Annual Report No. 1:

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 2007

Department of the Navy
Chief of Naval Operations
September 2008

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ACRONYMS AND ABBREVIATIONS

ANSI	American National Standards Institute
APA	Administrative Procedures Act
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
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
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
IA	Inshore Archipelago
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
m	Meter(s)
M	Million
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 (UK)
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
NP	North Pacific (Stock)
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
SPLASH	Structure of Population, Levels of Abundance, and Status of Humpbacks
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
WNP	Western North Pacific (Stock)

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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 sonar operations for the period 16 August 2007 through 15 August 2008.

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 (72 *Federal Register* [FR] 46890-93), this annual report for operations of SURTASS LFA sonar systems 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) (Appendix A). The primary purpose of this annual report is to provide NMFS with unclassified summary of the year's quarterly reports and an analysis of any Level A and/or Level B harassment takings by SURTASS LFA sonar operations.

1.2 SURTASS LFA Sonar Description

SURTASS LFA sonar is a long-range sonar system that operates in the low frequency (LF) band (100-500 Hertz [Hz]). During the period of this report, there were 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 under an ocean surveillance vessel. 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) or less. 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 wavetrain (also known as a "ping"). These wavetrains last from 6 to 100 seconds, although the duration of each continuous frequency transmission is never longer than 10 seconds.
- Average duty cycle (ratio of sound "on" time to total time) is less than 20 percent. The typical duty cycle, based on historical LFA operational parameters (2003-2007) are nominally 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 sonar 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 Sonar

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 (DON, 2001) 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."

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 (Friedman, 2004), 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).

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."

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].

1.4 Regulatory and Litigation History

Prior to the NMFS promulgating the current (2007) Final Rule (72 FR 46846-93) and LOAs, there were key regulatory and litigation events that influenced these regulations.

1.4.1 National Environmental Policy Act (NEPA)

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 environmental impact statement (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. As a result of this limitation, the Navy sponsored a series of independent, scientific field research referred to as the Low Frequency Sound Scientific Research Program (LSF SRP). This research found that these effects would be minimal.

1.4.2 Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA)

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 46785-89) for the operation of SURTASS LFA Sonar on R/V *Cory Chouest*. The Navy's ESA Section 7 consultation with the NMFS and permitting requirements under the MMPA concluded with

[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).

NMFS's issuance of the Biological Opinion and Incidental Take Statement (NMFS, 2002a; 2002b). Since the initial LOA was issued in 2002, the Navy requested annual renewals in accordance with 50 CFR §216.189 for the remaining four years of the 2002 Final Rule for the R/V *Cory Chouest* and USNS IMPECCABLE. NMFS subsequently issued the LOAs (68 FR 50123, 69 FR 51996, 70 FR 49919, 71 FR 48537).

1.4.3 National Defense Authorization Act (NDAA)

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 determined that the Navy's SURTASS LFA sonar testing and training operations that are the subject of NMFS's Final Rule constituted military readiness activities 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.

1.4.4 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 sonar 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 SURTASS LFA sonar 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 sonar 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. The SURTASS LFA Sonar operating areas under the permanent injunction, as amended, are 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.

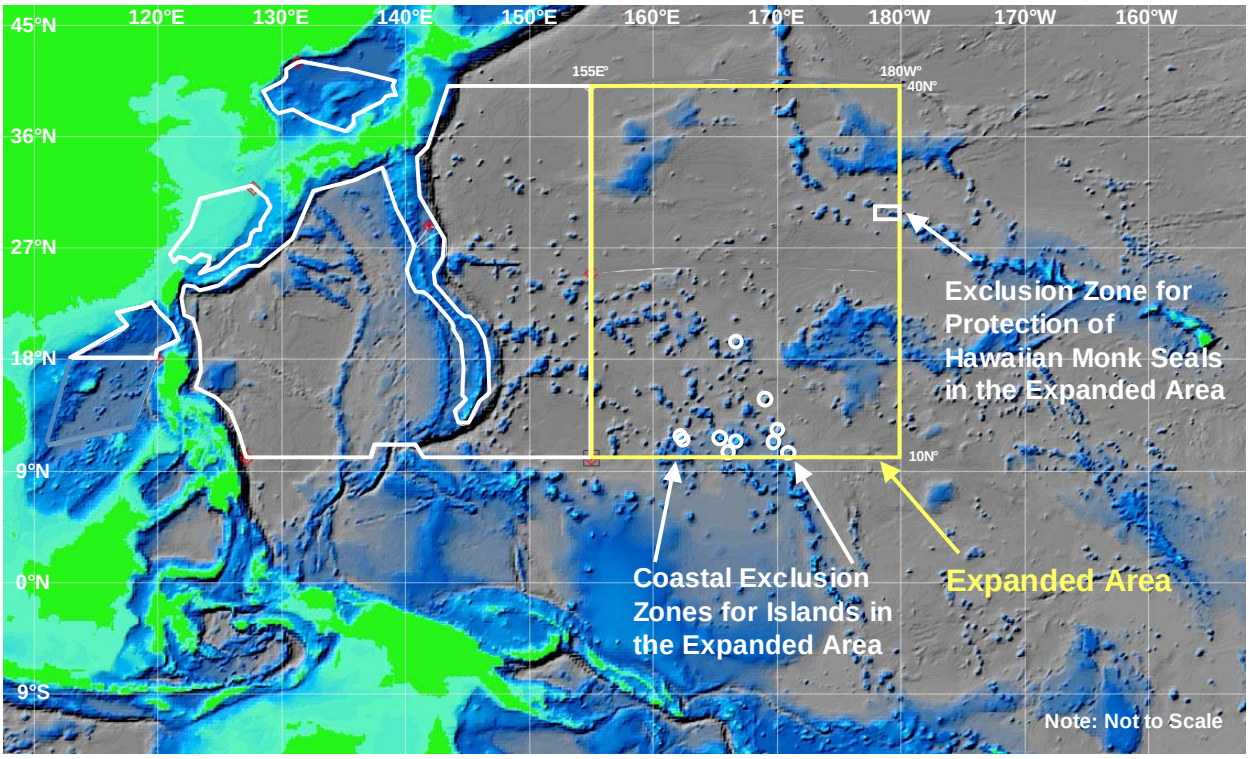

Figure 1. SURTASS LFA Sonar Operations Areas Permitted under Stipulation Regarding Permanent Injunction as Amended

1.5 Current Regulatory Compliance and Litigation

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 (SEIS) 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. On 26 September 2003, the NMFS agreed to be a fully cooperating agency in the preparation and review of the SEIS. The information developed from this analysis was used to support the Navy's application for the second five-year rule under MMPA (DON, 2006a) and the biological assessment for section 7 consultation under the ESA (DON, 2006c).

1.5.1 Supplemental Environmental Impact Statement

The Draft Supplemental Environmental Impact Statement (DSEIS) was completed in November 2005 (DON, 2005a) 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 April 2007 (DON, 2007b). The FSEIS evaluated the potential environmental effects of employment of SURTASS LFA sonar systems. The proposed action was 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 was 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 2002 rule expired 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.

1.5.2 Current MMPA and ESA Authorizations

On 12 May 2006, the Navy submitted an Application to the NMFS requesting an authorization under Section 101 (a)(5)(A) of the MMPA for the taking of marine mammals by Level A and Level B harassment incidental to the deployment of SURTASS LFA sonar system for military readiness activities to include training, testing, and routine military operations. The activities are

[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.

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 (71 FR 56965). The public comment period closed on 30 October 2006. These comments were considered in the development of the proposed and final rules. A proposed rule for the renewal of the regulations governing SURTASS LFA sonar MMPA authorization was published on 9 July 2007 (72 FR 37404) with a 15-day comment period. NMFS filed the Final Rule on 15 August 2007 and published in the Federal Register on 21 August 2007 (72 FR 46846-93). The initial LOAs under the 2007 Rule were issued by NMFS to the Chief of Naval Operations (N872A) for the R/V *Cory Chouest* and the USNS IMPECCABLE for the period 16 August 2007 to 15 August 2008 (Appendix A).

On 15 August 2007, NMFS issued its biological opinion on the effects of the proposed LOAs to take marine mammals incidental to the Navy's employment of SURTASS LFA sonar in accordance with section 7 of the ESA (1973), as amended (16 U.S.C. 1531 et seq.). The opinion concluded that the proposed LOAs and any take associated with activities authorized under those regulations are not likely to jeopardize threatened or endangered species in the action area. The proposed action is not likely to destroy or adversely modify designated critical habitats.

1.5.3 Current Litigation

On 17 September 2007, several environmental groups filed a lawsuit challenging actions by the Navy and NMFS regarding compliance to the NEPA, MMPA, ESA, and Administrative Procedure Act (APA) for the operation of SURTASS LFA sonar.

In order to avoid a temporary restraining order, the Navy and NMFS voluntarily agreed to operate SURTASS LFA sonar under the constraints specified in the 2003 permanent injunction, as amended on 2005. The exception was that the Navy may operate the SURTASS LFA sonar system within the coastal exclusion zones set forth in that injunction only when necessary to continue tracking an existing underwater contact detected outside of the exclusion zone or when necessary to detect a new underwater contact that would place the SURTASS LFA sonar system within the coastal exclusion zone to maximize opportunities for detection. This temporary restriction remained in effect for the entire period of this annual report.

On 6 February 2008, the Court issued its opinion and order granting in part Plaintiffs' motion for a preliminary injunction and required the parties to meet and confer on the precise terms. Case Management Conferences were held on 26 March 2008 and 27 May 2008 at the U.S. District Court, Northern District of California, in San Francisco, CA.

During the mediation on 26 March 2008, agreement was reached that SURTASS LFA sonar would operate in the Western Pacific areas stipulated in the 2003 permanent injunction, as amended in 2005, with the following modifications (See Figure 2):

- Stipulated LFA Operational Agreement permitting SURTASS LFA sonar ops up to 22 km (12 nm) from the coast when necessary to continue tracking an existing underwater contact or when operationally necessary to detect a new underwater contact to maximize opportunities for detection.
- Additional terms include assuring the LFA sound field does not exceed 180 dB at a distance of less than 18 nm from:

    - Islands of the Luzon Strait, including the Bashi Channel; and
    - Eastern coastlines of the islands of the Ryukyu Island Chain.

During the mediation on 27 May 2008, agreement was reached that SURTASS LFA sonar would operate in the Hawaii operations. The stipulated LFA Operational Agreement permits SURTASS LFA sonar ops up to 22 km (12 nm) from the coast when necessary to continue tracking an existing underwater contact, or when operationally necessary to detect a new underwater contact to maximize opportunities for detection within the Hawaii operations areas.

On 12 August 2008, the Court issued the Stipulated Settlement Agreement Order based on agreements from the 26 March 2008 and 27 May 2008 mediations, which finalized the operational areas as discussed above. On 29 August 2008, the Court signed the Stipulated Voluntary Dismissal with Prejudice, which effectively ended the litigation.

The follow-on LOAs issued by NMFS to the USNS ABLE[3] and USNS IMPECCABLE for the period 16 August 2008 to 15 August 2009 were based on the expanded operations areas described above.

[3] The R/V *Cory Chouest* has been retired from service and replaced by the USNS ABLE (T-AGOS 20).

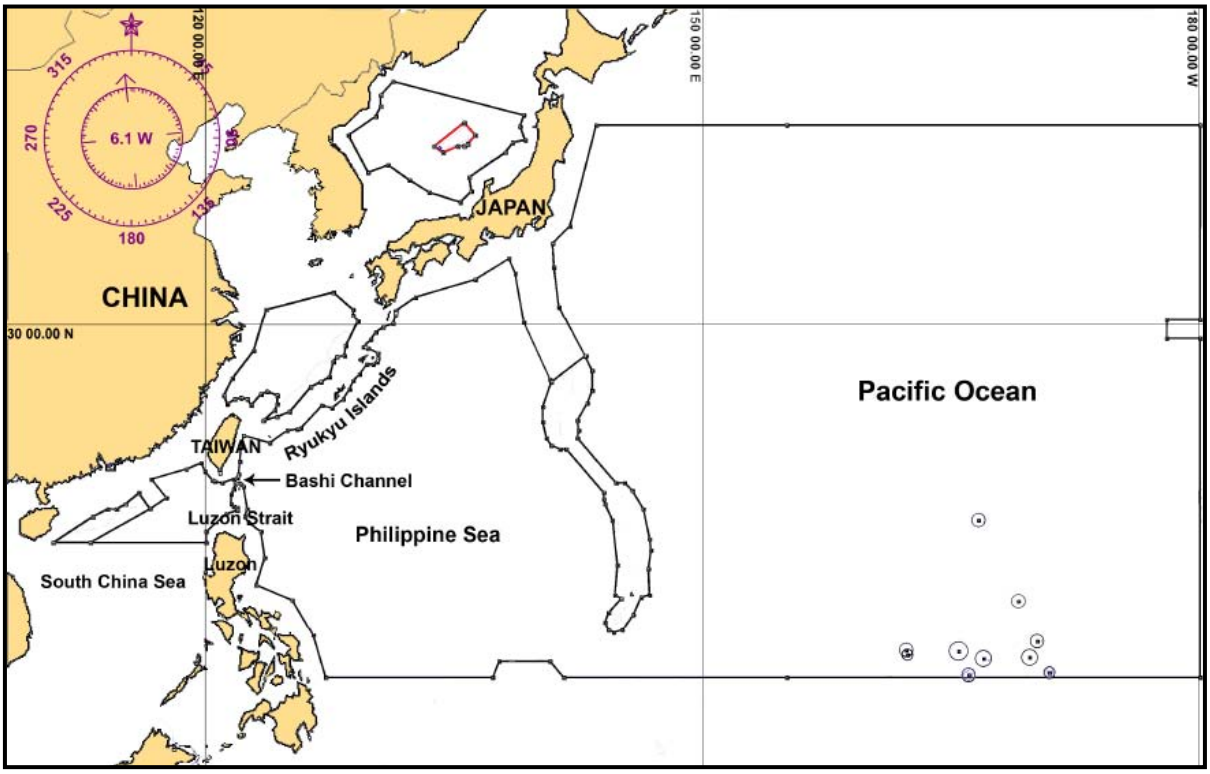

Figure 2. SURTASS LFA Sonar Western Pacific Operations Areas

2.0 MITIGATION MEASURES

Under the current rule, NMFS issued one-year LOAs for the period 16 August 2007 to 15 August 2008 to the Navy for the USNS IMPECCABLE and R/V *Cory Chouest* for an estimated total of 16 active sonar missions between the two ships (or equivalent shorter missions) not to exceed 432 hours of transmit time per vessel 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 for the initial LOAs were set forth in the Record of Decision (DON, 2007c), NOAA/NMFS Final Rule (72 FR 46890-93) and LOAs, and Court orders. These were promulgated by the CNO (N872A) through executive direction message of 16 August 2007.

2.1 2007 Final Rule and LOA Conditions

In the 2007 Final Rule and LOAs, as issued, NMFS included 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 Restriction—Buffer Zone

In the SURTASS LFA sonar 2007 Final Rule under the MMPA (72 FR 46890-93), NMFS added interim operational restrictions by the establishment of 1-km (0.54-nm) buffer shutdown zones:

- Outside of the 180-dB LFA mitigation zone, which may extend up to 2 km (1.1 nm) from the vessel, depending on oceanographic conditions, and
- Seaward of the outer perimeter of any offshore biologically important area designated in 50 CFR § 216.184(f).

At this distance, SPLs will be significantly less intense than 180 dB.

2.1.2 Former Interim Operational Restriction—Limitation of Frequency

In the 2002 Rule, 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 Final Comprehensive Report (DON 2007a) and the SURTASS LFA Sonar Final SEIS (DON, 2007b), 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 current 2007 Final Rule and LOAs issued by NMFS permit LFA transmissions between 100 and 500 Hz.

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)[4];
- 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 sonar mitigation (safety) and buffer zones as shown in Figure 3; 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.

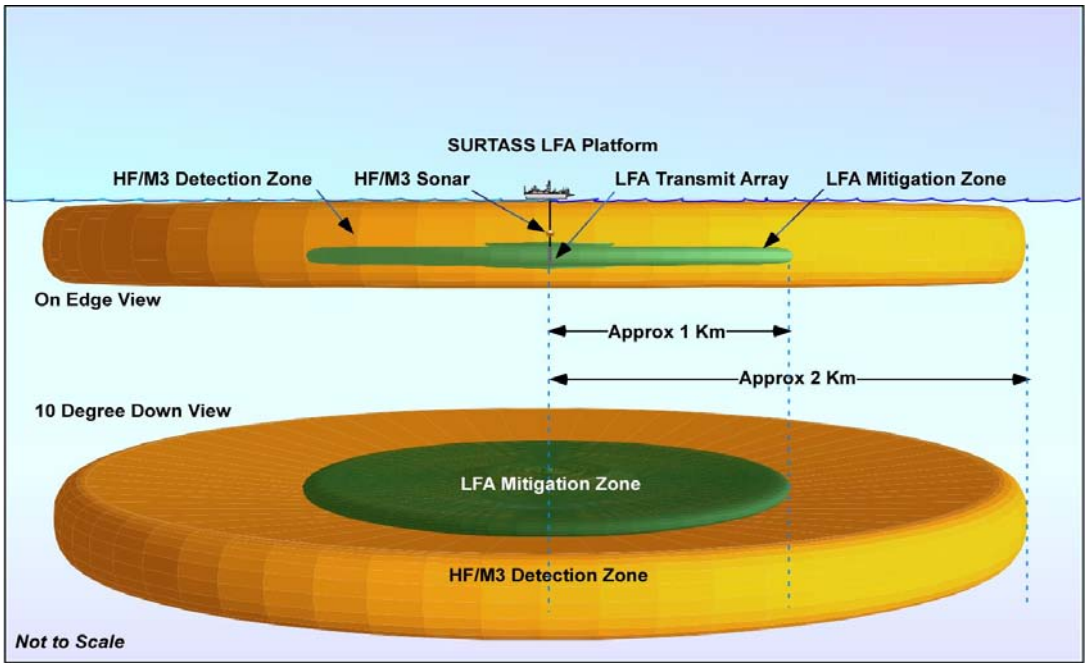

Figure 3. HF/M3 Sonar Detection and LFA Mitigation/Buffer Zones

[4] This was further restricted by the Court as described in Section 3.0.

Table 1. Summary of Mitigation

Mitigation	Criteria	Actions
Geographic Restrictions		
22 km (12 nm) from any coastline[5]	Sound field below 180 dB RL, based on SPL modeling.	Delay/suspend SURTASS LFA sonar operations.
1 km (0.54 nm) seaward of outer perimeter of any 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[6],
- SURTASS LFA sonar-generated sound field will be below 180 dB RL 1 km (0.54 nm) seaward of the outer perimeter of any offshore biologically important area designated in 50 CFR § 216.184(f).
- 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

[5] Ibid.
[6] Ibid.

- 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 ten areas designated by the NMFS as offshore areas of critical biological importance for marine mammals in the 2007 Final Rule (72 FR 46890-93). 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).
- Hawaiian Islands Humpback Whale National Marine Sanctuary—Penguin Bank, Hawaiian Archipelago, centered at 21 degrees North latitude and 157 degrees 30 minutes West longitude—November 1 through May 1.
- Cordell Bank National Marine Sanctuary, boundaries in accordance with 15 CFR 922.110—year-round.
- Gulf of the Farallones National Marine Sanctuary, boundaries in accordance with 15 CFR 922.80—year-round.
- Monterey Bay National Marine Sanctuary, boundaries in accordance with 15 CFR 922.130—year-round.
- Olympic Coast National Marine Sanctuary, boundaries within 23 nm of the coast from 47 degrees 07 minutes North latitude to 48 degrees 30 minutes North latitude—December, January, March and May.
- Flower Garden Banks National Marine Sanctuary, boundaries in accordance with 15 CFR 922.120—year-round.
- The Gully, 44 degrees 13 minutes North latitude; 59 degrees 06 minutes West longitude to 43 degrees 47 minutes N latitude; 58 degrees 35 minutes West longitude to 43 degrees 35 minutes North latitude; 58 degrees 35 minutes West longitude to 43 degrees 35

minutes North latitude; 59 degrees 08 minutes West longitude to 44 degrees 06 minutes North latitude; 59 degrees 20 minutes West longitude--year round.

None of these areas were within the authorized operational areas for SURTASS LFA sonar 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 by the ROD (DON, 2007c), the 2007 Rule (50 CFR § 216.185), and LOA condition 7 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 low frequency (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 and buffer zones.

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 and buffer zones, 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 and buffer zones, the OIC orders the delay or suspension of SURTASS LFA sonar transmissions when the animal enters the LFA mitigation zone. 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 and buffer zones. 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 increased 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 Sonar 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 COURT CONSTRAINTS FOR SURTASS LFA SONAR OPERATIONS

During the period of this report, the SURTASS LFA sonar systems onboard the R/V *Cory Chouest* and USNS IMPECCABLE were operated under the conditions of the two LOAs (Appendix A) and the agreement described in Subchapter 1.5.3. In order to avoid a temporary restraining order, the Navy and NMFS voluntarily agreed to operate SURTASS LFA sonar under the constraints specified in the 2003 permanent injunction, as amended on 2005. The exception was that the Navy may operate the LFA sonar system within the coastal exclusion zones set forth in that injunction only when necessary to continue tracking an existing underwater contact detected outside of the exclusion zone, or when necessary to detect a new underwater contact that would place the LFA sonar system within the coastal exclusion zone to maximize opportunities for detection. This temporary restriction remained in effect for the entire period of this annual report.

Details of the authorized areas of operation are shown in Figure 1.

4.0 SUMMARY OF SURTASS LFA SONAR OPERATIONS FOR FIRST YEAR ANNUAL REPORT

Under 50 CFR 216.186(b) and LOA Condition 8(b), this annual report consist of an unclassified summary of the quarterly reports under the first year LOAs for the USNS IMPECCABLE and R/V *Cory Chouest*, for the period of 16 August 2007 through 15 August 2008.

4.1 SURTASS LFA Sonar Operations for First Annual Report

Two SURTASS LFA sonar systems operated under the LOAs issued by NMFS for the period 16 August 2007 to 15 August 2008. The SURTASS LFA sonar systems onboard R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) operated in the western North Pacific. This report includes six missions from the R/V *Cory Chouest* and eight missions for the USNS IMPECCABLE.

4.1.1 R/V *Cory Chouest* Missions

The R/V *Cory Chouest* conducted six missions covering a period of approximately 25.5 days with 70.6 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 during the period of the LOA.

4.1.2 USNS IMPECCABLE Training Missions

The USNS IMPECCABLE conducted eight missions covering a period of approximately 24.3 days with 65.2 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, and the South China Sea during the period of the LOA.

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 SURTASS LFA sonar 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 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 sonar Final OEIS/EIS (DON, 2001) and detailed in the Subchapter 4.4 of the SURTASS LFA sonar Final SEIS (DON, 2007b).

During the period of the LOAs (16 August 2007 to 15 August 2008), SURTASS LFA sonar operational missions were conducted in areas generally defined as Sites 2, 3, and 7 in the LOA

application (DON, 2007d) and Provinces 53, 56, 64, and 69 as defined in the Final Rule (50 CFR § 216.180(a)) and Condition 3(b) of the LOAs.

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 SURTASS LFA sonar 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, and on operational requirements for SURTASS LFA sonar. The general ocean areas for the pre-operational estimates 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 B provides information on how the density and stock/abundance estimates were derived for the operational areas shown in Figure 4. 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 Pacific Ocean as cited in Appendix B.

Analyses for pre-operational estimates were performed at nominal potential operational sites, encompassing four seasons, which provide a conservative estimate of the potential for impacts to marine mammal stocks in those provinces where operations were proposed. These estimates were based on 16 missions of 7 days each.

Operations occurred in sites 2, 3, and 7 as shown in Figure 4. Tables 2 through 4 provide pre-operational risk estimates for marine mammal stocks in these operating areas (Sites 2, 3, and 7) as presented in the Navy's application for LOAs (DON, 2007d). 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 LOA Condition 6(g) and the Final Rule (72 FR 46886). 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 (50 CFR § 216.186(a)) and the condition 8(a) of the LOAs.

4.2.2 Post-Operational Estimates of Marine Mammal Stocks Potentially Affected

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.

SURTASS LFA sonar operations during the period of this annual report comprised 14 missions totaling 49.8 days of operations with 135.8 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 4 as Sites 2 and 3; and the South China Sea in LOA Provinces 64 and 69, depicted in Figure 4 as Site 7.

Tables 5 through 7 provide post-operational estimates of the percentage of marine mammal stocks affected by the 49.8 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 4 (see Appendix B).

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 7. Tables 5 through 7 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) and the Final Rule (72 FR 46886).

The post-operational incidental harassment estimates in Tables 5 through 7 show 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 SURTASS LFA sonar operations.

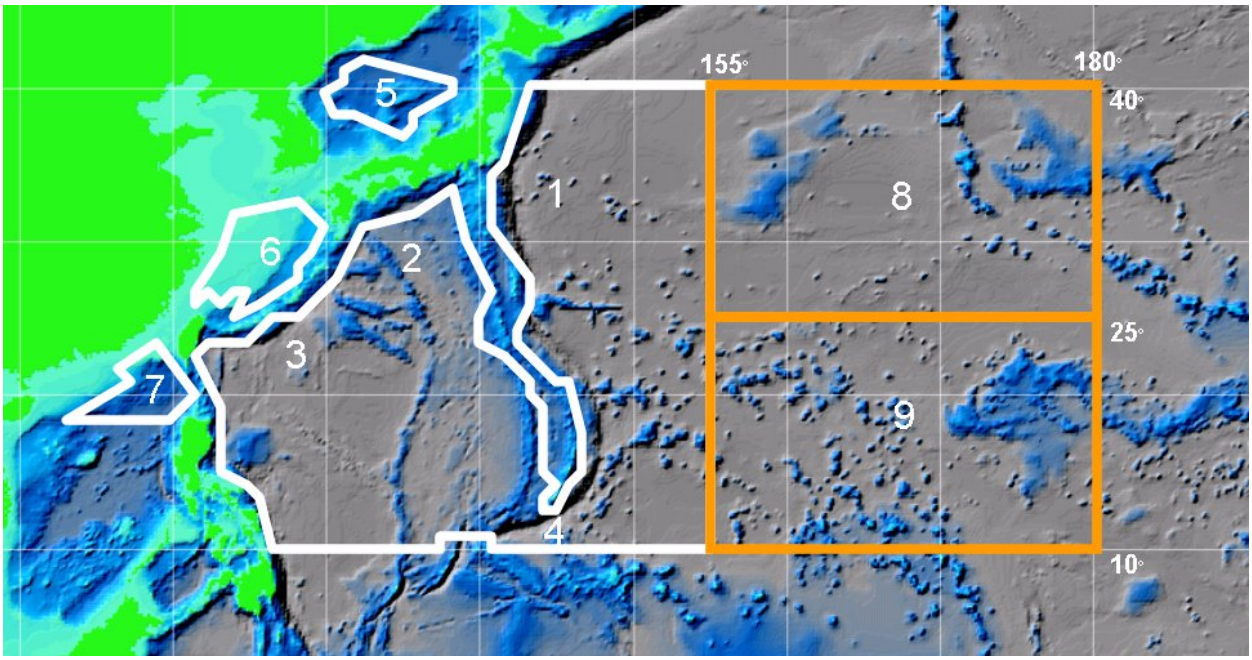

Figure 4. SURTASS LFA Sonar Western Pacific Operational Areas

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

North Philippine Sea					
Site 2	**Animal**	**Stock**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Bryde's whale	WNP	22000	0.25	0.00
	Minke whale	WNP "O" Stock	25049	1.62	0.00
	N. Pacific right whale	WNP	922	0.10	0.00
	Sperm whale	NP	102112	0.24	0.00
	Kogia	NP	350553	0.07	0.00
	Cuvier's beaked whale	NP	90725	0.55	0.00
	Blainville's beaked whale	NP	8032	0.58	0.00
	Ginkgo-toothed beaked whale	NP	22799	0.20	0.00
	Killer whale	NP	12256	0.30	0.00
	False killer whale	WNP	16668	1.61	0.00
	Pygmy killer whale	WNP	30214	0.64	0.00
	Melon-headed whale	WNP	36770	0.30	0.00
	Short-finned pilot whale	WNP	53608	2.64	0.00
	Risso's dolphin	WNP	83289	1.50	0.00
	Common dolphin	WNP	3286163	0.17	0.00
	Bottlenosed dolphin	WNP	168791	1.02	0.00
	Spinner dolphin	WNP	1015059	0.00	0.00
	Pantropical spotted dolphin	WNP	438064	0.32	0.00
	Striped dolphin	WNP	570038	0.58	0.00
	Rough-toothed dolphin	WNP	145729	0.41	0.00
	Fraser's dolphin	WNP	220789	0.18	0.00
	Pacific white-sided dolphin	WNP	931000	0.13	0.00

NP—North Pacific Stock
WNP—Western North Pacific Stock

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

West Philippine Sea					
Site 3	**Animal**	**Stock**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Fin whale	NP	9250	0.25	0.00
	Bryde's whale	WNP	22000	0.32	0.00
	Minke whale	WNP "O" Stock	25049	1.55	0.00
	Humpback whale (winter only)	WNP	394	0.00	0.00
	Sperm whale	NP	102112	0.09	0.00
	Kogia	NP	350553	0.04	0.00
	Cuvier's beaked whale	NP	90725	0.03	0.00
	Blainville's beaked whale	NP	8032	0.63	0.00
	Ginkgo-toothed beaked whale	NP	22799	0.22	0.00
	False killer whale	WNP	16668	2.05	0.00
	Pygmy killer whale	WNP	30214	0.82	0.00
	Melon-headed whale	WNP	36770	0.38	0.00
	Short-finned pilot whale	WNP	53608	1.67	0.00
	Risso's dolphin	WNP	83289	1.82	0.00
	Common dolphin	WNP	3286163	0.23	0.00
	Bottlenose dolphin	WNP	168791	1.24	0.00
	Spinner dolphin	WNP	1015059	0.01	0.00
	Pantropical spotted dolphin	WNP	438064	0.42	0.00
	Striped dolphin	WNP	570038	0.39	0.00
	Rough-toothed dolphin	WNP	145729	0.72	0.00
	Fraser's dolphin	WNP	220789	0.24	0.00
	Pacific white-sided dolphin	WNP	931000	0.35	0.00

NP—North Pacific Stock
WNP—Western North Pacific Stock

Table 4. Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 7

South China Sea					
Site 7	Animal	**Stock**	**# Animals Stock**	**% Affected (w/mit) 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Fin whale	WNP	9250	0.07	0.00
	Bryde's whale	WNP	22000	0.08	0.00
	Minke whale	WNP "O" Stock	25049	0.41	0.00
	Gray whale (winter only)	WNP	100	0.00	0.00
	N Pac Right whale	WNP	922	0.04	0.00
	Sperm whale	NP	102112	0.02	0.00
	Kogia	NP	350553	0.01	0.00
	Cuvier's beaked whale	NP	90725	0.01	0.00
	Blainville's beaked whale	NP	8032	0.16	0.00
	Ginkgo-toothed beaked whale	NP	22799	0.06	0.00
	False killer whale	IA	9777	0.62	0.00
	Pygmy killer whale	WNP	30214	0.23	0.00
	Melon-headed whale	WNP	36770	0.79	0.00
	Short-finned pilot whale	WNP	53608	0.48	0.00
	Risso's dolphin	WNP	83289	0.57	0.00
	Common dolphin	WNP	3286163	0.05	0.00
	Bottlenose dolphin	IA	105138	0.66	0.00
	Spinner dolphin	WNP	1015059	0.01	0.00
	Pantropical spotted dolphin	WNP	219032	0.25	0.00
	Striped dolphin	WNP	570038	0.11	0.00
	Rough-toothed dolphin	WNP	145729	0.11	0.00
	Fraser's dolphin	WNP	220789	0.07	0.00

NP—North Pacific Stock
WNP—Western North Pacific Stock
IA—Inshore Archipelago

Table 5. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected—Totals for the R/V Cory Chouest 1st Year LOA

LOA 1—R/V CORY CHOUEST								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Blue Whale	N. Pacific	9250	na	na	na	na	na	na
Fin Whale	N. Pacific	9250	0.30	0.15	0.02	na	0.47	0.00
Bryde's Whale	Western N. Pacific	22000	0.39	0.20	0.02	na	0.61	0.00
Minke Whale	Western N. Pacific	25049	1.86	0.93	0.10	na	2.89	0.00
N. Pacific Right Whale (spr/fall/win)	Western N. Pacific	922	na	0.00	Na	na	0.00	0.00
Humpback Whale (winter only)	Western N. Pacific	394	0.00	0.00	1.48	na	1.48	0.00
Gray Whale (winter only)	Western N. Pacific	100	na	na	Na	na	na	na
Sperm Whale	N. Pacific	102112	0.05	0.04	0.00	na	0.09	0.00
Kogia	N. Pacific	350553	0.03	0.01	0.00	na	0.04	0.00
Cuvier's Beaked Whale	N. Pacific	90725	0.02	0.02	0.00	na	0.04	0.00
Blainville's Beaked Whale	N. Pacific	8032	0.36	0.19	0.02	na	0.57	0.00
Ginkgo-Toothed Beaked Whale	N. Pacific	22799	0.13	0.06	0.01	na	0.20	0.00
Killer Whale	Western N. Pacific	12256	na	0.00	na	na	0.00	0.00
False Killer Whale	Western N. Pacific	16668	1.18	0.59	0.06	na	1.83	0.00
False Killer Whale	Inshore Archipelago	9777	na	na	na	na	na	na
Pygmy Killer Whale	Western N. Pacific	30214	0.47	0.24	0.02	na	0.73	0.00
Melon-Headed Whale	Western N. Pacific	36770	0.22	0.11	0.01	na	0.34	0.00
Short-Finned Pilot Whale	Western N. Pacific	53608	0.96	0.52	0.05	na	1.53	0.00
Risso's Dolphin	Western N. Pacific	83289	1.05	0.53	0.05	na	1.63	0.00
Common Dolphin	Western N. Pacific	3286163	0.13	0.06	0.01	na	0.20	0.00
Bottlenose Dolphin	Western N. Pacific	168791	0.71	0.36	0.04	na	1.11	0.00
Bottlenose Dolphin	Inshore Archipelago	105138	na	na	na	na	na	na
Spinner Dolphin	Western N. Pacific	1015059	0.00	0.00	0.00	na	0.00	0.00
Pantropical Spotted Dolphin	Western N. Pacific	438064	0.24	0.12	0.01	na	0.37	0.00
Striped Dolphin	Western N. Pacific	570038	0.22	0.12	0.01	na	0.35	0.00
Rough-Toothed Dolphin	Western N. Pacific	145729	0.31	0.15	0.02	na	0.48	0.00
Fraser's Dolphin	Western N. Pacific	220789	0.14	0.07	0.01	na	0.22	0.00
Pacific White-Sided Dolphin	Western N. Pacific	931000	0.20	0.10	0.01	na	0.31	0.00

Table 6. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected—Totals for USNS IMPECCABLE 1st Year LOA

LOA 1—USNS IMPECCABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Blue Whale	N. Pacific	9250	na	na	na	na	na	na
Fin Whale	N. Pacific	9250	0.16	0.21	na	na	0.37	0.00
Bryde's Whale	Western N. Pacific	22000	0.20	0.26	na	0.03	0.49	0.00
Minke Whale	Western N. Pacific	25049	0.95	1.30	na	0.17	2.42	0.00
N. Pacific Right Whale (spr/fall/win)	Western N. Pacific	922	0.00	na	na	0.00	0.00	0.00
Humpback Whale (winter only)	Western N. Pacific	394	na	0.00	na	na	0.00	0.00
Gray Whale (winter only)	Western N. Pacific	100	0.00	na	na	na	0.00	0.00
Sperm Whale	N. Pacific	102112	0.02	0.04	na	0.02	0.08	0.00
Kogia	N. Pacific	350553	0.01	0.02	na	0.00	0.03	0.00
Cuvier's Beaked Whale	N. Pacific	90725	0.01	0.01	na	0.03	0.05	0.00
Blainville's Beaked Whale	N. Pacific	8032	0.15	0.25	na	0.03	0.43	0.00
Ginkgo-Toothed Beaked Whale	N. Pacific	22799	0.05	0.09	na	0.01	0.15	0.00
Killer Whale	Western N. Pacific	12256	na	na	na	0.02	0.02	0.00
False Killer Whale	Western N. Pacific	16668	na	0.82	na	0.08	0.90	0.00
False Killer Whale	Inshore Archipelago	9777	0.61	na	na	na	0.61	0.00
Pygmy Killer Whale	Western N. Pacific	30214	0.22	0.33	na	0.03	0.58	0.00
Melon-Headed Whale	Western N. Pacific	36770	0.78	0.15	na	0.02	0.95	0.00
Short-Finned Pilot Whale	Western N. Pacific	53608	0.47	0.67	na	0.13	1.27	0.00
Risso's Dolphin	Western N. Pacific	83289	0.56	0.73	na	0.08	1.37	0.00
Common Dolphin	Western N. Pacific	3286163	0.05	0.09	na	0.01	0.15	0.00
Bottlenose Dolphin	Western N. Pacific	168791	na	0.50	na	0.05	0.55	0.00
Bottlenose Dolphin	Inshore Archipelago	105138	0.65	na	na	na	0.65	0.00
Spinner Dolphin	Western N. Pacific	1015059	0.01	0.00	na	0.00	0.01	0.00
Pantropical Spotted Dolphin	Western N. Pacific	438064	0.24	0.17	na	0.02	0.43	0.00
Striped Dolphin	Western N. Pacific	570038	0.11	0.16	na	0.03	0.30	0.00
Rough-Toothed Dolphin	Western N. Pacific	145729	0.11	0.22	na	0.02	0.35	0.00
Fraser's Dolphin	Western N. Pacific	220789	0.07	0.10	na	0.01	0.18	0.00
Pacific White-Sided Dolphin	Western N. Pacific	931000	na	0.14	na	0.01	0.15	0.00

Table 7. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected—Totals for 1st Year LOA

LOA 1—R/V CORY CHOUEST & USNS IMPECCABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Blue Whale	N. Pacific	9250	na	na	na	na	na	na
Fin Whale	N. Pacific	9250	0.19	0.36	0.02	na	0.57	0.00
Bryde's Whale	Western N. Pacific	22000	0.41	0.28	0.02	na	0.71	0.00
Minke Whale	Western N. Pacific	25049	2.81	2.23	0.10	0.03	5.17	0.00
N. Pacific Right Whale (spr/fall/win)	Western N. Pacific	922	0.00	0.00	na	0.17	0.17	0.00
Humpback Whale (winter only)	Western N. Pacific	394	0.00	0.00	1.48	0.00	1.48	0.00
Gray Whale (winter only)	Western N. Pacific	100	0.00	na	na	na	0.00	0.00
Sperm Whale	N. Pacific	102112	0.07	0.08	0.00	na	0.15	0.00
Kogia	N. Pacific	350553	0.04	0.03	0.00	0.02	0.09	0.00
Cuvier's Beaked Whale	N. Pacific	90725	0.03	0.03	0.00	0.00	0.06	0.00
Blainville's Beaked Whale	N. Pacific	8032	0.51	0.44	0.02	0.03	1.00	0.00
Ginkgo-Toothed Beaked Whale	N. Pacific	22799	0.18	0.15	0.01	0.03	0.37	0.00
Killer Whale	Western N. Pacific	12256	na	0.00	na	0.01	0.01	0.00
False Killer Whale	Western N. Pacific	16668	1.18	1.41	0.06	0.02	2.67	0.00
False Killer Whale	Inshore Archipelago	9777	0.61	na	na	0.08	0.69	0.00
Pygmy Killer Whale	Western N. Pacific	30214	0.69	0.57	0.02	na	1.28	0.00
Melon-Headed Whale	Western N. Pacific	36770	1.00	0.26	0.01	0.03	1.30	0.00
Short-Finned Pilot Whale	Western N. Pacific	53608	1.43	1.19	0.05	0.02	2.69	0.00
Risso's Dolphin	Western N. Pacific	83289	1.61	1.26	0.05	0.13	3.05	0.00
Common Dolphin	Western N. Pacific	3286163	0.18	0.15	0.01	0.08	0.42	0.00
Bottlenose Dolphin	Western N. Pacific	168791	0.71	0.41	0.04	0.01	1.37	0.00
Bottlenose Dolphin	Inshore Archipelago	105138	0.65	na	na	0.05	0.70	0.00
Spinner Dolphin	Western N. Pacific	1015059	0.01	0.00	0.00	na	0.01	0.00
Pantropical Spotted Dolphin	Western N. Pacific	438064	0.48	0.29	0.01	0.00	0.78	0.00
Striped Dolphin	Western N. Pacific	570038	0.33	0.28	0.01	0.02	0.64	0.00
Rough-Toothed Dolphin	Western N. Pacific	145729	0.42	0.37	0.02	0.03	0.84	0.00
Fraser's Dolphin	Western N. Pacific	220789	0.21	0.17	0.01	0.02	0.41	0.00
Pacific White-Sided Dolphin	Western N. Pacific	931000	0.20	0.24	0.01	0.01	0.46	0.00

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 in accordance with Condition 7(c) of the LOAs, were posted as specified in LOA Condition 7(a)(i) and CNO executive directives (see Section 2.0). During the 14 missions, one marine mammal sighting was noted.

During an operation on the USNS IMPECCABLE, there was one visual sighting of 1-3 pilot/pygmy sperm whales. The initial sighting was at 340 degrees relative at 2.6 km (1.4 nm), and LFA transmissions were suspended. 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). During 5 of the 14 missions, there were 19 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

In accordance with the requisite protocols under LOA Condition 6(b), LFA transmissions were delayed or suspended on 43 occasions. On the USNS IMPECCABLE, operations were delayed or suspended one time due to visual detection of marine mammals, 19 times due to HF/M3 contacts, and 7 times due to the failure of the HF/M3 sonar or the passive array. On the R/V *Cory Chouest*, there were 16 delays or suspensions 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 FSEIS (DON, 2007b) and supporting documentation, the Navy's assessment of the long-term and cumulative impact from employment of SURTASS LFA sonar remain consistent with the analysis of such impacts in the FSEIS.

5.0 LONG TERM MONITORING AND RESEARCH

As part of its continuing commitment to protect the environment, the Navy is continuing a LTM Program to assess and analyze the potential for effects of the employment of SURTASS LFA sonar 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 sonar 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 sonar received levels below 180 dB.

During routine operations of SURTASS LFA sonar, technical and environmental data are collected and recorded. As part of the LTM Program and as stipulated in the 2007 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 45 days after the 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.

The summary of SURTASS LFA sonar operations for the first year LOAs (16 August 2007 to 15 August 2008) have been provided in Section 4.0 of this report.

5.2 Research

Condition 7(d) of the LOAs and Final Rule (72 FR 46888) included the conduct of additional research involving the topics listed in Table 8. These research activities are to help increase the knowledge of marine mammal species and the determination of levels of impacts from potential takes. NMFS recommends that the Navy conduct, or continue to conduct, the following research regarding SURTASS LFA sonar over the second 5-year authorization period:

1. Systematically observe SURTASS LFA sonar training exercises for injured or disabled marine mammals.
2. Compare the effectiveness of the three forms of mitigation (visual, passive acoustic, HF/M3 sonar).
3. Conduct research on the responses of deep-diving odontocete whales to LF sonar signals.
4. Conduct research on the habitat preferences of beaked whales.
5. Conduct passive acoustic monitoring using bottom-mounted hydrophones before, during, and after LF sonar operations for the possible silencing of calls of large whales.
6. Continue to evaluate the HF/M3 mitigation sonar.
7. Continue to evaluate improvements in passive sonar capabilities.

According to the LOAs Condition 7(d), the U.S. Navy must conduct research in at least one of these areas during the period of the LOAs.

5.2.1 Research Status

Table 8 below provides the status of research that has been conducted, is underway or is being planned to address NMFS's seven research objectives.

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 has spent an average of $10M to $14M annually over the past five years on marine mammal research at universities, research institutions, federal laboratories, and private companies, and expects to increase that funding to $18M in 2008. In the past Navy-funded research produced scores of 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 includes 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 SURTASS LFA sonar operations, are crucial to the overall knowledge base on marine mammals and the potential effects from underwater anthropogenic noise.

In addition, the Navy is providing funding to support the Structure of Population, Levels of Abundance, and Status of Humpbacks (SPLASH) project. Oregon State University is being

funded to integrate available genetic data with humpback whale photo IDs. The goal is to provide further analysis of SPLASH genetic samples to describe individual movement and genetic differentiation of the western North Pacific humpback whales.

Table 8. 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; 2004; 2005b; 2006b; 2007e) under the 2002-2007 Rule, post-operational incidental harassment assessments demonstrated that there were no known marine mammal exposures to RLs at or above 180 dB. These findings are supported by the results from the visual, passive acoustic and active acoustic monitoring efforts discussed in Subsection 4.3 for the period of the first annual report under the 2007-2012 Rule. In addition, a review of recent stranding did not indicate any stranding events associated with the times and locations of SURTASS LFA sonar operations (Subsection 4.2.3)
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).
Conduct research on the responses of deep-diving odontocetes 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. o 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). o 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. o 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 funded 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., Behavioral Response Study [BRS]) with beaked whales in 2007/2008. The Navy convened an *ad hoc* scientific working group meeting in April 2006 to concentrate on the details of a 2007 beaked whale BRS. Independent scientists from Cornell University, Woods Hole Oceanographic Institution, and St. Andrews University, who developed a plan of action with milestones for the 2007/2008 experiments, attended. Navy, NOAA, and industry funding supported the 2007 research effort. Navy and NOAA funding supported the

NMFS Research Topics	Status
	2008 BRS. • 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. BRS plans centered around the use of MF sources because: 1) difficulties of using an LF source for the research proved to be insurmountable; and 2) MF sources have been implicated in beaked whale stranding events. Significant results from BRS research using coherent MF sources can be meaningfully extrapolated to LF sources, particularly SURTASS LFA sonar in the 100-500 Hz frequency regimes. • The objectives of the 2007 BRS (BRS-07), conducted in September-October 2007 were: 1) Establish, test and refine new protocols for studying beaked whales using established underwater sound playback paradigms; 2) Define response of beaked whales, and other species of odontocete whales, to MF sonar and natural sounds such as killer whale; and 3) Measure exposure parameters for sounds that evoke behavioral response. The following comprise the achievements from BRS-07: 1) Demonstrated that the concept for studying beaked whales using playbacks is feasible, with lessons-learned for improvements; 2) Engaged with NGO organizations to argue the case for controlled experimental approaches; 3) Realized a measurable response from beaked whales and possibly from pilot whales, that are clearly within their normal adaptive behavior; and 4) Collected a control data set that is vastly larger than before, increasing the knowledge of basic behavior in beaked whales, such that we can be confident that we can measure responses of animals that are unusual in nature. A Cruise Report on BRS-07 has been prepared (Boyd et al., 2007) • The objectives of the 2008 BRS (BRS-08), conducted in August-September 2008 are: 1) Determine the acoustic exposures of MF sonar sounds that elicit an identifiable behavioral indicator response in beaked whales; 2) Attempt to understand the initial steps in the chain of events that lead from exposure to MF sonar sounds, to atypical mass strandings of beaked whales; 3) Use this understanding to strive for the development of a safe response that can be used to indicate risk; 4) Test whether other man-made sounds elicit the indicator response in beaked whales and other deep-diving odontocetes; and 5) Attempt to define dose-response relationships for MF sonar and other man-made sounds. Findings from the Deep-Diving Odontocetes BRS will be published in peer-reviewed literature.

NMFS Research Topics	Status
Conduct research on habitat preferences of beaked whales	The U.S. Navy/ONR has funded the following research that has been published: Claridge, D., and J. Durban. 2007. Distribution, Abundance and Population Structuring of Beaked Whales in the Great Bahama Canyon, Northern Bahamas. MacLeod, C. et al., 2006. Known and inferred distributions of beaked whale species (Cetacea: Ziphiidae). Journal of Cetacean Research and Management, 7(3): 271-286. 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 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 were 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 supported this research effort.
Conduct passive acoustic monitoring using bottom-mounted hydrophones before, during, and after LF sonar operations for the possible silencing of calls of large whales	The Navy has and is continuing to sponsored multi-year research for the acoustic monitoring of marine mammals using fixed passive acoustic monitoring systems in the North Atlantic Ocean. During four of these research efforts (NORLANT, 2004, 2005, 2006-01, 2006-02) no variations in normal behavior patterns for fin, blue, or humpback whales were noted. The fifth research effort was completed in 2007, and a comprehensive paper to discuss the findings is forthcoming. The research reports for these tasks are classified; unclassified summary reports have been produced.
Continued to evaluate the HF/M3 mitigation sonar	The HF/M3 sonar has been upgraded for integration into the installations of Compact Low Frequency Active (CLFA) Sonar on the T-AGOS 19 Class vessels. The first installation of the upgraded HF/M3 sonar is onboard the USNS ABLE (T-AGOS 20), which commenced at sea testing in August 2008 under an LOA issued by NMFS on 15 August 2008.

NMFS Research Topics	Status
Continue to evaluate improvements in passive sonar capabilities	Advances in the development of passive acoustic technology include the development of SURTASS Twinline, a shallow water variant of the SURTASS system which will provide improved littoral capability. USNS ABLE (T-AGOS 20) has a twin line passive array. The capability of passive acoustic sensors is also benefiting from increased processing power in computers, and by network centricity, which is incorporating data from a variety of acoustic and non-acoustic sensors and sources to construct a more complete battlefield picture (Friedman, 2007).

5.2.3 Incident Monitoring

The Navy monitors and reviews data on strandings from federal, state, and international organizations and the media. No incidents were noted during the period of this report.

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APPENDIX A

Letters 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* and USNS IMPECCABLE, Office of Protected Resources, National Marine Fisheries Service, August 15, 2007

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

Captain Douglas S. Prince
Head, Undersea Surveillance, N872A
Office of the Chief of Naval Operations
2000 Navy Pentagon
Washington, D.C. 20350-2000

AUG 15 2007

Dear Captain Prince:

Enclosed are Letters of Authorization (LOAs) for the *R/V Cory Chouest* and the USNS IMPECCABLE, issued to the Chief of Naval Operations (N872A), Department of the Navy, under the authority of Section 101(a)(5)(A) of the Marine Mammal Protection Act, 16 U.S.C. 1361 et seq., and the regulations 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. These authorizations cover the taking of marine mammals by harassment incidental to SURTASS LFA sonar operations in areas 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 for a period of one year, provided the mitigation, monitoring and reporting requirements are undertaken as required by the regulations (attached) and the LOAs.

If you have any questions concerning the LOAs or their requirements, please contact Kenneth Hollingshead, Office of Protected Resources, National Marine Fisheries Service at (301) 713-2289. ext 128.

Sincerely,

for James H. Lecky, Director
Office of Protected Resources

Enclosures

DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

Letter of Authorization

The Chief of Naval Operations (N872A), 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, 2007, through August 15, 2008.

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 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 500 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 *R/V Cory Chouest* is valid for an estimated total of 16 nominal active sonar missions between the two ships (or equivalent shorter missions not to exceed a total of 432 hours of transmit time per vessel during the period of effectiveness of this Authorization) in accordance with boundary conditions described in the Navy's March 30, 2007, mission intention letter (as modified July 11, 2007, and August 15, 2007) (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*), humpback whale (*Megaptera novaeangliae*), northern Pacific right whale (*Eubalaena japonica*), southern right whale (*Eubalaena australis*), pygmy right whale (*Caperea marginata*), 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 beaked whale (*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 serious injury or 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 500 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 and condition 3(a), 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 in accordance with the August 15, 2007, modification to the mission intention letter.

(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.

(iii) At a distance of 1 km (0.5 nm) seaward of the outer perimeter of any offshore biologically important area during the biologically important period specified.

(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
(1) 200-m isobath North American East Coast	From 28° N. to 50° N., west of 40° W.	Year-round
(2) Antarctic Convergence Zone	30° E. to 80° E. to 45°; 80° E. to 150° E. to 55°; S.150° E. to 50° W. to 60° S.; 50° W. to 30° E. to 50° S.	October 1-March 31
(3) Costa Rica Dome	Centered at 9° N. and 88° W.	Year-round
(4) Hawaiian Islands Humpback Whale National Marine Sanctuary -Penguin Bank	Centered at 21° N. and 157° 30' W.	November 1 through May 1
(5) Cordell Bank National Marine Sanctuary	Boundaries in accordance with 15 CFR 922.110	Year-round
(6) Gulf of the Farallones National Marine Sanctuary	Boundaries in accordance with 15 CFR 922.80	Year-round
(7) Monterey Bay National Marine Sanctuary	Boundaries in accordance with 15 CFR 922.30	Year-round
(8) Olympic Coast National Marine Sanctuary	Boundaries within 23 nm of the coast from 47°07' N. to 48°30' N. latitude	December January, March and May
(9) Flower Garden Banks National Marine Sanctuary	Boundaries in accordance with 15 CFR 922.120	Year-round
(10) The Gully	44° 13' N., 59° 06' W. to 43° 47' N.; 58° 35' W. to 43° 35' N.; 58° 35' W. to 43° 35' N.; 59° 08' W. to 44° 06' N.; 59° 20' W	Year-round

(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 *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) systematically observe SURTASS LFA sonar training exercises for injured or disabled marine mammals, (2) compare the effectiveness of the three forms of mitigation (visual, passive acoustic, HF/M3 sonar), (3) conduct research on the responses of deep-diving odontocete whales to LF sonar signals, (4) conduct research on the habitat preferences of beaked whales, (5)

conduct passive acoustic monitoring using bottom-mounted hydrophones before, during, and after LF sonar operations for the possible silencing of calls of large whales, (6) continue to evaluate the HF/M3 mitigation sonar, and (7) continue to evaluate improvements in passive sonar capabilities. 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, 2007. 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 45 days after 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 2007

Date

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

DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

Letter of Authorization

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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 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 500 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 active sonar missions between the two ships (or equivalent shorter missions not to exceed a total of 432 hours of transmit time per vessel during the period of effectiveness of this Authorization) in accordance with the Navy's March 30, 2007, mission intention letter (as modified July 11, 2007, and August 15, 2007) (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*), humpback whale (*Megaptera novaeangliae*), northern Pacific right whale (*Eubalaena japonica*), southern right whale (*Eubalaena australis*), pygmy right whale (*Caperea marginata*), and gray whale (*Eschrichtius robustus*).

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(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 serious injury or mortality of any marine mammal species listed under Condition 3(c) is prohibited.

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(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 in accordance with the August 15, 2007, modification to the mission intention letter.

(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.

(iii) At a distance of 1 km (0.5 nm) seaward of the outer perimeter of any offshore biologically important area during the biologically important period specified.

(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
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(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.

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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) systematically observe SURTASS LFA sonar training exercises for injured or disabled marine mammals, (2) compare the effectiveness of the three forms of mitigation (visual, passive acoustic, HF/M3 sonar), (3) conduct research on the responses of deep-diving odontocete whales to LF sonar signals, (4) conduct research on the habitat preferences of beaked whales, (5)

conduct passive acoustic monitoring using bottom-mounted hydrophones before, during, and after LF sonar operations for the possible silencing of calls of large whales, (6) continue to evaluate the HF/M3 mitigation sonar, and (7) continue to evaluate improvements in passive sonar capabilities. 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, 2007. 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 45 days after 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 2007

Date

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

APPENDIX B

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

Background for Marine Mammal Density and Stock Estimates for SURTASS LFA Sonar Systems 1st Year LOAs

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 and Goto, 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-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 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 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. 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.

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 for the offshore region around the Hawaiian archipelago (Barlow, 2006) was used (0.0012/km^2). This value is very similar to the estimate from Mobley et al. (2000) for near the Main Hawaiian Islands: 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).

Stipulation 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. Abundance estimated from eastern Pacific (36,770 animals) (Ferguson and Barlow 2001, 2003). A density estimate for the offshore region around the Hawaiian archipelago (Barlow, 2006) was used (0.0012/km^2). This value is very similar to the estimate from Mobley et al. (2000) for near the Main Hawaiian Islands: 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. 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 #7 South China Sea

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 exists 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 estimate 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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