	
		time constant=4h	time constant=8h	TC=4h	TC=8h
1.0–1.5	16.0–24.0	143	85	0.042	0.025
1.5–2.5	9.6–16.0	54	36	0.031	0.020
2.5–5.0	4.75–9.6	15	10	0.016	0.011
5.0–10	2.25–4.75	11	8	0.038	0.027
>10	0–2.25	9	7	0.106	0.083
Average Call Density/1000 km^2 Weighted by number of detections				**0.040**	**0.027**

Bryde's whale: One Hawaii stock is recognized (Carretta et al. 2002), and the IWC website is source of stock estimate for the western North Pacific stock (22,000). There have been no recent observations of Bryde's whales in the region, though historical evidence suggests they might be present (Carretta et al. 2002)**.** Data from the ETP (Ferguson and Barlow 2003) for density estimates (0.0009/km^2) were used.

minke whale: They are not abundant anywhere in the Pacific except in the Bering and Chukchi seas and in the Gulf of Alaska. A Hawaii stock is not recognized (Carretta et al. 2002). There is an Alaska stock that is considered migratory and a "resident" CA/OR/WA stock that establishes home ranges (Dorsey et al. 1990). The IWC identifies three Pacific stocks – one in the Sea of Japan/East China Sea, one in the remainder of western Pacific west of 180°, and one east of 180°. The stock estimate is for the western North Pacific/Sea of Okhotsk stock (25,049 individuals) (Buckland et al. 1992). This is conservative because it is significantly higher than the limited data available on the CA/OR/WA stock. Barlow (2003) acoustically identified the "boing" as minke whales, suggesting that they are more common than previously thought. No density or abundance estimates were provided from the visual data, but are forthcoming from the acoustic data.

humpback whale: Humpback whales are only expected in this region during the winter, and they are typically found in water depths of less than 183 m (100 fm). A central North Pacific stock has been identified as individuals that migrate from summer/fall feeding grounds of northern British Columbia and southeast Alaska (Prince William Sound west to Kodiak), to winter/spring breeding and calving grounds of the Hawaiian Islands (Carretta et al. 2002)**.** Some exchange between winter/spring areas has been documented, as well as movement between Japan and British Columbia, and Japan and the Kodiak Archipelago (Calambokidis et al. 1997). Recent acoustic surveys (Norris et al. 1999) suggest a northbound migration heading of approximately magnetic north (10° true), with a "migration corridor" of 150-160°W. Animals are cycling through the breeding grounds with an average residency of approximately 30-45 days. The best abundance estimate for the central North Pacific stock is 4005 (CV=0.095) (Angliss and Lodge 2002). Mobley et al.'s (2001) aerial surveys observed that 64% of humpback whales were found in waters of depths less than 183 m (100 fm). Density estimate for waters greater than 183 m (100 fm) were derived from survey results.

sperm whale: Three stocks are recognized in U.S. EEZ waters, a North Pacific stock that migrates between Alaska and the western North Pacific, a central North Pacific stock around Hawaii, and a California/Oregon/Washington stock off the U.S. west coast (Angliss and Lodge 2002). Preliminary data indicate that the best abundance estimate for the western North Pacific is 102,112 individuals (CV=0.155) (Angliss and Lodge 2002). Sightings collected by Kasuya and Miyashita (1988) suggest that that there are two stocks of sperm whales in the western North Pacific, a northwestern stock with females that summer off the Kuril Islands (~50°N) and winter off Hokkaido and Sanriku (~40°N), and the southwestern North Pacific stock with females that summer off Hokkaido and Sanriku (~40°N) and winter around the Bonin Islands (~25°N). The males of these two stocks are found north of the range of the corresponding females, i.e., in the Bering Sea (~55°N) and off Hokkaido and Sanriku (~40°N), respectively, during the summer. A density estimate is taken from Mobley's surveys (Mobley et al. 2000, Carretta et al. 2002). These data are comparable to that observed by Barlow (2003) in a larger region around Hawaii.

Kogia: Mobley et al. (1999) saw 2 pods for a total of 5 individuals during his 1993-1998 survey efforts. No density or abundance estimates were derived. Hawaiian stocks of pygmy and dwarf sperm whales are recognized (Carretta et al. 2002). Ferguson and Barlow (2003) derived an abundance estimate of 350,553 and density estimate of 0.0017/km^2 for this latitude in the eastern North Pacific.

Cuvier's beaked whale: The best data available on density and abundance estimates are from the eastern tropical Pacific (ETP) at the same latitude: 0.0054/km^2 and 90,725 animals (Ferguson and Barlow 2003).

Blainville's beaked whale: The best data available on density (0.0013/km^2) and abundance estimates are from the eastern Pacific (Ferguson and Barlow 2003). The *Mesoplodon densirostris* estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate is 8,032.

false killer whale: Miyashita (1993) estimated abundance of false killer whales from 34 sighting cruises associated with the Japanese drive fishery (16,668 (CV=0.263)). The best data available

on density (0.0021/km^2) in the eastern North Pacific at similar latitudes and distance from the mainland (Ferguson and Barlow 2003) were used.

melon-headed whale: The best data available on density (0.0093/km^2) and abundance estimate in the eastern North Pacific (36,770) (Ferguson and Barlow 2003) were used.

short-finned pilot whale: : Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 (CV=0.224)). The best data available on density (0.0020/km^2) in the eastern North Pacific at similar latitudes (Ferguson and Barlow 2003) were used.

Risso's dolphin: Mobley et al. (2000) did not have enough sightings to derive density or abundance estimates. One Hawaiian stock is recognized, though animals appear to be rare in the area (Carretta et al. 2002)**.** Carretta et al. stated, **"**Based on the locations of interactions with the Hawaiian longline fishery, it is likely that Risso's dolphins primarily occur in pelagic waters tens to hundreds of miles from the main Hawaiian Islands and are only occasionally found nearshore." Leatherwood and Reeves (1983) stated that there is a sighting hiatus at about 20°N along the western coast of the U.S. where Risso's have been intensely studied. This sighting hiatus may extend out to the main Hawaiian Islands which are centered at about 20°N, and contribute to the rarity of their sightings. Miyashita (1993) reports a western North Pacific stock estimate (83,289 (CV=0.179)) Density estimate (0.0007/km^2) is from surveys in the eastern North Pacific (Ferguson and Barlow 2003).

bottlenose dolphin: : Miyashita (1993) reports an abundance estimate (168,791 (CV=0.261)).The best data available on density (0.0025/km^2) in the eastern North Pacific at similar latitudes and distance from the mainland (Ferguson and Barlow 2003) were used.

spinner dolphin: The best data available on density (0.0100/km^2) and abundance estimate for whitebelly spinner (1,015,059) from the eastern tropical Pacific (Ferguson and Barlow 2003) were used**.**

pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Japan. Miyashita (1993) reports an abundance estimate (438,064 (CV=0.174)) and density estimate east of Japan (0.0259/km^2). The best data available on density (0.1047/km^2) for offshore spotted dolphin in the eastern North Pacific (Ferguson and Barlow 2003) was used.

striped dolphin: Two concentrations exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. There is the potential for two populations in the area: one inshore north of 30°N, and one offshore north of 30°N, east of 145°E. However, the boundaries between these populations have not been resolved (Miyashita 1993). Therefore, Miyashita (1993) derived a total population estimate of 570,038 (CV=0.186). The best data available on density (0.0602/km^2) in the eastern North Pacific at similar latitudes and distance from the mainland (Ferguson and Barlow 2003) were used.

rough-toothed dolphin: The best data available on density (0.0058/km^2) and abundance estimate in the eastern North Pacific (145,729) (Ferguson and Barlow 2003) were used.

Stipulation Area #5 Sea of Japan

General Area Information:

Harbor porpoise are found in northern Sea of Japan, especially near Hokkaido and northern Honshu; most seasonal movements seem to be inshore-offshore rather than north-south; in general, a coastal species, limited to cold temperate and subarctic waters of northern hemisphere (Leatherwood and Reeves 1983). Because of their coastal nature, they were not modeled.

Specific Species Information:

fin whale: Fin whales migrate south in the winter to about 10°N, and are found in the summer from a line near Japan north to the Chukchi Sea and Aleutian Islands (Evans 1987). Fin whales are known to winter in the Sea of Japan, and are probably found there throughout the year. Fin whales migrate south from offshore waters of the northwest Pacific. Historic stock estimates were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Masaki 1977, Ohsumi 1977, Tillman 1977). The current density estimate (0.0009/km^2) for the western North Pacific is roughly estimated from data of the eastern tropical Pacific (Ferguson and Barlow 2001, 2003).

Bryde's whale: Omura (1977) refers to four major whaling grounds on the coast of Japan: waters off Bonin Islands, Sanriku, Wakayama (Taiji), and West Kyushu. None of these are in the Sea of Japan. However, Evans (1987) says that Bryde's whales are found from northern Japan to the equator in the western North Pacific. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that the best density data available are the long-term time series from the eastern tropical Pacific (Ferguson and Barlow 2003): density estimate (0.0001/km^2). The IWC stock estimate (22,000) for the western North Pacific was used.

minke whale: The west coast of Honshu was seldom used for whaling, but the west side of Hokkaido had established whaling grounds (Ohsumi 1978). As such, there are limited data on density and stock estimates in the southern portion of the Sea of Japan. However, based on the data available for the northern portion of the Sea of Japan, minke whales are relatively common in these waters. Two stocks of minke whales are recognized in the western North Pacific, the "O" stock in the Okhotsk Sea and off the eastern side of Japan and the "J" stock around the Korean peninsula and in the Sea of Japan (Pastene et al. 1998). Animals in this region are believed to be part of the "O" and "J" stocks (Gong 1988, Butterworth et al. 1996). The modeled density estimate (0.0004/km^2) of "O" stock animals was derived from the eastern tropical Pacific (Ferguson and Barlow 2003). An abundance estimate for the western North Pacific (25,049) was used (Buckland et al. 1992).

minke whale J-stock: Some of the individuals in this area are believed to be from the J-stock (Gong 1988, Butterworth et al. 1996). The modeled density estimate of "J" stock animals (0.0002/km^2) was derived from 40% of the western North Pacific density, as the maximum

proportion of J-stock animals reported in this area was 40.3% (Pastene and Goto, 1998). J-stock population size is estimated at 893 (Pastene and Goto, 1998).

gray whale: Western gray whales are genetically distinct from eastern gray whales (LeDuc et al. 2002). Present day range appears to be from summering grounds in west central Okhotsk Sea off the northeast coast of Sakhalin Island, to wintering grounds in the South China Sea (Weller et al. 2002). They migrate through the Sea of Japan in Nov-Dec. The exact migration route is not known, and Omura (1988) indicates that animals were caught along the Chinese and North Korea Sea of Japan coasts. Gray whales presumably maintain a shallow water/nearshore affinity throughout the southern portion of their range. Current IWC abundance estimates report less than 100 animals in the western Pacific stock.

North Pacific right whale: The western North Pacific right whale population is considered distinct from the eastern population, arbitrarily separated by the 180° line of longitude (Best et al. 2001). The Okhotsk Sea, Kuril Islands, and eastern Kamchatka coast represent major feeding grounds for the western population (Brownell et al. 2001) where animals are typically found May through September (Clapham et al. 2004). Various areas have been proposed for breeding and calving grounds, including the Ryukyu Islands, Yellow Sea, Sea of Japan, offshore waters far from land, and the Bonin Islands, but a lack of winter sightings (December-February) makes a definitive assessment impossible (Brownell et al. 2001). Clapham et al. (2004) note the extensive offshore component to the right whale's distribution in the 19th century data. Movement north in spring (peak months of February-April) and south in fall (peak months September-December) suggest the possibility of two putative sub-populations in the western population that are kept apart by the Japanese islands, though this seems unlikely (Brownell et al. 2001, Clapham et al. 2004). Data from Japanese sighting cruises in the Okhotsk Sea provide an abundance estimate of 922 animals (CV=0.433, 95% CI=404-2,108) (Best et al. 2001) for the western North Pacific population. The western population may be affected by proposed LFA operations in the spring, fall and winter in the Sea of Japan.

sperm whale: Kasuya and Miyashita (1988) did not report any Japanese whaling stations that processed sperm whales in the Sea of Japan; however, that may be a function of the fact that sperm whales are rarely found in waters of less than 200 m (Leatherwood and Reeves 1983). Gregr and Trites (2001) reviewed sperm whale catch data off the coast of British Columbia to determine habitat preferences, and it is possible that the Sea of Japan provides adequate conditions for sperm whales. Density estimate (0.0008/km^2) is calculated from the eastern tropical Pacific (Ferguson and Barlow 2003), and abundance estimate is for the North Pacific stock that migrates between Alaska and the western North Pacific (Angliss and Lodge 2002).

Stejneger's beaked whale: Leatherwood and Reeves (1983) stated that Stejneger's beaked whales are an inhabitant of the cold temperate to subarctic North Pacific, and are found in the northern Sea of Japan. Miyazaki et al. (1987) reported 4 Stejneger's beaked whales that stranded in the Sea of Japan at about 37°N/135°E. Density or stock estimate data are not available for this region. Considering habitat preferences (e.g., water temperature, bathymetry), Stejneger's density estimate (0.0014/km^2) is approximated as one-third of the Cuvier's density estimate and the abundance estimate is approximated as that of Baird's beaked whales (8,000 animals).

Baird's beaked whale: Kasuya (1986) reported catches of Baird's in the Sea of Japan around approximately 37°N (Toyama Bay) and off southern Hokkaido (41-42°N). He states that animals are only found in water depths of 1000-3000 m (3281-9842 ft). Leatherwood and Reeves (1983) refer to a sizeable fishery in Japan where catches of several hundred per year were made in the 1950s. Kasuya (1986) did not report density or stock estimates for the Sea of Japan; therefore, based on his encounter rate and effective search width off the Pacific coast of Japan, derived summer abundance estimate of 4220 (CV=0.295) is used. This covered the region from about 32-40°N and seaward of the Pacific Japanese coast out to about 150°E. Since his surveys did not include habitat further north, the stock estimate is increased to 8,000 to account for unsurveyed areas. Without any data on density estimates for the western North Pacific, it is roughly estimated that the data from the eastern Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

Cuvier's beaked whale: No density or stock estimate data are available for this region, Leatherwood and Reeves (1983) state that Cuvier's are relatively common in the Sea of Japan. Considering habitat preferences (e.g., water temperature, bathymetry) it was determined that best density and abundance data available are derived from Ferguson and Barlow (2003): density estimate (0.0043/km^2), abundance estimate (90,725 animals).

ginkgo-toothed beaked whale: Miyazaki et al. (1987) reported one stranding of *M. ginkgodens* from the southern Sea of Japan. This is probably a separate population from that of the offshore western North Pacific, but no data are available. Since no data on density or stock estimates are available for this species, it is roughly estimated that the data on *Mesoplodon* spp. from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate. Using the northernmost strata, the density estimate is 0.0005/km^2 and the abundance estimate is 22,799 animals.

false killer whale: Kishiro and Kasuya (1993) reviewed the history of Japanese coastal whaling, reporting that false killer whales were caught on the Noto coast of Japan in the Sea of Japan**.** Miyashita (1993) suggested that animals summering in the Sea of Japan were probably from a different stock, by analogy from Pacific white-sided dolphins. Kishiro and Kasuya (1993) cited Miyashita (1986) as estimating the population wintering in Iki Island waters (in the Korea Strait) and part of the East China Sea at 3,259. Since these data represent only about one-third of the habitat of false killer whales in the East China Sea, the population estimate is multiplied by 3 for the inshore Archipelago stock estimate (9777). Since there are no data available on stock estimates for the Sea of Japan, this value was used for the Sea of Japan population. This is smaller than the estimated abundance of false killer whales off the Pacific coast of Japan (16,668 (CV=0.263)) (Miyashita 1993). Miyashita (1993) also derived density estimates in 1° latitude by 1° longitude boxes from 34 sighting cruises associated with the Japanese drive fishery from which an average was derived for the Pacific coast of Japan. Since no sightings of false killer whales were made during the survey effort in the Sea of Japan and East China Sea (Miyashita 1993), the western North Pacific density estimate (0.0027/km^2) is estimated from the northernmost region of eastern North Pacific (Ferguson and Barlow 2003).

melon-headed whale: Leatherwood and Reeves (1983) state that melon-headed whales are rare except in the Philippine Sea. Distributed in tropical and subtropical waters, preferring equatorial

water masses, they are probably uncommon in the colder waters of the Sea of Japan. With these limited data, the density estimate (0.00001/km^2) and the abundance estimate (36,770 (CV=0.467)) are estimated from eastern tropical Pacific data (Ferguson and Barlow 2003).

short-finned pilot whale: Kishiro and Kasuya (1993) reported that short-finned pilot whales are uncommon in the Sea of Japan, and that insufficient information exists from which to determine whether the southern or northern form occurs in the region. Because of limited data specific to this region, data from the Pacific coast of Japan and Taiwan and the eastern North Pacific was used. Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 (CV=0.224)). He also derived density estimates in 1° latitude by 1° longitude boxes. This estimate was similar to a density estimate derived from analogous latitudes in the eastern North Pacific (Ferguson and Barlow 2003). Kasuya et al. (1988) suggested that there might be more than one stock of short-finned pilot whales off the Pacific coast of Japan and Taiwan, since there is a southern form found south of the Kuroshio Current front (south of 35°N) and a northern form found between the Kuroshio Current front and the Oyashio Current front (from approximately 35-43°N). However, the northern form has not been harvested by Japanese drive fisheries (Kishiro and Kasuya 1993), and it is therefore not included in the above analyses (Miyashita 1993).

Risso's dolphin: Kishiro and Kasuya (1993) reported that Risso's dolphin was caught on islands in the Korea Strait. Miyashita (1993) reports sightings in the Sea of Japan during June surveys (no effort during other months). This suggests by analogy to bottlenose dolphins and Pacific white-sided dolphins that animals summering in Sea of Japan are a separate stock from the western North Pacific. There are no separate data reported for the Sea of Japan or East China Sea, however. Therefore, the western North Pacific stock estimate (83,289 (CV=0.179)) and density estimate (0.0073/km^2) were derived from the Pacific coast of Japan (Miyashita 1993) and is similar to estimates in the eastern North Pacific (Ferguson and Barlow 2003).

common dolphin: Common dolphins have been caught on the Tsushima Islands in the Korea Strait (Kishiro and Kasuya 1993). There are no data on density or stock estimates (Miyashita 1993). A gregarious species; not unusual to find associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds; pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour; found in waters of temp 10-28°C (50-82.4°F), very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves 1983). The density estimate (0.0860/km^2) and abundance estimate were calculated from Ferguson and Barlow (2003) in the eastern North Pacific at similar latitudes.

bottlenose dolphin: Kishiro and Kasuya (1993) reported that bottlenose dolphins were caught at Ohmishima in Yamaguchi Prefecture in the Sea of Japan. Miyashita (1993) reports that reproductive differences suggest that animals from the Pacific and East China Sea are different stocks. Kishiro and Kasuya (1993) cite Miyashita (1986) as estimating the abundance of the stock in the East China Sea as 35,046. Since these data represent only about one-third of the habitat of bottlenose dolphins in the East China Sea, the population estimate is multiplied by 3 for the inshore Archipelago stock estimate (105,138). It is assumed that animals found in the Sea of Japan and South China Sea are of the same stock. No density estimates are available for this

stock; therefore the density estimate (0.0009/km^2) was calculated from Ferguson and Barlow (2003) in the eastern North Pacific at similar latitudes.

spinner dolphin: Gilpatrick et al. (1987) reported a high density of sightings in the Korea Strait and adjacent waters to the north. Species presence is not mentioned in historical Japanese whaling records (Kishiro and Kasuya 1993); no data on density or stock estimates are available (Miyashita 1993). Without any data on density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

pantropical spotted dolphin: Miyashita (1993) summarized data from 34 sighting cruises conducted as part of the Japanese drive fishery. There is no discontinuity in sightings to suggest different stocks, though based on data from the ETP, it is possible that multiple populations exist in the western North Pacific (Miyashita 1993). Total population size was 438,064 (CV=0,174); density estimate for western North Pacific was 0.0137/km^2. Estimating that the Sea of Japan animals are one-half the abundance of the western North Pacific stock, a stock estimate of 219,032 was calculated. The density estimate derived from an analogous region in the eastern North Pacific was similar to that of the western North Pacific (Ferguson and Barlow 2003).

Pacific white-sided dolphin: Pacific white-sided dolphins have a primarily temperate distribution, found north of tropical waters and south of arctic waters (Leatherwood and Reeves 1983). These pelagic, offshore animals are encountered along or seaward of the 100-fm contour, and feed at night on the deep-scattering layer. Recent research on genetic differentiation suggests that animals found in coastal Japanese waters and the Sea of Japan belong to a different population than animals found in offshore North Pacific waters (Hayano et al. 2004). Sighting surveys in the North Pacific were analyzed to estimate the abundance of Pacific white-sided dolphins as 931,000 individuals (Buckland et al. 1993). This estimate is over an order of magnitude larger than the abundance estimate in the eastern North Pacific (Ferguson and Barlow 2001, 2003). Without any data for the Sea of Japan/East China Sea population, it is roughly estimated that the abundance estimate from the western North Pacific (931,000) and the density estimate (0.0030/km^2) from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Mobley et al. 2000, Barlow 2003).

Dall's porpoise: Dall's porpoise are found only in the North Pacific, primarily north of 36°N in the western North Pacific. They are frequently found associated with Pacific white-sided dolphins from 50°N south, and pilot whales from 40°N south. This species has two distinct color morphs: one with a white flank patch that extends forward to the dorsal fin (*dalli* type) and one with a flank patch extending all the way to the front flippers (*truei* type). These morphological differences have been noted between animals from the Pacific coast of Japan (the *truei*-type), the Sea of Japan and Sea of Okhotsk (the *dalli*-type), and the offshore northwestern Pacific and western Bering Sea (the *dalli*-type) (Hayano et al. 2003). Dall's porpoise are present in oceanic waters to at least 100 km (62 mi) from shore and abundant throughout their range (Leatherwood and Reeves 1983). Hayano et al. (2003) conducted genetic studies on the three populations and found a low, but significant, difference between the Sea of Japan-Okhotsk population and the other two populations. The Sea of Japan population is known to migrate into the Pacific Ocean

via the Tsugaru Strait, and into the Sea of Okhotsk through the Soya Strait in the summer (Amano and Kuramochi 1992). Miyashita and Kasuya (1988) estimated a minimum of *dalli*-type individuals wintering in the Sea of Japan at about 46,000. No density estimates were available for the area. Based on surveys off the western U.S., a density estimate of 0.0520/km^2 and an abundance estimate of 76,720 animals were derived (Ferguson and Barlow 2003). This density estimate is probably higher than what would be encountered by LFA operations in the Sea of Japan since it includes survey effort in nearshore waters where animals are more often found.

Stipulation Area #7 South China Sea/Winter, Summer & Fall

Specific Species Information:

fin whale: De Boer (2000) conducted a research cruise in the Indian Ocean Sanctuary and the South China Sea from 29 March to 17 April, 1999. Sightings of fin whales and a sperm whale west of the Balabac Strait suggest a possible migration route of these species between the South China Sea and the Sulu Sea. De Boer's cruise is the first record of fin whales in the South China Sea. The East China Sea population is thought to be resident and may represent a distinct population (Evans 1987). Without any data on stock or density estimates for the South China Sea, it is roughly estimated that the data from the western North Pacific are appropriate. Density and stock estimates were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Masaki 1977, Ohsumi 1977, Tillman 1977). These data are comparable to density estimates in other areas of the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) and around Hawaii (Barlow 2003).

Bryde's whale: Yoshida and Kato (1999) identified 3 stocks of Bryde's whales in the western North Pacific: Solomon Islands/Southeast Asia stock (mainly Philippine waters and the Gulf of Thailand), East China Sea, and offshore western North Pacific. Animals found in this area are considered part of the southeast Asia stock of Bryde's whales, which includes waters of the Philippine Sea and Gulf of Thailand (Yoshida and Kato 1999) and which is separate from both the East China Sea and western North Pacific populations. Animals in this region are the offshore form of *Balaenoptera edeni*. De Boer (2000) sighted Bryde's whales during his cruise. No data specific to this stock were reported. The Ohsumi (1977) western North Pacific density estimate is most appropriate; comparable to Barlow (2003) (0.0002/km^2) and Ferguson and Barlow (2001, 2003) (in South Gulf of CA d=0.0011/km^2; area 85 d = 0.0006/km^2; 0.0003-0.0009/km^2 in eastern North Pacific). The IWC website is source of stock estimate for western North Pacific stock (22,000).

minke whale: As a cosmopolitan species, minke whales are expected to be present in the South China Sea, though De Boer (2000) did not observe them during his recent cruise through the area and Smith et al. (1997) did not document them during their cruises or from historical "whale temples." Whaling data from the East China Sea suggest that animals do not migrate through the Taiwan Strait, though other studies (Gong 1988, Butterworth et al. 1996) indicate that individuals might be from the J-stock, migrating into the region in the winter. In either case, there are limited data on density and stock estimates. Therefore, estimated encounter rates and stock estimate similar to the favored whaling grounds of the western North Pacific were used (Buckland et al. 1992). These estimates are an order of magnitude higher than any calculated in the eastern North Pacific (Ferguson and Barlow 2001, 2003).

gray whale: Gray whales would only be expected to be in this area during the winter season. Exact wintering grounds of this species are not known, though believed to winter in the South China Sea, in the vicinity of Korea and China (Evans 1987, Omura 1988). Presumably they maintain a shallow water/nearshore affinity throughout the southern portion of their range. The exact migration route is not known, but they are believed to migrate directly across the East China Sea, which is one of the few times that they leave their shallow, nearshore habitat (Omura 1988). During this time, they may be found up to 400 nm (741 km) offshore (Weller et al. 2002). Weller et al. (1999) conducted photo-id studies in the Sakhalin region to begin to characterize this population. It is believed that the total population size is less than 100 individuals. Considering the few number of animals in the population and the lack of data on the species in this region, a density estimate characteristic of a "very low-level species" is proposed for the winter.

North Pacific right whale: There has been a limited search effort in the South China Sea, but no observations of right whales have ever been reported in the area (Clapham et al. 2004). In addition, right whales migrate further north during the spring, summer, and fall, and are not expected in the area at this time of year. The only possibility of a right whale encounter would be during the winter season.

sperm whale: De Boer (2000) sighted sperm whales in the South China Sea (Mar-Apr), and suggested that animals seen west of the Balabac Strait might be migrating between the South China Sea and the Sulu Sea. Miyashita et al. (1996) also observed sperm whales in the winter (Jan-Mar) in the South China Sea, very close to the Philippines. No data on density estimates or stock estimates were provided in either study. Because this region is found in the lower latitudes, it is most probable that females and juveniles would be in the area. Since this site is on the edge of the concentration of southwest females, a year-round density estimate comparable to Mobley's estimate (0.0010 animals/km^2) where sperm whales were generally seen in the outer 5% of his survey effort (Mobley et al. 2000) is considered appropriate. This is also comparable to the density estimate (0.0029 animals/km^2) calculated from the summer/fall survey off Hawaii in 2002 (Barlow 2003). Abundance estimate is for the North Pacific stock that migrates between Alaska and the western North Pacific (Angliss and Lodge 2002).

Kogia: Smith et al. (1997) reported that *Kogia* were found in "whale temples" in nations surrounding the South China Sea. No density or abundance estimates are available. No sightings of *Kogia* spp. were made by De Boer (2000). Summing the abundances of *Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001), an overall abundance of 350,553 animals is computed in the eastern tropical Pacific. At this latitude, expect *Kogia breviceps* and *Kogia simus*. Reviewing density estimates calculated in the eastern Pacific Ocean at about 20°N (Ferguson and Barlow 2003), a density estimate of 0.0017/km^2 was modeled.

Cuvier's beaked whale: De Boer (2000) sighted Cuvier's beaked whales during his cruise through the South China Sea. No density or stock estimate data are available for this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that best data available are a density estimate (0.0003/km^2) and an abundance estimate of 90,725 animals from the same latitude in the eastern Pacific (Ferguson and Barlow 2003).

Blainville's beaked whale: Miyazaki et al. (1987) did not report any strandings of *M. densirostris* from the South China Sea. De Boer (2000) and Miyashita et al. (1996) did not observe any *M. densirostris* during their research cruises. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate. The *Mesoplodon densirostris* estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate is 8,032.

ginkgo-toothed beaked whale: Miyazaki et al. (1987) report no strandings of *M. ginkgodens* from the South China Sea, and De Boer (2000) and Miyashita et al. (1996) did not observe *M. ginkgodens* during their research cruises. Since no data on density or stock estimates are available for this species, it was roughly estimated that the density (0.0005/km^2) and abundance estimates (22,799 animals) for *Mesoplodon* spp. at the same latitude in the eastern Pacific (Ferguson and Barlow 2001, 2003) are approximate.

false killer whale: Miyashita (1993) suggests that animals summering in the Sea of Japan are probably from a different stock, by analogy of Pacific white-sided dolphins. Animals in the East and South China seas are probably part of this inshore Archipelago stock. Kishiro and Kasuya (1993) cited Miyashita (1986) as estimating the population wintering in the East China Sea at 3,259. Since these data represent only about one-third of the habitat of false killer whales in the South China Sea, the population estimate is multiplied by 3 for the inshore Archipelago stock estimate (9777). False killer whales are sighted infrequently in the South China Sea (Miyashita et al. 1996, Smith et al. 1997, De Boer 2000). There are no data on density estimates for the South China Sea. Miyashita (1993) derived density estimates in 1° by 1° boxes from 34 sighting cruises associated with the Japanese drive fishery from which a weighted-average was derived for the Pacific coast of Japan. Since false killer whales are sighted infrequently in the South China Sea, the western North Pacific density estimate is halved for South China Sea. This estimate is higher than that calculated for around Hawaii (Barlow 2003) (0.0001/km^2) and within the range of estimates in the eastern North Pacific (Ferguson and Barlow 2001, 2003).

pygmy killer whale: Leatherwood and Reeves (1983) stated that this species is not abundant in any particular area, but is widely distributed in tropical waters. Pygmy killer whales are seen relatively frequently in the ETP, especially near Hawaii. Pygmy killer whales were seen by De Boer (2000) during his research cruise through the South China Sea, known from historical "whale temples" (Smith et al. 1997), but not seen by Miyashita et al. (1996). No mention of these animals exist in Japanese whaling records (Kishiro and Kasuya 1993). There are no data on density or stock estimates off Japan or Taiwan (Miyashita 1993), or nearshore Hawaii (Mobley et al. 2000). An estimate of 0.0003/km^2 was calculated in offshore waters of Hawaii (Barlow 2003). Without data available in the western North Pacific, a density estimate (0.0021/km^2) and abundance estimate (30,214) from the eastern Pacific (Ferguson and Barlow 2003) was used.

melon-headed whale: Leatherwood and Reeves (1983) stated that melon-headed whales are rare except in the Philippine Sea. Distributed in tropical and subtropical waters, preferring equatorial water masses, they have been observed in the South China Sea (De Boer 2000) and in "whale temples" on islands surrounding the South China Sea (Smith et al. 1997). However, they were not observed by Miyashita et al. (1996). A density and abundance estimate from similar latitudes

in the eastern Pacific (Ferguson and Barlow 2003) were used. These values are greater than estimates in Hawaii (0.0012/km^2 (Barlow 2003); 0.0021/km^2 (Mobley et al. 2000)).

short-finned pilot whale: Smith et al. (1997) reported that short-finned pilot whales are found in "whale temples" on islands surrounding the South China Sea. De Boer (2000) did not observe pilot whales during his research cruise, but Miyashita et al. (1996) did observe them in the western North Pacific. With limited data for this particular region, data from the Pacific coast of Japan were used. Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 (CV=0.224)). He also derived density estimates in 1° latitude by 1° longitude boxes. Kishiro and Kasuya (1993) reported a southern limit to the short-finned pilot whale range of approximately 20°N; therefore, a density estimate was derived as one-half the density estimate of the area south of Japan. Kasuya et al. (1988) suggest that there might be more than one stock of short-finned pilot whales off the Pacific coast of Japan and Taiwan, since there is a southern form found south of the Kuroshio Current front (south of 35°N) and a northern form found between the Kuroshio Current front and the Oyashio Current front (from approximately 35-43°N). However, the northern form has not been harvested by Japanese drive fisheries (Kishiro and Kasuya 1993), and therefore, it was not included in the above analyses (Miyashita 1993). The modeled estimate was in the range of other density estimates in eastern North Pacific (Ferguson and Barlow 2001, 2003) and Hawaii (0.0036/km^2 (Barlow 2003); 0.0237/km^2 (Barlow 2003)).

Risso's dolphin: Smith et al. (1997) reported that Risso's dolphin were found in "whale temples" in nations on the South China Sea, but not seen by Miyashita et al. (1996) or De Boer (2000) during their research cruises. Miyashita (1993) suggests by analogy to bottlenose dolphins and Pacific white-sided dolphins that animals summering in Sea of Japan are a separate stock from the western North Pacific. There have been no separate data reported for the Sea of Japan, East China Sea, or South China Sea, though. Therefore, the western North Pacific stock estimate (83,289 (CV=0.179)) and the density estimate derived for southeast Pacific coast of Japan/east of Taiwan (Miyashita 1993) were used. This is within the range of densities estimated in the eastern North Pacific (Ferguson and Barlow 2001, 2003) and higher than those around Hawaii (not observed by Mobley et al. (2000); 0.0010/km^2 (Barlow 2003)).

common dolphin: Common dolphin has been found in "whale temples" in nations along the South China Sea (Smith et al. 1997). There are no data on density or stock estimates (Miyashita 1993). This is a gregarious species, not unusual to find associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. These dolphins are pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour, and found in waters of temperature 10-28°C (50-82.4°F). They are very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves 1983). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate. Common dolphins were not sighted around Hawaii in recent surveys (Mobley et al. 2000, Barlow 2003).

bottlenose dolphin: Smith et al. (1997) reported that bottlenose dolphins are found in "whale temples" in South China Sea nations. Miyashita (1993) reports that reproductive differences

suggest that animals from the Pacific and East China Sea are different stocks. Kishiro and Kasuya (1993) cite Miyashita (1986) as estimating the abundance of the stock in the East China Sea as 35,046. Since these data represent only about one-third of the habitat of bottlenose dolphins in the East China Sea, the population estimate is multiplied by 3 for the inshore Archipelago stock estimate (105,138). It is assumed that animals found in the Sea of Japan and South China Sea are of the same stock. No density estimates are available for this stock; therefore, a density estimate was derived from the southeast Pacific coast of Japan/east of Taiwan (Miyashita 1993)(0.0146/km^2). This is within the range of densities estimated in the eastern North Pacific (Ferguson and Barlow 2001, 2003) and higher than those around Hawaii (0.0103/km^2 Mobley et al. (2000); 0.0013/km^2 (Barlow 2003)).

spinner dolphin: Gilpatrick et al. (1987) reported a high density of sightings in the Korea Strait and adjacent waters to the north, but none were reported from the South China Sea or Philippine Sea. Spinner dolphins are not mentioned in historical Japanese whaling records (Kishiro and Kasuya 1993), reported during the De Boer (2000) research cruise, or encountered in historical "whale temples" (Smith et al. 1997). There are no data on density or stock estimates available (Miyashita 1993). Because of the multispecies/subspecies data confounding the eastern tropical Pacific density estimates (Ferguson and Barlow 2001, 2003), and the offshore nature of the experiment site, the offshore Hawaii density estimate (0.0011/km^2) (Barlow 2003) rather than the nearshore Hawaii estimate (0.0443/km^2) (Mobley et al. 2000) was used.

pantropical spotted dolphin: These animals have been reported during the De Boer (2000) research cruise, observed in winter (Jan-Feb) in South China Sea (Miyashita et al. 1996), and reported from historical "whale temples" (Smith et al. 1997). Gilpatrick et al. (1987) summarized one report from west of Taiwan in the northern portion of the South China Sea. Miyashita (1993) summarized data from 34 sighting cruises conducted as part of the Japanese drive fishery. There is no discontinuity in sightings to suggest different stocks, though based on data from the ETP, it is possible that multiple populations exist in the western North Pacific (Miyashita 1993). In the western North Pacific, total population size was 438,064 (CV=0.174); density estimate was 0.0137/km^2. It was estimated that the population in South China Sea was one-half the abundance of the western North Pacific stock (219,032) with the same density estimate of 0.0137/km^2. This is within the range of densities estimated in the eastern North Pacific (Ferguson and Barlow 2001, 2003) and around Hawaii (0.0407/km^2 Mobley et al. (2000); 0.0042/km^2 (Barlow 2003)).

striped dolphin: These animals were not reported during the De Boer (2000) research cruise in March-April, but seen by Miyashita et al. (1996) in the South China Sea are Jan-Feb cruise. No data on density or abundance estimates for the South China Sea is available. Two concentrations of striped dolphin are recognized in the western North Pacific: one south of 30°N and the other in the offshore waters north of 30°N. There is the potential for three populations in the area: one south of 30°N, one inshore north of 30°N, one offshore north of 30°N, east of 145°E though the boundaries between these populations have not been resolved (Miyashita 1993). Therefore, Miyashita (1993) derived a total population estimate (570,038 (CV=0.186)). One-half of the density estimates off southern Japan/east Taiwan for this site (0.0164/km^2) was used. This is greater than density estimates around Hawaii (0.0016/km^2 (Mobley et al. 2000) and 0.0042/km^2 (Barlow 2003)).

rough-toothed dolphin: Rough-toothed dolphins have a primarily pelagic distribution in tropical to warm temperate waters. They are seen from time to time with bottlenose dolphins and short-finned pilot whales, and are reportedly rare off Japan and in the heavily studied eastern tropical Pacific. These animals have been found in “whale temples” in South China Sea nations (Smith et al. 1997). Without data available in the western North Pacific, a density (0.0040/km^2) and abundance estimate (145,729) from eastern Pacific (Ferguson and Barlow 2001, 2003) was used. This is within the range of density estimates around Hawaii (0.0081/km^2 (Barlow 2003) and 0.0017/km^2 (Mobley et al. 2000)).

Fraser's dolphin: Highly gregarious groups of a hundred to a thousand dolphins have been observed, and occasionally have been found mixed in herds of spotted dolphins. Fraser’s dolphins have also been observed in the company of false killer whales, sperm whales, striped dolphins, and spinner dolphins. Their diet consists of squid, crustaceans, and deep-sea fish (Leatherwood and Reeves 1983). Comparing the feeding ecology of spinner and Fraser’s dolphins, spinner dolphins feed primarily in upper 200 m (656 ft), but maybe as deep as 400 m (1312 ft), whereas Fraser’s are more diverse, feeding from the surface to as deep as 600 m (1968 ft). Kishiro and Kasuya (1993) report catches off the Pacific coast of Japan in drive fisheries. Dolar et al. (2003) report Fraser’s and spinners found together in the eastern Sulu Sea, Philippines. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate, though Fraser’s dolphins were not observed at this latitude; all observations were south of 10°N.

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